A Comparative Exploration of Green Energy Transition (GET) Outcomes Across Small Island Developing States (SIDS): Jamaica, Barbados, and Mauritius

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Abstract

Within the last few decades, the notion of a greener economy and the movement towards it, has become more tightly integrated with the global sustainable development agenda. Otherwise referred to as energy transition, one outcome of this shift has been the green energy targets set by small island developing states (SIDS). Up to twenty-three (23) SIDS identified the movement towards green energy as a green transition priority area.

SIDS' isolated geography, social and economic conditions, make them ideal for understanding the green energy transition (GET) experience within a well-defined geographic boundary. These small and vulnerable economies face many constraints and are some of the most affected by climate change. Although signatories to several international agreements, limited evidence-based literature exists on the GET experiences and outcomes within and across SIDS contexts.

In this PhD, I examine the cross-country variances in GET experiences and outcomes across SIDS. I do so by assessing the drivers and barriers within these countries using comparative case study analysis of the islands of Jamaica, Barbados, and Mauritius. In doing so, I adopt an integrative approach, lending from leading GET-related scholarship pertaining to: sustainable development, small states, the green economy, climate governance, sustainability transitions, diffusion research, and polycentricity theory, to systematically explore the variances across the three SIDS' green energy transition landscapes.

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List of Accompanying Materials

1. The full dataset used for the quantitative analysis conducted under chapter 7- see excel file labelled ‘Greene_Dewasmes_202056525_DatasetAppendix8’.

2. The Master Code for the OLS model designed and implemented under the quantitative phase of this thesis (see chapter 7) run using the Stata statistical software- see separately attached pdf file labelled ‘Greene_Dewasmes_202056525_RegresCodeAppendix9’.

3. The R software code used to automatically conduct thematic analysis on primary interview data gathered via expert interviews from Barbadian and Mauritian stakeholders- see pdf file labelled ‘Greene_Dewasmes_202056525_RNgram CodeAppendix10’.

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Declaration

I declare that this thesis, which I have presented for examination for the PhD degree of the University of York, is a presentation of my own original work. I declare that I am the primary author of this thesis and its papers, with statistical contribution (n-gram analysis) made by co-author Dr Corrado Topi and editorial contributions made by co-author Dr Khalil Elahee under chapter five. Editorial contributions were also made under chapter seven by co-authors Paulina Flores Martinez, Dr Sindra Sharma and Dr Corrado Topi, as well as in the design of a quantitative model and the generation of statistical outputs. I am the sole author of all other sections of this thesis. This work has not previously been presented for an award at this, or any other, University. All sources are acknowledged as References. I warrant that this authorisation does not, to the best of my knowledge, infringe upon the rights of any third party.

I declare that my thesis consists of 79,617 words excluding references, and 92,502 words including references.

Chapter 1: Introduction

Within this thesis I ask an overall question of 'how' - how can variances in green energy transition (GET) outcomes across small island developing states (SIDS) be accounted for? In pursuit of the answer, I make several propositions, as well as engage in the collection, and analysis of evidence guided by the overarching hypothesis that 'SIDS' GET experiences differ from that of other countries due to their status as small states, and their GET outcomes are determined by nuances between SIDS contexts. The structure of this thesis is in the format of 'Ph.D. incorporating publications' via four distinct academic papers in publishable format. These papers are all connected by their common thematic focus and contribution to my thesis' overarching research question. The relevance of my research is derived from the limited evidence-based knowledge in existence that demonstrates how to transition towards the vision of a green economy via renewable energy, particularly geared at the small developing country perspective (Ramos-Mejia, et al., 2018; Wieczorek, 2018; Geoghegan, et al., 2014; EEA, 2011)

I seek to fill this conceptual gap through an integrated analytical theoretical approach which forms the foundations of this thesis. This was implemented by first conducting a broad review of GET-related literature, which gradually narrowed onto the perspective of SIDS within the existing scholarship (chapter 2). In the remaining sections of this thesis, I proceed to present my research design and methodology (chapter 3), and my four academic papers in respective chapters (4 to 7). In the remainder of the thesis, I go on to tie together the discoveries made across the four papers through a synthesis of findings (Chapter 8). Lastly, I lay out general conclusions and recommendations made all under the harmonised scope of the overarching research question (Chapter 9).

A key question for small island developing states (SIDS) to date has been the overall inability to capture how domestic challenges experienced have either positively or negatively influenced their overall green transition experiences (UNEP, 2015). By extension, little to no in-depth analysis has been conducted, with few learning examples available to policymakers, on the outcomes that existing green energy transition frameworks have had in SIDS' contexts (Ramos-Mejia, et al., 2018; Wieczorek, 2018; Rogers, 2016; Scobie, 2016). To help address this information gap, I used mostly qualitative (supplemented by quantitative) methods to systematically employ case study analysis supported by an integrated theoretical analytical approach on the countries of Jamaica, Barbados, and Mauritius. These countries were selected due to their explicitly expressed GET ambitions via renewable energy (UNFCCC, 2015), and similar socio-economic and demographic indicators (The World Bank Group, 2018; Briguglio, 2014), which made them suitable for case country comparisons. Specifically, I examine how varying climate governance landscapes or policy frameworks in the renewable energy sector have influenced green energy transition (GET) outcomes at the national level over time; a sustainable development priority area identified within each of the selected island states under energy security.

Throughout this thesis, I draw insight from several bodies of SIDS- and GET-related scholarship. These include: small states literature (e.g. World Bank, 2016; Crowards, 2002; Read, 2001) as well as climate change mitigation and adaptation, small island developing states, and sustainable development scholarship (e.g. Dornan, 2015; UNEP, 2015; Briguglio, 2014; UNEP, 2014; UN-OHRLLS, 2011; United Nations, 2005b). I also draw on climate governance (e.g. Allen & Clouth, 2012; Boto & Biasca, 2012; IPCC, 2008; UNFCCC, 2005), and green economy literature (e.g. Yang, et al., 2019; SELA, 2012; UNEP, 2011). My analysis conducted under chapters four to seven of this thesis were executed lending mainly from principles under the theoretical framework of sustainability transitions (e.g. Ramos-Mejia, et al., 2018; Geels & Schot, 2010; Loorbach, 2010; Loorbach, 2007), diffusion studies (e.g. Wejnert, 2002; Rogers, 1962), and polycentricity theory (e.g. Aligica & Tarko, 2012).

I specifically address five specific knowledge gaps within the existing academic literature. Firstly, the limited application of leading green energy transition theoretical concepts on SIDS (Wieczorek, 2018). Secondly, a tendency of leading literature to stem from a technical or technological perspective and less from a comparative politics/public policy standpoint (Dodman & Mitlin, 2015). Thirdly, the limited analytical consideration of SIDS-specific characteristics that make them distinctive from their developed and large developing country counterparts. Fourthly, the limited attention paid to the actors shaping adoption of new technologies within societies (Wittmayer, et al., 2016; Wejnert, 2002). Lastly, an overall lack of empirical evidence on which factors matter, and to what extent to GET progress across varying SIDS cases (Ramos-Mejia, et al., 2018; Wieczorek, 2018). These topics are explored across the four following entitled academic papers which compose chapters four to seven within this thesis:

1. **Chapter 4:** The Distinct Outcomes Shaping Green Energy Transition Outcomes in the Small Island Developing States: Exploring Renewable Energy Progress in Jamaica
2. **Chapter 5:** The Key Factors Distinguishing GET Outcomes Across Small Island Developing Country Contexts: Barbados and Mauritius
3. **Chapter 6:** The Significant Impact of Actors on Renewable Energy Outcomes in SIDS: Stakeholder Perceptions in Barbados and Mauritius Compared
4. **Chapter 7:** Quantitative Analysis of the Factors Most Impacting Green Energy Transition in SIDS

Ultimately, I hope my findings prove insightful to the key actors implementing GET in small states such as SIDS. I also aim to stimulate future research on GET experiences within these underexplored country contexts that is more systematic and explicit in nature.

Chapter 2: Relevant Perspectives on Green Energy Transition: A Literature Review

2.1. Conceptualising Green Energy Transition (GET)

The mobilisation of ‘green’ targets has been an international priority, discussed and negotiated by countries at numerous international platforms (Allen & Clouth, 2012). Within this context, developing countries, including small island developing states (SIDS), have made voluntary commitments towards a green transition via climate adaptation and mitigation targets (iSciences, 2012). In pursuit of this societal shift, SIDS have referred to the significance of the sustainable development goals (SDGs) and the pursuit of more sustainable energy practices (UN-OHRLLS, 2012). In addition, their developed country counterparts have committed to support their sustainable green transition process (UNCSD, 2012). In this regard, noteworthy outcome documents have included the United Nations Framework Convention on Climate Change 1992, Agenda 21 of the 1992 Earth Summit, the 1997 Kyoto Protocol, the 2009 Green Growth Declaration, the Future We Want of the Rio+ 2012 Conference, the S.A.M.O.A. Pathway 2014, and the 2015 Paris Agreement, among others.

From an academic standpoint, varying pathways relevant to green transition have been presented, along with their critical components proposed under multiple disciplines. For example, writings under the scope of ‘green growth’ or ‘green economics’ (Jacobs, 2012; OECD, 2011a; OECD, 2010; Cato, 2009; Pearce, 1992; Bowers, 1990; Pearce, et al., 1989), the ‘green economy’ (Geoghegan, et al., 2014; SELA, 2012; Boston University, 2011; EEA, 2011; UNEP, 2011; WCED, 1987), as well as ‘ecological economics’ and ‘ecological sustainability’ (Northorp & Connor, 2013; Daly, 2008; Dasgupta, 2007; Milani, 2000; WWF, IUCN and UNEP, 1991; IUCN, 1980), all present ways towards achieving a more harmonious balance between economic activity and the environment.

Relevant writings and declarations all have in common an emphasis on actions that promote social advancement which secures both economic and environmental betterment for present and future generations. However, limited evidence-based knowledge exists that demonstrates exactly how to inclusively achieve this vision (Geoghegan, et al., 2014;

EEA, 2011). In terms of policy, most guidance offered has focused on the aspect of economic-related growth with the expectation that social benefits would follow (Geoghegan, et al., 2014). Additionally, international actors offer little guidance on what is needed for developing such a national strategy and how transition pathways can specifically, “integrate, balance and achieve social, environmental and economic objectives” (Geoghegan, et al., 2014, p. 9). The opportunities and challenges of green transition largely rest on how challenges of sustainable development can be incorporated into the institutions and implementation capacity created that translate those concerns into practice (Puppim de Oliveira, 2012; Bosselmann, et al., 2008). For SIDS, this is particularly the case given their many social, economic, and environmental constraints faced (Hurley, 2015; Boto & Biasca, 2012; Briguglio, 1995).

Through this literature review, I first seek to examine the main political, economic, and social/ behavioural variables currently recognised by existing scholarship as relevant to countries’ green energy transition outcomes. For the purpose of this thesis, the term ‘green economy’ rather than green growth or ecological sustainability, was ultimately used to define this greener and more sustainable society that countries seek to transition towards. This term was chosen since it especially emphasises a more inclusive approach towards improved livelihoods and takes into account the interests of a wide range of actors, including civil society (Geoghegan, et al., 2014). Furthermore, in line with international commitments made, it gives priority to the government’s role in creating the enabling framework that drives the green transition process.

Green energy transition (GET) in this thesis shall be universally understood as the actions taken by countries to achieve national energy commitments towards a ‘green economy’. Although much has been written on the opportunities available for SIDS in the achievement of green economy goals (UNEP, 2014; Boto & Biasca, 2012; UNEP, UNDESA and FAO, 2012; UN-OHRLLS, 2011; Garcia & Meisen, 2008), little exists which examines the national green transition experience and how national context has influenced processes and outcomes. Although existing academic writings under diffusion research (Wejnert, 2002; Rogers, 1962), and sustainability transitions (Ramos-Mejia, et al., 2018; Geels & Schot, 2010; Loorbach, 2010; Loorbach, 2007) literature provide valuable means for examining GET, they significantly stem from a developed or large developing country perspective. Hence, to effectively explore this topic, I first had to design an investigative approach sufficiently sensitive to the more or less unique characteristics of SIDS.

Additionally, existing research on climate change often fails to consider critical political economy dimensions (Thurlow, 2012). Hence, in this thesis I adopt an overall interdisciplinary approach. I use environmental science to help define and understand the nature of the challenge (relating to energy security) along with the outcomes of green energy transition (renewable energy uptake trends). In addition, I utilise political science to help understand the processes introduced for achieving green energy targets- the role of government, as well as the regimes and conditions needed to be present for success.

Overall, the expected outcome from the thesis includes an original contribution to knowledge that:

1. Contributes additional literature and empirical findings that help to better explain green energy transition outcomes from the small developing country perspective, namely, in the renewable energy sector of small island developing states (SIDS).
2. Develops a theoretically integrated methodological schema which extends and applies sustainability transitions, diffusions research, polycentricity theory, and environmental governance literature outside the narrow scope within which it has been generally applied (the developed country and large developing country contexts).
3. Highlights and explores those main political, economic, and social/ behavioural factors pertinent to the green energy transition experience of developing or lower- and middle-income country contexts, specifically SIDS.
4. Provides information relevant to GET implementing actors in the pursuit of their green energy transition targets set- via empirical findings on transition drivers, barriers, and landscape actors.
5. Provides example of a more systematic analytical approach that could be later expanded upon to assess and compare green transition and climate governance regimes within and across developing countries, especially those faced with structural constraints such as SIDS.

The remainder of this literature review provides an overview on the general context within which SIDS have pursued green transition goals and puts forward an originally developed theoretically integrated methodological schema on how green energy transition may be further examined given existing assumptions and theoretical frameworks. It shall do so in the following order:

(i) Section I – Overview of the GET landscape: an overview of the climate change challenge as it relates to small states and the main factors influencing their ability to respond to challenges faced.

(ii) Section II – The Special Case of Small Island Developing States (SIDS): shall review the role that green transition and green energy plays amidst the wider sustainable development agenda.

(iii) Section III - Assessing Green Energy Transition (GET): Observed Gaps in the Literature - shall review existing scholarship related to GET, highlighting strengths and weaknesses of existing academic works.

(iv) Section IV - An Integrated Theoretical Investigative Approach: shall outline how concepts from sustainability transitions, diffusion studies, polycentricity theory, and broader environmental governance literature will be used to explore the GET experiences of SIDS in this thesis.

2.2. Section I- The GET and Climate Change Landscape

2.2.1. The Main Drivers of Climate Change

There exists broad scientific consensus that manmade emissions of greenhouse gases (GHG) from activities such as fossil fuel consumption and industrial processes, are key drivers of ongoing climate change and that their continued trend will lead to further warming and long-lasting damage to the climate system (European Commission, 2020; IMF, 2016). During the 2000 to 2010 period, the majority (47%) of annual anthropogenic emission increases directly came from the energy supply sector (IPCC, 2015). The sources of GHG emissions across the globe have varied drastically between regions and individual countries (Berkeley Energy Resources & Collaborative, 2014). The top three emitters (developed and large developing industrialized countries) of China, the European Union, and the United States, contribute more than half of total global emissions, while the bottom 100 countries only account for 3.5% (Friedrich, et al., 2017).

For the rest of the world, energy is also seen as the major contributor to global emissions. For example, for small state countries like Haiti, Swaziland, and Cuba it represented 40%, 50%, and 68% of all national emissions respectively (Friedrich, et al., 2017). Between 2000 and 2010 climate change driven by growth in global population and economic activities, outpaced emissions reductions from improvements in energy intensity, while the increased use of coal relative to other energy supplies reversed the long-standing trend of gradual global decarbonisation of the world's energy supply (IPCC, 2015).

The IPCC (2015) identified decarbonising electricity generation as one of the key components of effective mitigation in achieving low-stabilisation levels. This would include a phasing out of fossil fuel power generation and the use of coal, with an increase in the share of low-carbon electricity supply from renewable energy sources like wind, hydro, solar and nuclear. Many renewable energy (RE) technologies have demonstrated substantial performance improvements and cost reductions, that enable their deployment at a significant scale (IPCC, 2015). However, many RE technologies still need both direct and indirect support to substantially increase their market share (IPCC, 2015). The integration of RE into energy systems faces challenges and varying costs according to the renewable energy technology adopted, regional circumstances and characteristics of the existing energy system in place (IPCC, 2015). For poor nations and tropical countries, sound domestic policies and development alongside investment in adaptation strategies could aid in the required energy shift (IMF, 2017). However, given the constraints faced by low-income countries, the international community is expected to play a key role in supporting these countries' efforts to cope with climate change (IMF, 2017).

The nature and the extent to which GET outcomes materialise will be case and site-specific, depending on local circumstances, the scale, scope, and pace of implementation (IPCC, 2015). Furthermore, the outcomes of climate policy could include effects on a partly overlapping set of objectives such as local air pollutant emissions reductions with related health and ecosystem impacts, energy access, energy, and food security, among others (IPCC, 2015). However, such valuation can be made difficult by factors such as the interaction of climate policy with pre-existing non-climate policies, external and non-competitive behaviour (IPCC, 2015). Due to the complex nature of such policy analysis, in this thesis I narrow my analytical scope. I specifically examine those main factors that have influenced the achievement of national renewable energy objectives as stated in select SIDS' nationally determined contributions (NDCs) submitted to the UNFCCC.

Below I begin by pinpointing the characteristics that have been identified under previous scholarship as bottlenecks, and or key drivers to GET success.

2.2.2. Factors Affecting Countries' Ability to Respond to Climate Change

In 2017, an IMF study found that "economic and institutional development" were likely to "strengthen a country's ability to cope with climate change" (IMF, 2017, p. 133). For example, stronger institutions could more effectively enforce soft measures such as strengthened public information provision, and targeted incentives for climate-related technologies. It additionally found that having fiscal space could allow for any needed investment in infrastructure. While conversely, climate change strategies such as more efficient water usage and technology investments, can also contribute to a country's development agenda (IMF, 2017).

Although the empirical findings were far from conclusive, the IMF (2017, p. 133) report found that "the medium-term adverse effects of a temperature increase appear to fade when domestic and international markets are better regulated, the exchange rate is flexible, infrastructure is widely available, democratic institutions are strong, and the distribution of income is fairly even", that is, characteristics often depicted by developed economies. Hence, it may be uncovered that where a developing country is found to more so emulate these characteristics, they may be in a better position to respond to climate change. Below, such relevant national conditions related to political, social and economic factors are further explored pertaining to their relevance in influencing a country's ability to respond to climate change.

Political Factors

Sound domestic policies, institutions, and development in general, can play a key role in partially reducing the negative effects of climate change (IPCC, 2015). For example, policy buffers can cushion negative effects such as from weather shocks through policies and institutions that facilitate the reallocation of factors of production across economic sectors, geographic region, and foster development (IPCC, 2015). According to Armstrong and Read (2000), small states such as SIDS, because of their small size potentially have the ability to be more responsive to change and hence more flexible in policymaking towards creating a more fertile environment for economic growth (Read, 2001). Paradoxically, small size and the heightened frequency of direct contact between decision-makers and constituents, can also encourage divisive rent-seeking behaviour based upon family ties or clientelism (Read, 2001).

Consequently, a key question posed by developing countries' governments can be how to affect the desired societal change given already scarce and strained resources? For example, technology support policies have promoted noteworthy innovation and diffusion of new technologies, but the cost-effectiveness of these policies can be difficult to assess (IPCC, 2015). Political economy analysis can help to examine such political processes within a society. Political economy refers to "the distribution of power and wealth between different groups and individuals, and the processes that create, sustain and transform these relationships over time" (Dfid, 2009, p. 4). This includes a concern with the interests and incentives facing different groups in society (and particularly political elites), and how these generate particular policy outcomes that may encourage or hinder development.

In this way, political economy analysis can be a useful tool for understanding how incentives, institutions and ideas shape development outcomes in countries (Dfid, 2009). According to Harris' (2013) adapted political economy analytical framework, three stages of assessment can be used to uncover the key political and socio-economic dimensions that drive or hinder sector reform through transformational climate policies. That is, (i) reflection- identification and assessment of the procedures and aims of the reform process, (ii) structural diagnosis- of the structural features and institutions involved in the reform process and agency diagnosis- of power, incentives and behaviours of key actors and stakeholders, and (iii) prescription- of what can be learned across contexts and actions proposed for more effective delivery of transformational climate policy. Also important from traditional political economy analysis is the role of historical features (e.g. historical influence of culture and power) (Jones & Carabine, 2013).

Socio-Economic Factors

The economies of small states have been found to be more vulnerable when compared to their larger counterparts (Brito, 2015). Empirical research suggests that a rise in temperature can lower per capita output by as much as 9 percent in countries with high average temperatures (IMF, 2017). Small states have been found to exhibit certain main socio-economic characteristics that helped to explain differences in their economic performance when compared to larger states, particularly in the context of climate change. That is, (i) small domestic markets, (ii) limited domestic resources, (iii) the narrow structure of domestic output, exports and export markets, (iv) openness to foreign markets, (v) proximity to developed markets, and (vi) fiscal constraints and public indebtedness (IMF, 2016; World Bank, 2016; Brito, 2015; Read, 2001).

Through climate financing, the global community has acknowledged small states' developmental constraints and limited resources to sufficiently address the challenges of climate change (IMF, 2017). Climate finance refers to those financial resources devoted to addressing climate change globally, and the financial flows to assist developing countries in addressing climate change (IPCC, 2014; UNFCCC, 2014). According to the principle of common but differentiated responsibility and the respective capabilities set out in the United Nations Framework Convention on Climate Change (UNFCCC, 1992), developed country Parties (or Appendix 2 Parties) are to provide financial resources to assist developing country Parties in implementing the objectives of the UNFCCC

(UNFCCC, 2014). Furthermore, under the 2015 Paris Agreement, developed country Parties were also encouraged to continue to take the lead in mobilising climate finance from a wide variety of sources, including supporting country-driven strategies, and taking into account the needs and priorities of developing country Parties (United Nations, 2015).

Small states have begun to access the global climate funds available (IMF, 2016). Characterised by high per unit public institutional and infrastructural costs, aid is often used in these areas to help cover overhead costs (IMF, 2016). However, their needs remain under-funded by as much as $1 billion annually (IMF, 2016). In addition to this, access to climate change financing is complex and administratively cumbersome, hampering access by small states who often have weak capacities and thus have less access to multilateral funds (IMF, 2016). Furthermore, many island states find that they increasingly do not fit into the standard development model, excluding them from much needed external support to address the many systemic challenges faced and to effectively combat climate change.

For instance, limited criteria such as by the OECD/DAC which evaluate countries based solely on a single variable such as Gross National Income (GNI) per capita, can ignore all other structural and development issues faced such as national debt, fiscal deficit, poverty levels, economic vulnerability, disaster risk etc. Hence, small vulnerable economies such as Barbados and Seychelles are considered ineligible for certain funding due to their status as “high-income threshold” countries (OECD, 2018). Where countries are able to successfully access funds, authors such as Hughes (2003), argue that such development support can do more damage than good by allowing governments to pursue extravagant policies unsuitable for small economies such as in the Pacific (Briguglio, 2014).

Table 1 Climate Change Financing to Small Developing States – 2014 (US$ millions)

Table 5. Climate Change Financing to Small Developing States – 2014 (US$ millions)

Multilateral development banks [1/]	444
Bilateral officials sources	368
Climate funds	140
Total	**952**

1/ Data for the 39 members of the Alliance of Small Island States (AOSIS).

Source: IMF staff elaborations on OECD DAC and ODI-Climate Finance Update databases and AfDB, ADB, EBRD, IDB, IFC, and WB (2016a).

Source: (IMF, 2016, p. 44)

In many countries, the private sector also plays a central role in financing climate change responses (IPPC, 2014). For example, appropriate enabling environments, can facilitate the financing of mitigation by the private sector along with the public sector. The IPCC (2014, p. 29) found that "the quality of a country's enabling environment includes the effectiveness of its institutions, regulations and guidelines regarding the private sector, security of property rights, credibility of policies and other factors that have a substantial impact on whether private firms invest in new technologies and infrastructures". Dedicated policy instruments can provide an incentive for investment by lowering risks for private actors. These can include, for example, power purchase agreements and feed-in tariffs, concessional finance or rebates (IPCC, 2014).

2.3. Section II- The Special Case of Small Island Developing States

2.3.1. Small States, SIDS and Climate Change

"Small states contribute little to global CO_2 emissions and other greenhouse gases" (IMF, 2016, p. 29). Nonetheless, many small states have submitted emission reduction pledges via their intended nationally determined contributions (INDCs) (UNFCCC, 2015).

According to the IMF (2016), climate change affects all aspects of small states with varying political and socio-economic implications. These countries have been most commonly identified based upon the criteria of their population size (Read, 2001; Crowards, 2002), ranging from those with a size of 5 million or less in the 70s and 80s (Jalan, 1982; Lloyd and Sundrum, 1982), to 3 million (Armstrong, et al., 1998) or 1.5 million or less in the 90's (Commonwealth Secretariat, 1997; Bray et al., 1991). However, the sole use of population size to determine smallness has been criticised (Crowards, 2002; Brito, 2015; Briguglio, 1994). Hence, alternative definitions have emerged which have sought to better capture the grouping. According to the World Bank (2016), small states could also be defined as those who are members of the Small States Forum. Alternatively, Crowards (2002) uses cluster analysis to identify 79 countries as small states using the three parameters of population, land area and income. In most recent times, these countries are defined as sovereign countries with a population of 1.5 million or fewer, or who are members of a small states Forum (Commonwealth Secretariat, 2016; World Bank, 2016). For the purpose of this research project, small states are defined as countries with a population of 3 million or less, or who are members of a small states Forum.

Certain factors are common to all small states. They generally share characteristics such as high transportation costs due to insularity and geographic remoteness, dependence on particular imports such as food and fuel, limited capacity to harness growth opportunities, as well as an increasing exposure to climate change and market shocks (Commonwealth Secretariat, 2018; World Bank, 2016; Crowards, 2002; Bray, et al., 1991). These countries often suffer from reduced scope for economies of scale and higher costs in production, distribution, and public administration (IMF, 2016). This in turn can undermine competitiveness, hinder the delivery of public goods and services, and limit diversification against external shocks (IMF, 2016).

Despite their similarities and shared structural characteristics, for academic and development purposes, the generalised small states categorisation is problematic in that these countries can also be very diverse. This is demonstrated by widely varying land mass areas, geographic locations, political systems, levels of income, and economic structures. For example, small state countries range from those that are landlocked (e.g. Lesotho and Swaziland); while many are island states (e.g. Bahrain, Cabo Verde and Tuvalu); countries such as Sao Tome and Principe have a land mass of around 960 km^2, while others like Qatar are around 11,571 km^2; some are considered high-income countries (e.g. Barbados and Trinidad & Tobago); while many are middle- or low-income countries (Samoa and Fiji); a few are Least Developed Countries (LDCs e.g. Haiti and Kiribati); fragile or conflict-affected (e.g. Papa New Guinea and the Solomon Islands); some are largely commodity exporters (Botswana, Belize and Trinidad & Tobago); while others are more service-oriented and tourism-based economies (Antigua & Barbuda, Palau and The Bahamas) (FAO, 2008; World Bank, 2016; OECD, 2017; Commonwealth Network, 2018; WITS, 2018; World Bank, 2018; Trading Economics, 2018).

Nevertheless, amidst small states' diversity scope for comparability also exists. Within these varying sub-categories, small states share many key common circumstances that allow for comparisons for academic and development purposes. For example, Liou & Ding (2002) analyse the key underlying economic and environmental aspects of vulnerability characterising small states according to nine main clusters: e.g. export-diversified group, export-concentrated group, poor export-diversified group, least developed group etc. Alternatively, Briguglio's (2014, p. 26) vulnerability/ resilience nexus categorises and analyes small states under the four categories of worst-case category, prodigal-son category, self-made category and best-case category. Briguglio's (2014, p. 3) work also highlights the distinction between SIDS and other small states. Namely, the author recognises many SIDS' additional economic and environmental disadvantages and tendency of geographic isolation. In this thesis, I chose to focus on the small states sub-category of small island developing states (SIDS), a group of countries with some of the most ambitious green energy targets in the world (Ourbak & Magnan, 2018; Robinson, 2018).

Of the 50 small state countries listed by the World Bank (2016) (see appendix 1), more than half (at least 32) could be further categorised as a Small Island Developing State (UN-OHRLLS, 2020). In total, the United Nations lists a minimum of 40 and up to 58 countries as Small Island Developing States (SIDS) (United Nations, 2019); (UN-OHRLLS, 2020). However, similarly to the small states group, a diversity of countries compose the SIDS grouping (IMF, 2016). A sizeable number of SIDS can be found located in the Caribbean, Pacific, and African or Indian Ocean (World Bank, 2016) (see appendix 2). Although a vast body of literature highlights the many common challenges faced by island states (e.g. Ourbak & Magnan, 2018; Robinson, 2018; Chen, 2017; GFDRR, 2017; Briguglio, 2016; Kopf & Isbell, 2016; World Bank, 2016; ODI and CDKN, 2014; AOSIS, 2012; UNEP, UNDESA and FAO, 2012; Winters & Martins, 2004), in practice their climate-related and sustainable development experiences can occur on significantly varying scales and levels of development. These experiences in turn are influenced by their geographic, political, social, economic, and cultural contexts.

For example, in 2014, the CO_2 emissions of Guyana equated to that of 2.6 metric tons per capita, while for the island Timor-Leste it equated to 0.4 metric tons per capita (World Bank Group, 2018). In terms of national debt, in 2014 Caribbean SIDS were the most heavily indebted at an average 75% of GDP. The next highest levels were in the Atlantic, Indian Ocean, Mediterranean and South China Sea (AIMS) at an average 65% of GDP. Whereas the Pacific region possessed a comparatively lower average debt level of 33% (Chen, 2017) in comparison. Hence, transitioning from one economic model to another, rests upon these differences found at the national level. Guided by Briguglio (2016; 1995; 1994), Benedicto (2014), Grote (2010), Campling (2006), Crowards (2002) and Armstrong, et al. (1998), for the purpose of this research project, I narrowed my definition of SIDS according to the parameters of population size, land area, income, and level of vulnerability. My narrowed definition served to set strict parameters to guide my case selection process. This was done in order to minimise the danger of SIDS' diverse country experiences skewing my research results. Namely: in my thesis I considered SIDS as countries with a population of 3 million or less (small or limited domestic markets), a land area of 15,000 km^2 or less, physically isolated (i.e. with a geographic boundary completely surrounded by water), high public debt or chronic fiscal deficits, high energy and transport costs, as well as high economic and environmental vulnerability.

SIDS' climate change and development challenges stand out even within the small states grouping. SIDS are among the countries most vulnerable to the impacts of climate change (UNFCCC, 2005); on the forefront of climate change related issues faced, which include rising sea levels, coastal erosion, and an increase in the occurrence of floods and droughts (Kopf & Isbell, 2016). Sixty percent (60%) of the countries with the highest losses from disaster events are small island developing states, with damages valued up to 9% of their gross domestic product (GDP) (GFDRR, 2017). SIDS' heightened and combined vulnerabilities have been further exacerbated by the past "global energy, food, financial and economic crises, the increased incidence of natural disasters, and environmental challenges" (AOSIS, 2012, pp. 1-2). Furthermore, even when compared to other small states, they "are highly dependent on imported oil and other fossil fuels for transport and electricity generation" which pose "a major source of economic vulnerability... and leave SIDS highly exposed to oil-price volatility," where "imported fossil fuels represent a major impediment to the achievement of sustainable development and poverty eradication" (AOSIS, 2012, pp. 1-2).

SIDS' heavy reliance on fossil fuels has worsened trading deficits and debt problems. In 2012, the Caribbean's fuel imports were worth around 550% of the total value for regional exports (Chen, 2017). Fossil fuel dependence has contributed to the debt in SIDS, especially in the Caribbean region where island states hold outstanding loans to oil exporters, like Venezuela, valued at as much as 10% of countries' GDP (Chen, 2017). According to the World Bank (2016), the majority of small island states are at a high risk of debt distress. On average, SIDS are more severely indebted when compared to other developing countries. In 2014, several SIDS' debt to GDP ratio was approximately 57% compared to 44% in other middle and low-income countries (Chen, 2017). According to Winters & Martins (2004, p. 348), a "combination of diseconomies of scale and high transaction costs with the rest of the world prevent small remote economies from generating competitive exports" or attracting significant foreign investment.

SIDS tend to have a high dependence on a small range of exports accompanied by high import patterns for strategic products such as food and fuel (Chen, 2017). Consequently, global trade, financial volatility and economic downturns can quickly and substantially affect SIDS (Chen, 2017) when compared to other small states. In addition, many SIDS' small and remote economies suffer from structural disadvantages in terms of economic competitiveness (Winters & Martins, 2004). This makes them less attractive for commercial activities, the solution for which requires proactive policies from the global community (Winters & Martins, 2004). Several islands in the Pacific, Caribbean and African/Indian Ocean have been recipients of the World Bank's International Development Association (IDA) grants to relieve fiscal constraints faced (World Bank, 2016). In addition, SIDS nations have received around USD 1,380 million from multilateral climate funds between 2003 and 2017 to support their green transition ambitions (Watson, et al., 2017). In 2017, another USD 228 million was approved for projects in SIDS in further recognition of their limited capacity to transition on their own (Watson, et al., 2017).

Although underexplored within leading green transition-related literature, SIDS' distinct circumstances (Briguglio, 2016) alongside their ambitious green transition targets compared to other countries (Ourbak & Magnan, 2018; Robinson, 2018), make them particularly relevant cases amidst the overall green transition discourse. SIDS uniquely suffer from additional handicaps arising from the heightened interplay of several factors such as smaller land mass, insularity and geographic remoteness, geographical dispersion, higher transport costs, higher vulnerability to natural disasters, export concentration, higher dependency on imports with higher vulnerability to energy and food price shocks and speculation, and highly limited internal markets (Briguglio, 1995, p. 1615).

Due to their heightened socio-economic and environmental vulnerabilities and characteristics, these countries' sustainable development challenges inevitably add further complexity to the achievement of any green energy transition ambitions set when compared to other countries. Despite this, given their well-defined, closed geographic contexts, they also provide ideal settings to test and study innovation and transition strategies towards sustainability; that can then become models for larger countries (Benedicto, 2014). SIDS' exposure to heightened challenges can potentially inspire innovative strategies to green transition problems commonly faced by all countries. For example, how to finance the transition given finite resources, effective models of actor participation, and effective harmonisation of green transition ambitions with wider sustainable development strategies.

Despite their many challenges faced, some SIDS have been able to not only achieve their green energy transition (GET) targets set, but to surpass them. I explore the strategies that have allowed for successful GET to occur within SIDS' setting of increased challenges such as higher debt, small constrained national markets, and increased economic and environmental vulnerability. Namely, I explore what nuances in the drivers, barriers and context conditions faced have allowed some SIDS to succeed and for others to lag behind their national green energy transition goals set.

2.3.2. Green Energy Transition (GET) in SIDS

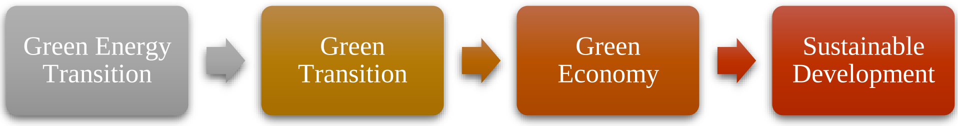
2.3.2.1. Sustainable Development and SIDS

Within the last few decades, a major shift in international perspective concerning sustainable development has occurred. Growth and poverty eradication goals have increasingly included climate and environmental related targets or ‘green transition’ ambitions. Green Transition can be defined as a shift towards an environmentally sustainable economy centred on the transformation of markets, behaviours, products and processes, technological deployment and new skills (EBRD, 2015, p. 4).

Concerning the sustainable development agenda, many SIDS may leverage green economy opportunities as a means to address key problems relating to the need for a cleaner and more sufficient lifestyle. In the context of SIDS, sustainable development and the green transition agenda are intrinsically linked, where specific climate mitigation and adaptation targets have been identified as an integral part of overall societal advancement. Green transition targets set by countries such as Antigua & Barbuda, Barbados, Fiji, the Marshall Islands among others, have explicitly mirrored national sustainable development needs, such as, energy consumption, electricity generation, waste and water management (UNFCCC, 2015).

Within my thesis, the relationship between green energy transition and its contribution towards sustainable development is understood as seen depicted below:

Figure 1 The Interrelationship between green energy transition and sustainable development



Green energy transition targets are recognised as contributors to broader green transition targets, which are viewed to in turn contribute to overarching green economy objectives, that go on to fulfil wider sustainable development goals.

2.3.2.2. Opportunities in the Renewable Energy Sector

Although the energy supply sector has been identified as the largest contributor to global GHG emissions (IPCC, 2015), the sector also offers a multitude of options to reduce these trends (IRENA, 2018a; Tschakert, et al., 2018; Bowers, 1990). These options include energy efficiency improvements, fossil fuel switching and low GHG energy supply technologies such as renewable energy (RE) (IPCC, 2015). In recent years, several renewable energy technologies have become economically competitive (Chen, 2017). In 2012, RE accounted for just over half of the new electricity generating capacity globally, led by a growth in wind, hydro and solar power (Chen, 2017). For countries such as Jamaica and the Dominican Republic whose energy demands are 85% supplied by foreign inputs respectively, RE can represent a means towards enhanced energy independence and security (Chen, 2017).

Most SIDS import the bulk of their energy resource needs in the form of fossil fuels (Atteridge & Savvidou, 2019), spending over US$67 million per day for oil, with the cost of fuel imports accounting for around 12% to 37% of total imports (Feinstein, 2013). As such, islands need to assess their full potential for producing clean energy which for many includes the full array of wind, wave, and tidal power, as well as solar, hydro, geothermal, and biomass (Chen, 2017; Garcia & Meisen, 2008). Nevertheless, in order to successfully increase their market share, these technologies require both direct (e.g. feed in tariffs, renewable energy quotas) and indirect (e.g. sufficiently high carbon process) enabling policy support (IPCC, 2015).

To date, some SIDS have been able to implement steps towards leveraging green economy opportunities via the renewable energy sector (Chen, 2017). For example, in the Caribbean island of Barbados the introduction of solar water heaters (SWH) during the 1974 to 2010 period resulted in over 100,000-megawatt hour (MWH) of energy saved. In addition, millions of dollars-worth of fossil-fuel imports have been saved every year and millions of tonnes of carbon-dioxide emissions avoided (Greene & Nurse, 2015).

For SIDS, such as in the Caribbean, individually no renewable energy resource can reliably meet growing energy demand across all member states by itself (with the exception of geothermal which could power entire member nations) (Ochs, Alexander, et. al., 2015). However, when developed simultaneously, these resources possess significant synergistic potential and can reduce each other's disadvantages (Ochs, Alexander, et. al., 2015). Nevertheless, the potential of renewable energy resources as substantial commercial fuels by SIDS is dependent on the development and commercial production of appropriate technologies (IPCC, 2014; ODI and CDKN, 2014; CARICOM, 2013; UN-OHRLLS, 2011).

An IRENA (2014) report showed that the wide variety of island states in their different locations and varying levels of development, can attract investment in cost-effective renewable energy resources through a mix of: (i) political priority to attract investment, (ii) market framework for investment, (iii) technical planning for investment, and (iv) capacity to implement investment, suitable to their respective local contexts (Global Renewable Energy Islands Network, 2014). To be credible and have impact, political priority should be clearly articulated by ministers and embodied in legislation (Global Renewable Energy Islands Network, 2014). Additionally, an effective market framework would ensure an open electricity market to all types and sizes of players who could profit by installing renewable energy power facilities. For example, incumbent utilities, independent power producers and building owners (Global Renewable Energy Islands Network, 2014). Regulations should also make it profitable for utilities to invest in cost-effective renewable energy power options (Global Renewable Energy Islands Network, 2014).

Furthermore, integrated resource planning should ensure that an optimal mix of energy options is chosen for the country (Global Renewable Energy Islands Network, 2014). The successful integration of renewable power onto the national power grid also requires human capacity (Global Renewable Energy Islands Network, 2014). This includes a range of skills to plan, finance, manage, operate, and maintain the power grid effectively, safely, reliably, and economically (Global Renewable Energy Islands Network, 2014). To varying degrees, SIDS from around the globe have begun to create the political, market, technical and human capacity settings required for renewable energy investment (Global Renewable Energy Islands Network, 2014).

In several SIDS, the fiscal incentives and public financing exist to encourage renewable energy development. Since 2010, renewables such as solar and wind deployment have significantly increased (Chen, 2017). However, the deployment of renewable energy in small island economies remains low compared to the total energy used in these countries (Chen, 2017). Despite this, renewable energy generation targets have been strengthening in SIDS (Chen, 2017). This may reflect the growing confidence of policymakers in the feasibility of renewable energy technologies (Chen, 2017).

Numerous reports and studies done by organisations such as the World Bank (2016), International Monetary Fund (2016), and the Intergovernmental Panel on Climate Change (2014), among others, have sought to capture these case stories. However, this has been done either in a rather broad scope or in narrowed silos looking at a specific topic area such as fiscal policy, scientific, or technological assessments. Consequently, a gap exists which explains and compares those key factors that influence the successful uptake of renewable energy technologies in SIDS, and the degree to which their distinct national contexts can affect this transition process.

However, in order to know one’s path one must first determine their destination. Below I examine exactly what is meant by a green economy? How does one hope to measure successful achievement towards it? Several international organisations have sought to clarify just this. However, part of answering this question would also entail pinpointing the key characteristics that SIDS themselves have highlighted as features of such a green economy, and hence the role that green energy technologies can play towards achieving it.

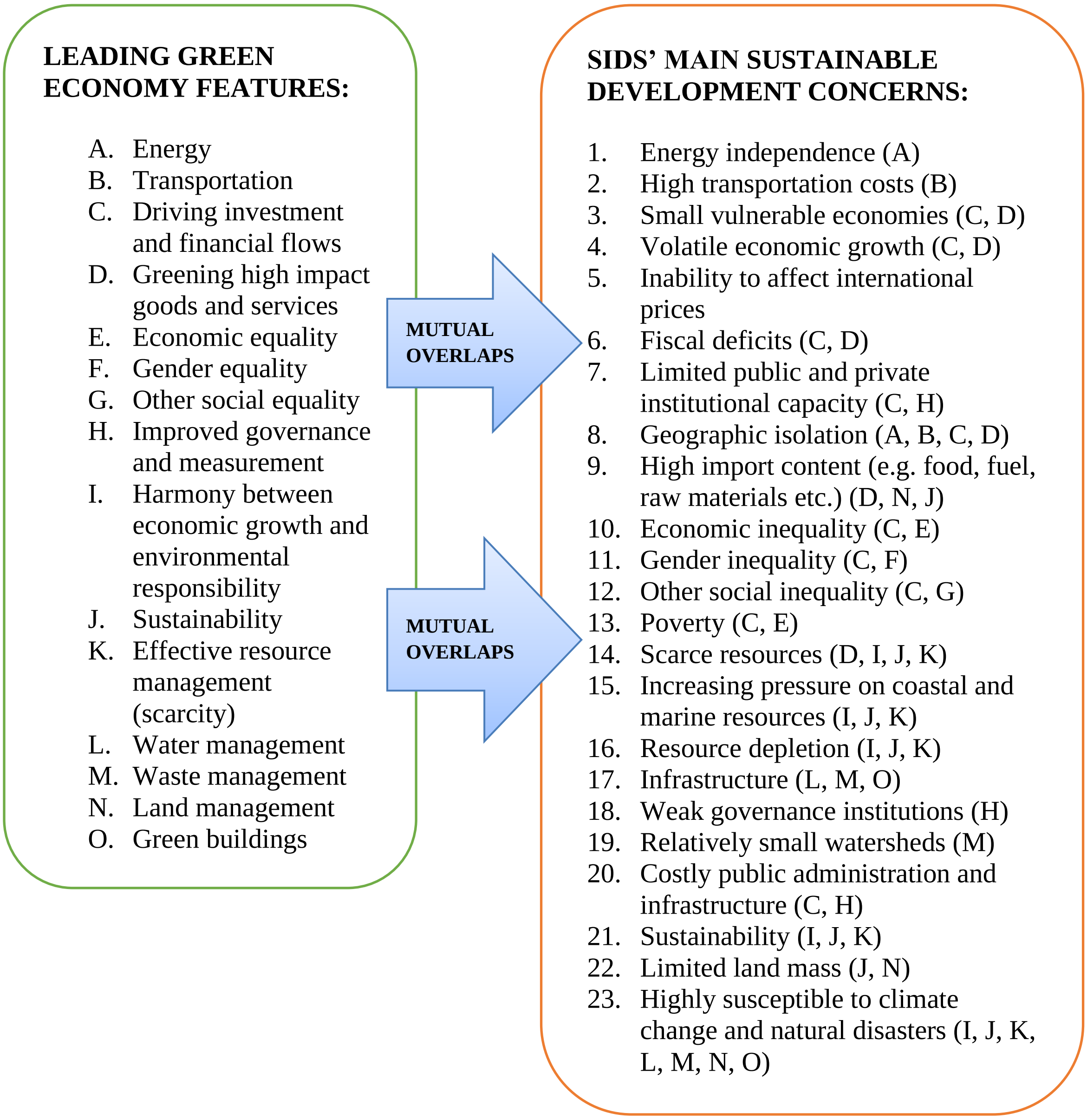
2.3.2.3. Clarifying the Transition Destination: A Suitable Green Economy Definition for SIDS?

The concept of a green economy has emerged as one which aims to marry key principles found under economic fields with that of environmental science. While green transition can be viewed as the pathways taken by countries to achieve green economy goals.

While many definitions exist that define the green economy (Kaggwa, et al., 2013; Government of Barbados, 2012; Government of Belize, 2012; Government of Samoa, 2012; Unmussig, et al., 2012; Economic Development Department Republic of South Africa, 2011; GEC, 2011; ICC; UNCTAD, 2011; UNEP, 2011; Burkart, 2009; Jones, 2008), no one description wholly encompasses the plethora of issues faced by the small and vulnerable economies that characterise many SIDS. Moreover, several criticisms have been put forward on the concept of a 'green economy'. Although positive interactions exist between the environment and development, they are not entirely compatible (Unmussig, et al., 2012). According to Unmussig, et al. (2012), this is due to the ambiguity of the term ‘sustainable development’, whether this is viewed in terms of growth or equity and who should participate in such advancements. The writers add, that also unclear are the views on who should benefit from the green economy, how shall it be achieved and through what instruments? For example, the definition put forward by UNEP (2011) has been criticised for its commodification of natural resources in order to gain traction with the private sector, rather than a view to protect local resources from exploitation (Unmussig, et al., 2012).

While these aspects are of course also important within the overall goal of sustainable development, the important linkages between “human social and environment relationships are too easily neglected” (Spash, 2012, p. 96). For this thesis, I aimed to ensure that whatever definition ultimately employed was one that was suitable to the sustainable development agenda of SIDS. Consequently, I strove for a definition that maintained as much of a harmonious linkage as possible between; (i) the characteristics outlined in leading definitions, with (ii) the main sustainable development concerns highlighted by SIDS themselves.

Figure 2 A Compilation of Proposed Key Characteristics for a 'SIDS-friendly' Green Economy Definition



Sources: (Kaggwa, et al., 2013; Economic Development Department Republic of South Africa, 2011; GEC, 2011; ICC, 2011; UNCTAD, 2011; UNEP, 2011; Burkart, 2009; Jones, 2008).

Figure 2 above shows that each of the 23 major challenges faced by SIDS, could be addressed under at least one area outlined within a green economy. This is denoted by the letters ‘A’ through ‘O’ which appear next to the relevant concern that SIDS face. Individually, the respective definitions fall short of effectively covering all sustainable development needs. However, when the main elements of all the previously mentioned definitions were extracted, a green economy feature was found relevant to each of the main sustainable development challenges faced by SIDS. Therefore, the best definition may be one that combines characteristics from all the definitions covered.

Therefore, for this thesis, the green economy definition that utilised to guide analysis was one that sought to promote the fifteen characteristics (A to O) outlined in figure 2 above. In this way, the major elements of these countries’ sustainable development needs are recognised when analysing their path towards a green economy via green energy. That is, one which facilitates overcoming the overall sustainable development context conditions and concerns within SIDS.

This thesis therefore generally refers to the green economy as: a resilient economy within the ecological limits of the planet that results in improved human well-being and social equity and works as an enabling component of the overarching goal of sustainable development, where economic growth and environmental responsibility work together in a mutually reinforcing fashion. Whereas transition towards the green economy goal is understood to be driven by the actions of both public and private investments that enhance energy and resource efficiency (UNEP, 2011), that are undertaken within, but not limited to, the areas of; (i) energy, (ii) transportation, (iii) water, (iv) waste, (v) land management and (vi) green building (Burkart, 2009; Jones, 2008).

Although an overall understanding of the green economy as a sustainable development destination for SIDS is important, this thesis shall specifically focus on the journey or transition towards getting there under the sub-sector area of green energy (or renewable energy), with reference made to the specific concept of a green economy only within this context. Namely, focus shall be on the transition policies, processes and institutional mechanisms countries have established, meant to achieve corresponding green economy and sustainable development targets or outcomes within the energy sector.

2.4. Section III - Assessing Green Energy Transition: Observed Gaps in the Literature

2.4.1. Understanding Transition Drivers and Barriers

Multiple factors can influence a country's transition progress positively and, or negatively over time. These for example, can include the role of government (IPCC, 2015; SELA, 2012; Flannagan, et al., 2011; Kemp, et al., 2010; Loorbach, 2010; Loorbach, 2007), key adaptation leaders and advocates (IPCC, 2014; Spash, 2012; Unmussig, et al., 2012), external market factors (Clausen & Fichter, 2019; Yang, et al., 2019; Kemp, et al., 2010; Loorbach, 2010; Loorbach, 2007; Rogers, 1962), among many others. This thesis collectively refers to these factors as 'transition determinants'. In an interdisciplinary manner, I apply elements from existing GET-related scholarship, towards identifying and understanding the determinants that drive and or hinder green energy transition within the context of SIDS.

On its own no singular theoretical framework when operationalised satisfactorily facilitates analysis of transition determinants from a policy implementation perspective (Edmondson, et al., 2018; Rogge & Reichardt, 2016; Markard, et al., 2015; Flannagan, et al., 2011). Furthermore, concerning the case of small island developing countries (SIDS), theoretical application and empirical gaps also emerge (Wieczorek, 2018; Scobie, 2016). Despite their respective limitations, when elements from sustainability transitions literature, as well as diffusion research are combined, they provide a sound starting point for undertaking case study exploration on transition drivers and barriers within SIDS.

2.4.1.1. Sustainability Transitions

'Sustainability transitions' writers perceive transition as the important "alignment between technological and socio-economic elements such as user preferences, practices, prices, rules and regulations" (Berkhout, et al., 2010, p. 267). To achieve both environmental and economic goals, it is widely acknowledged that a roadmap for the development and diffusion of environmentally friendly technologies combined with a coherent and effective governance framework is required (Crespi, 2016). This principle proves especially relevant for SIDS like Barbados, Jamaica, and Mauritius who have been in pursuit of a green energy transition strongly centred on the uptake of RE technologies (Ministry of Energy & Public Utilities, 2019; Government of Barbados, 2018; Planning Institute of Jamaica, 2018). The ‘multi-level perspective’ (MLP), ‘strategic niche management’ (SNM) and ‘transition management’ (TM) perspectives, have been the most widely used frameworks for understanding sustainability related transitions within the developed world (Wieczorek, 2018).

Multi-level Perspective (MLP)

According to Wittmayer, et al. (2016), Geels (2011; 2005; 2002), Geels and Schot (2007), and Rip and Kemp (1998), the multi-level perspective (MLP) perceives transition as non-linear processes resulting from the interplay of developments at three analytical levels. These levels include niches (where radical innovations occur), socio-technical regimes (established practices and associated rules that stabilise the existing system), and the exogenous socio-technical landscape. Higher levels are considered to be more stable than lower levels in terms of the number of actors and degrees of alignment between the elements (Geels & Schot, 2010). Primary focus is on the regime level where transitions are defined as shifts from one regime to another (Geels, 2011). The niche and landscape levels are viewed as derived concepts, defined in relation to the regime as practices or technology that deviate substantially from the existing regime and as the external environment that influences interactions between niches and regime (Geels, 2011).

Four types of transitions categories are described under MLP (Berkhout, et al., 2004). The first type referred to as ‘endogenous renewal’, where regime actors consciously respond to perceived pressures using internal resources. Here, the pressure that stimulates regime change is a result of high coordination, where responses are based on resources which have originated from within the regime. Rotmans and Kemp (2001), add the perspective of “blueprint thinking”, which operates from a fixed notion of goals and corresponding visions. Innovation under this general typology area is “steered by the prevailing values, cognitive structures and problem-solving routines” (Loorbach, 2014, pp. 58-63). While many small island developing states simply lack the resources to fully implement such a type of transition (Briguglio, 2016), it may be found that at least to some extent, the involvement of endogenous resources available (human, institutional, networks, skills etc.) are key towards facilitating transition advancements that are suitably adapted to local conditions (Berkhout, et al., 2004).

The second typology of ‘reorientation of trajectories’ results from a shock either internal or external to the regime which is followed by a response by regime actors using internal resources (Geels, et al., 2016; Geels & Schot, 2007). The third, ‘emergent transformation’ occurs from uncoordinated pressures outside the regime, often driven by small and new firms (Geels & Schot, 2007). The fourth, ‘purposive transitions’ refers to intended and coordinated change processes that emerge from outside the existing regime. This fourth type is seen as deliberate, pursued from the offset towards an explicit set of societal expectations or interest (Geels & Schot, 2007). Berkhout et al. (2004), described this fourth type as the transformation of a socio-technical regime guided primarily by negotiation between social actors from beyond the regime. Social actors have a greater role in forming the socio-technical response to the co-ordinated pressure for change which is the outcome of a deliberate attempt to change the regime.

Critiques of the MLP have highlighted that it can neglect economic variables (Foxon, 2011), presents limited analysis of agency and actor roles (Wittmayer, et al., 2016; Smith, et al., 2005) and could benefit from greater emphasis on institutions, ideology, and politics (Kern, 2011; Meadowcroft, 2011).

Strategic Niche Management’ (SNM)

Strategic niche management (SNM) writers describe transition in terms of a regime shift that comes about through bottom-up processes of niche innovation expansion which eventually replace and transform the existing regime (Geels & Schot, 2010; Kemp, et al., 1998). Niche innovations may not always compete with or substitute the prevailing regime but may be incorporated into and transform it from within (Geels & Schot, 2010). A key assumption is that, where constructed appropriately, the creation of technological niches can drive sustainable innovation pathways (van den Bosch, 2010; Schot & Geels, 2008). Sustainable innovation pathways refer to protected spaces that allow nurturing and experimentation alongside the co-evolution of technology, user practice and regulatory structures (Geels & Schot, 2010).

According to Nill and Kemp (2009), and Rip (2006), SNM involves a bottom-up perspective focused on endogenous steering or steering from within (Geels & Schot, 2010). Although niches are not initiated by government, they can be modulated into more sustainable directions. Also considered important in determining transition outcomes is the design of experiments. Specifically, in terms of technological and market niche development (Geels & Schot, 2010).

Geels et al. (2017), further add that innovator networks drive the transition through research and experimentation, with many failures. An innovation eventually enters the market in small niches which provide resources for further development and specialisation, until eventually a dominant design emerges within the market. This innovation will go on to more widely break through to compete head on with the established regime (Geels, et al., 2017). This process is driven by internal drivers to the niche, such as price or performance improvements, scale and learning economies, development of complementary technologies and infrastructures, positive cultural discourses, and support from powerful actors. Additionally, driving the transition is the destabilisation of the existing regime due to internal problems (e.g. urban air quality), landscape pressures such as rising oil prices, which create windows of opportunity for niche innovations (Geels, et al., 2017).

Several shortcomings of SNM have been identified by scholars. It neglects the embedding of sustainable innovations within broader societal goals (Schot & Geels, 2008). The approach lacks elements that look at issues of resources and entrepreneurship which are crucial for niche dynamics (Geels & Schot, 2010). Hendry et al. (2007) and Harborne et al. (2007), also highlighted that greater attention could be paid to the role that structured repeated visioning could play, driven by a sense of urgency (Geels & Schot, 2010). Brown et al. (2004) and Harborne et al. (2007), further stressed consideration of the drivers and contexts that influence the involvement of outside actors to the niche, as well as second order learning (Schot & Geels, 2008).

Despite their shortcomings, collectively MLP and SNM provide useful starting points in identifying the main drivers and barriers of green energy transition within SIDS.

Transition Management Approach

Transition management (TM) is based on the analytical perspective of society as a patchwork of complex systems which evolve, change, adapt and sometimes undergo structural changes or transitions (Loorbach & van Raak, 2006). TM scholars (Loorbach and Rotmans 2006; Rotmans, Kemp et al. 2001; Rotmans, Kemp et al. 2000), introduced it as a policy or governance approach, later developed into a policy model to deal with long-term desired change and sustainable development (Loorbach & van Raak, 2006). Guided by the multi-level approach, a societal system in TM is understood to be made up of subsystems which can be interpreted as 'functional subsystems' (e.g. energy, water, waste, health care, mobility), or regions (e.g. a province). In many subsystems, while technology can be recognised to play a dominant role, the starting point in any TM study is focused on a societal problem (Kemp, et al., 2005a).

Derk Loorbach (2010; 2007), further built upon transition management literature, presenting it as a new governance approach for sustainable development (Loorbach, 2010). Within the approach, sustainable development was referred to as the "persistent problems" of western industrialized societies "that can only be dealt with… through specific types of network and decision-making processes" (Loorbach, 2010, p. 161). This thesis considers this viewpoint within the context of SIDS, specifically within their green energy transition process.

Crespi (2016, p. 145) highlights the "importance of adopting a systematic perspective for the analysis of sustainable transition to better identify challenges related to transition governance". Building upon the multilevel model under innovation and technology studies (Geels, 2002; Rip and Kemp, 1998), Loorbach (2007 and 2010) approached transitions from a policy perspective. He presented a framework that proposed an integrated analysis on four different types of governance activities that could influence long term change along with their respective roles within societal transitions. The four spheres outlined of societal transition included the: 'strategic sphere', where wider goals and visions are set, the 'tactical sphere' where rules and regulations are introduced, the 'operational sphere' where new behaviours and technologies are deployed, and finally the reflexive sphere which involves the monitoring and evaluation of policies and societal change (Loorbach, 2010, pp. 168-171).

In this thesis I aim to examine cross-country variances in green energy transition drivers, barriers, and outcomes across three SIDS, within the context of sustainable development. TM when compared to other sustainability transitions literature (SNM and MLP), forms an analytical starting point based on the societal problem, versus that oriented on a technological starting point (Loorbach & van Raak, 2006). Transition direction is observed to be mainly determined by that of shared problems, long term goals, visions and learning-process, rather than the trajectory of technologies or technological systems (Loorbach & van Raak, 2006). Through thematic analysis, I borrow from Loorbach's (2010) approach (which examines transitions towards sustainable development), to help map the transition landscape.

Table 2 Summary of Loorbach's (2010) Transition Management Analytical Approach

Sphere of Governance Activity	Analytical Use	Focus	Problem Scope	Timescale
Strategic	Identify processes of vision, strategic discussions, long-term goal formulation, collective goal, norm setting and long-term anticipation. Factors that drive a sense of socio-political urgency.	Culture	Abstract/ societal system	Long term (30 years)
Tactical	Identify interest driven steering activities related to the dominant regime or structures e.g. rules, regulations, institutions, organisations, networks, infrastructure and routines.	Structures	Institutions / regime	Midterm (5-15 years)
Operational	Identify actions that have a short-term horizon, often carried out in the context of innovation projects and programmes generally referred to as innovation. This includes all societal, technological, institutional and behavioural practices that introduce or operationalise new structures, cultures, routines or actors. These innovations can emerge in niches without any link to formal policies or agenda.	Practices	Concrete/ project	Short term (0-5 years)
Reflexive	Relates to the monitoring and evaluation of policies and societal change, relevant to all three types of transition management outlined above. Although it should be an integrated part of governance processes, it often comes afterward or in a detached manner	Feedback loops	At all levels	Short to long term

Source: (Loorbach, 2010, pp. 168-171).

Loorbach's framework is especially useful since it can be easily applied across multiple levels, from that of the societal system, to the sub-system or project level from a policy perspective. While TM proved useful in helping to map the overall transition outcomes, this research also sought to empirically capture transition progress over time. In this regard, research lent from diffusion of innovation theory (e.g. Rogers, 1962), which was used to empirically track transition progress over time.

Sustainability Transitions Theory on Developing Countries

Sustainability transitions literature is beginning to more and more be applied on developing countries (Hansen, et al., 2018; Wieczorek, 2018). However, case studies have tended to mostly focus on large industrialising developing economies such as Brazil, China, India, and South Africa, with several focused on the Asian region and least developed economies of Africa (Wieczorek, 2018). Hence, evidence-based knowledge remains deficient regarding the small developing country context (Ramos-Mejia, et al., 2018). This is especially the case concerning small island developing countries, who generally lack data for comprehensive climate change and socio-economic projections (Scobie, 2016).

Furthermore, little attention has been paid to the limitations of utilising existing sustainability transitions frameworks such as MLP and SNM on developing world contexts (Ramos-Mejia, et al., 2018). Unlike their developed country counterparts, these countries exhibit distinctive characteristics such as "ill-functioning institutions", "market imperfections", "social exclusion" among others (Ramos-Mejia, et al., 2018, p. 217). These elements have tended to be overlooked by sustainability transitions scholars, with focus instead made on environmental sustainability or production-consumption systems (Ramos-Mejia, et al., 2018).

Ramos-Mejia et al. (2018), attempt to address this shortcoming from a socio-institutional perspective of sustainability, through use of development studies literature. Namely, the ability of societies to counteract what Sen (2000), refers to as processes of poverty reproduction and capability deprivation. Sustainability in this sense is viewed from the standpoint of overcoming poverty (Ramos-Mejia, et al., 2018). This thesis similarly seeks to address the shortcomings of existing sustainability transitions research, also lending from the concept of sustainable development. That is, the national conditions (e.g. social, cultural, economic and political) (Hansen, et al., 2018), that may drive or hinder achievement of sustainable development goals set relevant within the energy sector. Sustainability in this sense is viewed as the overcoming and or leveraging of contextual conditions towards the attainment of sustainable energy goals.

In addition, according to Lockwood (2003), the national and local politics of climate change adaption in lower income countries are underexplored, with more focus being placed on technical solutions to support adaption (Dodman & Mitlin, 2015). However, the achievement of planning processes within highly vulnerable countries will inevitably affect and be affected by social and power relations (Dodman & Mitlin, 2015). When compared to developed countries, developing countries are often faced with the similar conditions of: weaker state apparatus, less efficient bureaucracies, higher levels of political instability, less transparency and enforcement of legal frameworks, relatively high levels of economic and social inequality, a reliance on foreign sources of technology, knowledge and financial resources, less advanced industrial processes, a dominance of low-tech sectors and employment in the informal sector (Hansen, et al., 2018).

Given the significant differences between developed and developing countries, the study of transition in developing countries is likely to be a less than straightforward task than simply and strictly applying existing sustainability transitions theoretical frameworks to these cases (Hansen, et al., 2018). For instance, the concept of innovation within a developed country context concerns the radical development of new technologies based on research and development (R&D). However, for a developing country, innovation may entail less formalised activities to include concepts such as ‘frugal innovation’, ‘grassroots innovation’ and ‘inclusive innovation’ which utilise local assets and indigenous knowledge systems located outside of R&D laboratories (Hansen, et al., 2018). Hence, attempts to analyse sustainability transitions within developing countries require greater attention on to how specific contextual conditions can ultimately influence sustainability transition pathways (Hansen, et al., 2018).

Another example includes the ‘politics of climate change’, a topic often discussed under global politics literature (Dodman & Mitlin, 2015). However, long established within the literature on environmental issues and development, is a recognition that local interactions both to protect resources and to adapt to adverse changes in environmental goods and services are highly political (Dodman & Mitlin, 2015). Here, national, and local politics matter greatly, in terms of both how climate change is incorporated into national policies and programmes, as well as in terms of how climate-change politics has an impact on broader political processes (Dodman & Mitlin, 2015). According to Dodman & Mitlin (2015), in the case of Zimbabwe this has included the creation of formal sections within government, and the production of official documentation such as communications to the UNFCCC. In the African country it has also included growing engagement by international NGOs and donors, as well as access to new resources such as knowledge, finances, and networks. Other areas identified by existing academics as worthy of further research include: the role of actors, power relations in the policy process and decision-making, incentives and the role of scarcity and poverty (Dodman & Mitlin, 2015).

In 2018, Wieczorek reviewed over one hundred documents (between the years 2005 to 2016), published on sustainability transitions. The scan provided several useful policy insights relevant to the large developing country context:

- International donor projects are only likely to succeed when they meaningfully engage with place-specific cultures, power relations and infrastructures,
- Differing perceptions of sustainability across societies can cause disagreements about problems and solutions. Therefore, governments need to design policies that better consider the interplay between global forces with local competencies and context, and
- The increasing transnational connectedness of regime and niche actors can provide access to transition resources, however local assets and policies still play a crucial role (Wieczorek, 2018).

Although applicable to large developing countries, the above observations at least provide a useful starting point, highlighting potential drivers or barriers (determinants) worth being explored for their relevance within a small island developing country context.

In addition to the above, in this thesis I shall also consider the extent to which determinants important to developed countries, may or may not also manifest within a SIDS context. For instance, broad inclusive learning and adaptation of technology

(Berkhout, et al., 2010, p. 267), building of new actor networks, allowing actor participation, agency of actors, reflexive behaviour, policy action and interactions, market forces, positive externalities, contesting values and expectations, among others (Kohler, et al., 2019; Edmondson, et al., 2018; Kern & Rogge, 2016; Markard, et al., 2015; Flannagan, et al., 2011; Loorbach, 2010; Kemp, et al., 2010; Schot & Geels, 2008; Loorbach, 2007; Kemp, et al., 2005a; Kemp, et al., 2005b; Voss & Kemp, 2005).

2.4.1.2. Diffusion of Innovation Research

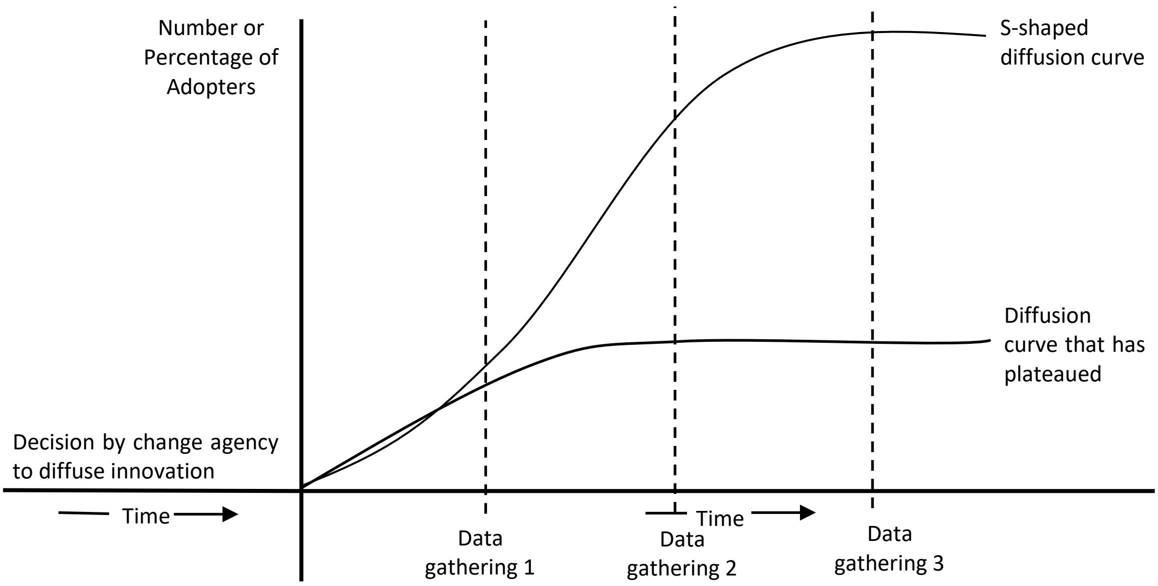
In the area of low-carbon innovation policy, Stern (2007) argues that a combined set of three policy measures are needed: (i) putting a price on carbon e.g. carbon taxes, to create the right incentives, (ii) promoting the innovation and diffusion of low-carbon technologies e.g. through demonstration projects strategic deployment programmes to create markets and drive uptake, and (iii) removing the institutional and non-market barriers to diffusion (Foxon, et al., 2008). According to Stern (2007), the design and implementation of such policies requires a better understanding of innovation processes, technological, economic, social, and environmental drivers and barriers through the integration of insights from different approaches (Foxon, et al., 2008).

Everett Rogers' (1962) diffusion of innovation theory provides a useful lens through which green energy transition progress over time could be empirically understood, particularly within the renewable energy sector which requires adoption of new technologies and infrastructure. Rogers (1962) defines diffusion as a form of social change, "the process by which alteration occurs in the structure and function of a social system" (p.7). This change can create a degree of uncertainty or unpredictability that can only be reduced through the provision of information. In this regard, diffusion can be further understood "as a special type of communication, in which the messages are concerned with a new idea" (Rogers, 1962, p. 7). While innovation is viewed as a new idea, practice or object that is perceived as new. For diffusion (which is understood in this thesis as transition, i.e. the uptake of green energy technology) to occur, a beneficial innovation alone is not enough for its successful adoption (Rogers, 1962). Transition in this regard, is measured as the process by which an innovation is communicated through certain channels over time among the members of a social system. While the author refers to the societal system as the set of interrelated units engaged in joint problem solving to accomplish a common goal. For example, norms and the roles of opinion leaders and change agents. That is, issues involving relationships between the societal system and the diffusion taking place within it (Rogers, 1962).

In part of my analysis, this thesis specifically adopts a combined use of Rogers' (1962) varying diffusion curves. In doing so, I seek to: (i) investigate the broader context of diffusion, which in this thesis is synonymous to transition, helping to answer questions of when- over a set timeline, and how- indicated by points of interests on the diffusion curve, decisions were made to diffuse the innovation (i.e. renewable energy technology uptake), (ii) capture diffusion (or transition) progress over time: making use of available secondary data, as well as providing deeper analysis aided by primary data collected and analysed, and (iii) conduct case study comparisons between ongoing diffusion experiences within and across select small island developing states; intra-regionally within the Caribbean context (Barbados and Jamaica) and cross regionally through inclusion of the African SIDS Mauritius. This approach helped to overcome one of the main critiques of diffusion of innovation theory. Namely, 'pro-innovation bias' where research has been mostly focused on completed and successful innovations (Nguyen, 2019; Karch, et al., 2016; Rogers, 1962).

The diffusion curve depicts the relative speed with which an innovation is adopted into the social system. This is done via the plotted rate of adoption of the innovation on a cumulative frequency basis over time. According to Rogers (1962), the s-shape of the curve generally portrays early adoption of the innovation which occurs by a few innovators. Then the rate of adoption trajectory begins to increase, eventually levelling off until the curve finally reaches its asymptote, and the diffusion process is complete. Most innovations depict an s-shaped rate of adoption, but this can vary from innovation to innovation. Rate of adoption is measured by the length of time required for a certain percentage of an innovation to be adopted in a system, using a specific innovation or system rather than individual as the unit of analysis. For example, in the context of this thesis, the renewable energy sector of select small island developing states over an approximate 18 to 35-year period.

Figure 3 Sample diffusion curves referenced by this thesis



Source: (Rogers, 1962, pp. 97-101)

Functions of Innovation or Transition Determinants

Several ‘characteristics of innovations’ can influence its rate of adoption or transition in a social system, and hence the type of diffusion curve observed (Rogers, 1962, p. 15). Namely:

i. **Relative advantage-** the degree to which an innovation is perceived as better than the idea it supersedes. The greater the perceived relative advantage of an innovation, the more rapid its rate of adoption is going to be,
ii. **Compatibility-** the degree to which an innovation is perceived as being consistent with the existing values, past experiences and needs of potential adopters. An idea incompatible with existing values and norms of a social system will not be adopted as rapidly as an innovation that is compatible, and may first require the adoption of a new value system,
iii. **Complexity-** the degree to which an innovation is perceived as difficult to understand and use. Some innovations are readily understood by most members of a social system; others are more complicated and will be adopted more slowly,

iv. **Trialability**- the degree to which an innovation may be experimented with on a limited basis. New ideas that can be tried on the instalment plan will generally be adopted more quickly than innovations that are not divisible, and

v. **Observability**- the degree to which the results of an innovation are visible to others. The easier it is for individuals to see the results of an innovation, the more likely they are to adopt.

Rogers (1962) further highlights that "it should not be assumed that the diffusion and adoption of all innovations are necessarily desirable" (p.13). While an innovation may be desirable for one adopter, it may not be so for another adopter in a different situation. Social structure or the patterned arrangements of the units in a societal system, can affect diffusion. It can provide regularity and stability to human behaviour through formal structures such as bureaucratic organisations like government agencies, where there is a hierarchy and orders are expected to be carried out. Informal structures also exist, such as communication structures: interpersonal networks that determine who interacts with whom and under what circumstances. Social structures are recognised by the patterned communication flows within a system. According to its pattern, social structures can either impede (e.g. a complete lack of communication in a system) or facilitate (regularised communication patterns via networks), the diffusion of innovations in a system (Rogers, 1962).

Subsequent researchers go on to highlight additional factors that can affect the rate of diffusion. Geroski (2000) points out that public procurement can be a very powerful technology policy tool since governments are often large, tend to be very heavy users of new technologies and insensitive to price. Therefore, they can be important potential agents in the bandwagon process (Geroski, 2000). Wejnert's (2002), work emphasises the significance of environmental context in the adoption of an innovation. "Innovations are not independent of their environmental context" but rather they "evolve in a specific ecological and cultural context" (Wejnert, 2002, p. 310).

According to Ormrod (1990), successful adoption of an innovation depends on its suitability to the new environment that it enters (Wejnert, 2002). "A broad array of variables can significantly influence the probability of whether an actor will adopt an innovation" (Wejnert, 2002, p. 318). Many low-carbon technologies require significant levels of investment to become competitive with existing technologies, which are often capita-intensive and long-lived (Foxon, et al., 2008). Foxon et al. (2008), highlight that social rule systems tend to be defined in terms of existing technologies. Consequently, significant institutional change will also be needed. To this end, “socially created expectations will be a key factor in changing business strategies and investment decisions” (Foxon, et al., 2008, p. 10).

Wejnert (2002), underscores four main subgroup variables of environmental context: (a) geographic settings, (b) societal culture, (c) political conditions, and (d) globalisation and uniformity. ‘Geographic settings’ refers mainly to innovations with private consequences adopted by individual actors. The latter three subgroups of environmental context factors refer to innovations with private and public consequences adopted by micro- and macro-level actors. The presence or absence of such contextual factors can largely influence the decision to adopt an innovation. James (1993) refers to them as externalities which affect the practicality and benefits of adoption, as well as the willingness and ability of an adopter to take up an innovation (Wejnert, 2002).

Wilson (2012) assesses energy technologies from the traditional linear model of innovation. Based on a sample of eight energy technologies, the author looks at the factors that have either enabled or constrained up-scaling at the unit level within the overall industry level growth. Under technology characteristics, the author highlights the importance of a formative phase as a precursor of efforts to scale-up unit capacities. Upscaling (i.e. the increase in size or performance capacity of a technology) was likely to be conflated with learning effects, in particular for centralised energy supply technologies. Over time, technologies are repeatedly and iteratively tested, modified, refined, and adapted to market demands (e.g. demonstration plants, projects, or prototypes). This process is widely used in order to demonstrate the viability of up-scaling technologies to commercial levels (Wilson, 2012).

The Danish wind case examined particularly demonstrated Wilson’s (2012) findings. Here, a period of experimentation and learning took place, with the build out of many units of a relatively small scale and fairly constant unit size from the late 1970’s to early 1990’s. This facilitated learning through relationships between industry actors supported by public investments, for example, in testing infrastructure. This in turn allowed experiences to be fed back into subsequent designs (Wilson, 2012). In contrast, countries like Germany, Sweden and the Netherlands placed early emphasis on the capture of unit economies of scale through the rapid increase of turbine capacities. According to Meyer (2007), this premature move into the up-scaling phase failed to build and enduring industry relative to the German case (Wilson, 2012).

Wilson's (2012), findings conclude that upscaling without sufficient numbers of commercial experiments or small-scale applications, risk being premature. The writer provides a cautionary note to policy makers against: (i) acting too early in a technology's commercial life cycle to support upscaling, or (ii) policies which presume rather than support the discovery of returns to scale (economies of scale associated with upscaling) (Wilson, 2012).

More recent writers of diffusions research Clausen & Fichter (2019), examined the diffusion of environmental innovations within the German market across a wide range of products and service sectors. Their findings distinguished three main factors that help explain why certain innovations diffuse well while others remain consumed only in market niches. Three key meta-factors were found to either drive or hamper the diffusion of innovations. Namely; (i) 'market push' (examples included- renown and reputation of suppliers, completeness and availability of services, degree of support by intermediaries as change agents, degree of support/ resistance of market leaders, among others), (ii) a 'favourable cost-benefit ratio' (e.g. relative advantage of the innovation, financial (dis-) advantage/ price competitiveness, and price development), and (iii) 'high compatibility and confidence in the innovation' (e.g. high technical and cultural compatibility, low need for behaviour modification, low uncertainty on the part of adopters and self-reinforcing social effects) (Clausen & Fichter, 2019).

Clausen & Fichter's (2019) findings suggested that even if combined with government information and labelling, an intense market push does not necessarily result in the high market penetration of an environmental innovation. Additional factors are required such as a very good cost-benefit ratio, high compatibility and inspired confidence in the innovation. Overall, a favourable economic framework is essential and supplier-related factors have a significant influence on diffusion. Whereas information-related policy instruments (e.g. labelling and information campaigns) can stimulate diffusion, alone they will not achieve a high dissemination rate. Moreover, necessary change in behaviour and uncertainties of the end-user can slow down diffusion. However, hard regulation or financial incentives can help to overcome such hurdles (Clausen & Fichter, 2019).

According to Clausen & Fichter (2019), for successful diffusion it is absolutely central that environmental innovations provide a favourable cost-benefit ratio, high compatibility, and inspire confidence in the innovation (Clausen & Fichter, 2019). Also of importance, can be variations of the fundamental innovation, tailored to specific customer groups (Clausen & Fichter, 2019). However, Van der Vooren et al. (2012), also highlight that too much variety can also increase uncertainty (as cited in Clausen & Fichter, 2019).

Based on developed country case contexts such as the United Kingdom, Germany and Japan, Foxon et al. (2008) emphasise that “economic policies on their own are not enough to transform society to low carbon energy systems” (p. 11). This is especially the case when seeking to implement policies geared at low-carbon innovation (Foxon, et al., 2008). Economic policies are highlighted as necessary, but on their own are insufficient. Instead, a combination of mutually supporting policies are required that: (i) address economic incentives to adopt new technologies, (ii) overcome microeconomic institutional barriers to change, (iii) generate expectations that there will be new markets for low-carbon technologies (Foxon, et al., 2008). In addition, the complex nature of innovation systems implies that different policy packages, employed at varying stages of the innovation process will be required for each different market. Therefore, energy policies would need to effectively address the demand-side. That is, they should help to create markets through strategic deployment policies, along with measures that overcome barriers and accelerate diffusion of technologies and behavioural change (Foxon, et al., 2008).

However, when it comes to the developing country context, the extent to which such conclusions also apply remains underexplored within diffusion studies. Little empirical evidence and understanding exists on the mechanisms and approaches that may characterise innovation and technical change in developing countries (Da Silveira, 2001). Much of research conducted has mostly focused on gathering evidence from developed economies and building theories based on that evidence (Da Silveira, 2001). Based on my readings, this exploratory deficit to a notable extent remains the case, especially concerning SIDS.

2.4.2. Climate Governance: Assessing the Actor Landscape

Limited understanding exists on the national actor types and their roles that can influence transition success over time (Wittmayer, et al., 2016; Markard, et al., 2012; Flannagan, et al., 2011), this especially includes the small island developing country context. To specifically examine the energy transition actor landscape, this thesis extracted from the literature and was guided by relevant elements pertaining to how existing scholarship viewed and assessed the transition actor landscape (i.e. climate governance). Aside from transition-related academia, I also explored key concepts under polycentricity theory.

2.4.2.1. Sustainability Transitions Scholars on Transition Actors

Based upon the foundations of earlier works on systems and complexity theories, transitions theory views “social change as a result of the interaction between all relevant actors on different societal levels within the context of a changing societal landscape” (Kemp, et al., 2005b, p. 9). Transitions towards sustainability possess certain characteristics that make them unique from historical transitions (Geels, 2011). Namely, they are goal oriented or purposive, seeking to address persistent environmental problems, versus historical transitions which tend to be emergent (e.g. entrepreneurs exploring commercial opportunities in new technologies) (Geels, 2011). Secondly as a result of being towards the collective good, sustainability transitions usually do not offer obvious user benefits. Thirdly, according to Rothaermel (2001), sustainability transitions tend to be required in domains (e.g. transport, energy and agri-food) that are characterised by large firms such as car manufacturers, electric utilities and oil companies, who possess complementary assets such as access to distribution channels, service networks and complementary technologies (Geels, 2011).

These assets give incumbent firms strong positions who often first develop environmental innovations. Despite this, large incumbent firms tend not to be the initial leaders of sustainability transitions, but their involvement may accelerate their breakthrough where they support innovations through their complementary assets and resources. However, this requires a strategic reorientation of incumbents. These entities would otherwise defend existing systems and regimes which are stabilised through lock in mechanisms such as scale economies, sunk investment costs in machines, infrastructures and competencies (Geels, 2011).

Private actors have limited incentive to pursue sustainability related transitions where the goal is related to the collective good. Hence, public authorities and civil society are crucial towards changing economic frame conditions (e.g. taxes, subsidies, regulatory frameworks) in the support of green niches (Geels, 2011). Without such changes in economic frame conditions, environmental innovations are unlikely to replace existing systems (Geels, 2011). Processes of societal change structurally alter the culture, structure, and practices of a societal system (Loorbach, 2007). Voss and Kemp (2005) speak of 'reflexive governance', which acknowledges that "governing activities are entangled in wider societal feedback loops and are partly shaped by the (side-) effects of its own working. Resting on the principles of 'rationalist problem-solving', it seeks to "select relevant elements, linearise cause-effect chains, put goals in hierarchal order, and divide responsibilities" (Voss & Kemp, 2005, p. 5). Geared towards continued learning, reflexive governance also promotes adaptivity which entails the capacity to respond to unexpected effects and developments (Voss & Kemp, 2005).

Within this context, the actions of various actors are coordinated along the lines of collective strategies (e.g. state actors, interest groups, producers and consumers, scientists, media etc.). Transitions can be recognised as "the outcome of the interactions between actors on one level and interactions between levels" (Kemp, et al., 2005b, p. 12). The capacity to enact such societal change may be analysed across functional domains such as production, consumption, political regulation and between actors. While the government plays a main coordinating role, they may be but one amongst many types of actors, where the competencies of the state itself can be fragmented into several agencies, government departments, political parties, regulatory agencies etc. (Voss & Kemp, 2005). Through negotiation, adaptation, co-production and debate, actors' visions and positions are redefined, involving the participation of other actors such as societal organisations, companies, knowledge institutes and intermediary organisations (Loorbach & van Raak, 2006). The outcome of societal change is viewed as the result of the interaction between all relevant actor types at varying societal levels within the context of a changing societal landscape (Loorbach & van Raak, 2006). According to Chilvers & Longhurst (2016), "the who (publics), what (issues), and how (procedural formats) of participation do not externally exist in a natural state but are actively constructed through the performance of collective participatory practices" (p. 586).

In practice, over the last few decades the central government's power to develop and implement policies in a top down manner has decreased, resulting in policymaking structures and processes stratified across sub-national, national and supranational levels of government (Loorbach, 2007; Hooghe & Marks, 2001). In developed regions like the EU, the current practice of government policymaking is an interactive one that involves a diversity of societal actors (Loorbach, 2007). Under strategic niche management, actor diversity is seen as productive for niche development due to enhanced learning and network development. However, it also acknowledges that too much diversity can hamper developments because it creates uncertainty which in turn prevents full commitments, fragments resources and hampers the emergence of a stable set of rules (Geels & Schot, 2010). Although existing literature provides no convergence on how multi-level governance should be ideally organised, two main typologies have emerged. Namely, (i) power sharing dispersed to a limited number of levels and (ii) a vast number of intersecting, flexible jurisdictions that are functionally specific (Hooghe & Marks, 2001). Hooghe and Marks (2001), highlight that often times a combination of both could arise within a context.

Studies on societal change have come to an increasing consensus, that traditional forms of steering are not suitable for societal challenges such as climate change which possess a high degree of complexity (Loorbach, 2007). However, the need still exists to direct complex societal dynamics. Consequently, the role of government is still an important one, albeit "top-down planning and market dynamics only account for parts of societal change", while network dynamics (where parties may have mutual influence), and "reflexive behaviour account for other parts" (Loorbach, 2007, p. 71). Transition management (TM) constitutes a selective participatory approach that relies heavily on market forces and decentralised decision-making (Kemp, et al., 2010; Loorbach, 2010). According to TM, the state engages in "context control" aimed at orienting market dynamics towards achievement of societal goals (Kemp, et al., 2010, p. 320).

In its analytical approach, this thesis especially utilises TM to help map the actor landscape across multiple levels of governance as outlined by Loorbach (2010), from the societal system to the sub-system or project level. The framework seeks to consider the "multilevel network in which actors sometimes even unconsciously contribute to shared goals through different types of governance strategies and actions" (Loorbach, 2010, p. 11). However, Loorbach's (2010) framework falls short of helping to answer causal questions concerning actor interactions. This research sought to fill this analytical gap by lending from additional bodies of literature (later discussed) such as climate governance and polycentricity theory.

2.4.2.2. Polycentricity Theory

Actors may play multiple roles within a transition system, which may be in tension with or even contradict the expectations or demands of other actors (Flannagan, et al., 2011). Additionally, multiple actors may play similar roles and individual actors may play multiple roles simultaneously, for example implementation agent and entrepreneur (Flannagan, et al., 2011). Individuals may also play different but multiple roles at the same time, as well as a similar role played by different actors at different times. Policy action often creates new actors, organisations or networks that can then go on to play other roles (Flannagan, et al., 2011). Furthermore, individuals that make up or are members of institutions may play other contradictory roles to the role of the institutions or organisations that they are a member of (Flannagan, et al., 2011). Such complex overlapping and interchange of roles can especially be the case within the small populations of SIDS (Berkhout, et al., 2010).

According to sustainability transition writers Geels and Schot (2007, p. 403), "rules are not just constraining (making some actions more legitimate than others), but also enabling (creating convergence of actions, predictability, trust, reliability)." The actions of these actors could in turn themselves become regimes when social networks grow larger and rules become more stable and constraining." Actors exist within rules structures but also at the same time reproduce them through their actions (Geels & Schot, 2007, p. 403). This thesis attempts to understand 'what' main factors have driven GET in SIDS contexts, then proceeds to explore more causal questions of 'how' and 'why' that further explain the behaviour of actors within SIDS' green energy transition process. To do so, polycentricity theory provided a useful analytical tool to complement my reference to diffusion and sustainability transitions scholarship.

Polycentricity was first envisaged by Michael Polyani in his 1951 book ‘The Logic of Liberty’. It was described as “a social system of many decision centres having limited and autonomous prerogatives and operating under an overarching set of rules” (Aligica & Tarko, 2012, p. 237). The concept later diffused into the fields of governance studies and environmental science, introduced by Vincent and Elinor Ostrom and the Bloomington School of institutional analysis (Thiel, 2016; Aligica & Tarko, 2012). The Bloomington school approach outlines three defining features of polycentricity: (i) the existence of many decision-making centres, (ii) existence of a single system of rules, and (iii) existence of a spontaneous social order. These can be used to empirically map the conceptual decision-making space in which multiple actors engage (Aligica & Tarko, 2012, p. 252).

Polyani (1951), outlined that social tasks can be organised in two ways. The first, a ‘deliberate’ or ‘direct’ order coordinated by an ultimate authority that exercises control via a unified command structure (Aligica & Tarko, 2012). Here a superior, subordinate relationship exists between actors. Vincent (1999, p. 57), describes the second type as ‘spontaneous’ or polycentric in nature, where many elements are capable of making mutual adjustments for ordering their relationships with one another within a general system of rules (Jordan, et al., 2018). Vincent Ostrom (1999; 1972), elaborates that polycentricity can be considered a study of monocentricity, the two being correlated concepts where a polycentric system may not necessarily preclude elements of monocentricity and vice versa (Aligica & Tarko, 2012). Under this system, each element acts with independence of the other, where individual decision makers pursue their own interests within the boundaries of the enforced rules (Ostrom, 1972, p. 6). Furthermore, Polyani’s ‘spontaneity’ implies that organisation patterns within a polycentric system will be self-generating and self-organising, as individuals are incentivised into appropriate patterns of ordered relationships (Ostrom, 1972). The idea of spontaneity emphasises the ability of individuals to change rules in an orderly and complex way (Tarko, 2017; Aligica & Tarko, 2012).

Ostrom (1972), further outlines three levels of conduct needed for a polycentric system to manifest spontaneity and hence ordered relationships (Aligica & Tarko, 2012). One level applies to the conditions of entry and exit into a polycentric ordering, that is, the extent to which individuals or firms could enter a market and engage in trade. The second level places particular significance on the enforcement of general rules of conduct, that provide the legal framework for a polycentric order. Polycentricity becomes increasingly viable when actors are incentivised to take actions that enforce the general rules of conduct. The third level speaks to the formulation and revision of rules of conduct. The system should allow for conditions that enable rules to be altered if a particular set of rules fail to evoke an appropriate set of responses (this echoes Voss and Kemp's 2005, concept of reflexive governance under sustainability transitions scholarship). Rules of a polycentric system help to describe the regularised behaviour of interdependent actors. In fact, McGinnis (2011) of the Bloomington school defines governance in terms of "the process by which the repertoire of rules, norms and strategies that guide behaviour within a given realm of policy interactions are formed, applied, interpreted and reformed" (Thiel, 2016, p. 3).

In his study, Ostrom (1972) makes a rather notable observation that "the structure and dynamics of a polycentric system was a function of the presence of polycentrism in the governance of other related and adjoined systems" (as cited in Aligica & Tarko, 2012, p. 247). Polycentric systems in one area tended to encourage polycentricity in others. For example, in government arrangements, economic affairs, political processes, and so forth. He concluded that as long as "no single set of decision-makers is able to gain dominance over all decision-making structures," polycentric decision-making arenas can occur within the context of a polycentric political system (Ostrom, 1972, p. 21).

I use the conditions laid out by the authors Aligica & Tarko (2012) as the basis for an analytical tool to explore GET in SIDS. Within this thesis, indicators developed by the authors were referenced to help map the conceptual space of a polycentric system, and the extent to which it was operational in the green energy sector.

Table 3 Indicators for Measuring Polycentricity Proposed by Aligica & Tarko (2012)

No	Core Polycentricity Conditions	Indicator(s) Proposed
1	Existence of many decision-making centres	(i) Presence of autonomous decision-making layers; and (ii) Existence of a set of common or shared goals.
2	Existence of a single set of rules that are enforced	(i) Involvement of decision centres on drafting overarching rules. (ii) The alignment between rules and incentives, that is, whether rules are seen as useful by the decision-centres (regardless of whether or not they are involved in the drafting). (iii) Nature of the collective choice aggregating mechanism (market, consensus or majority rule), where the general rules cover all sub-units within the polycentric system.
3	Existence of a spontaneous social order	(i) Relevant information for decision-making is public (available to all decision centres equally). (ii) The nature of entry into the polycentric system, that is: • *Free*- a decision centre can decide to enter the system and existing decision centres cannot prevent this, • *Meritocratic*- based on ability and talent rather than on class privilege or wealth, or • *Spontaneous*- no decision is involved.

Source: (Aligica & Tarko, 2012, pp. 253-254)

Aligica & Tarko (2012, pp. 255-256) stipulate that three main conditions should be satisfied for a system to be classified as polycentric:

1. Active exercise of diverse opinions and preferences (ideas or methods on how to conduct something) are implemented into practice by at least one decision centre,

2. The alignment of rules and incentives must exist, if not, then it is not an instance of polycentricity, and

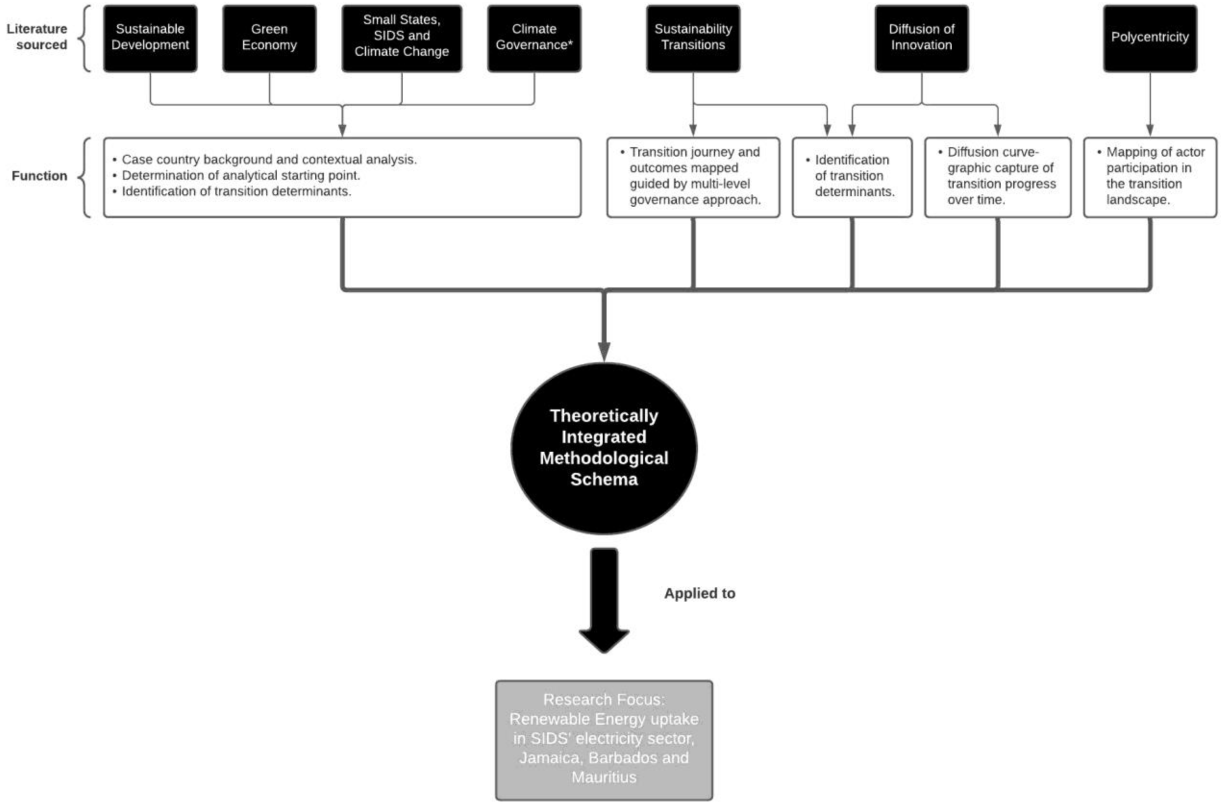
3. The different overlapping decision centres make operational decisions autonomously from the higher level.

Ultimately, polycentricity theory has the potential to enrich initial analysis done using diffusion and sustainability transitions theory. Polycentricity allows one to make analytical inferences in relation to units of analysis or actors, where the participation arenas can be specified. In the case of this thesis, the proposed transition arena examined being the renewable energy sector of select SIDS.

2.5. Section IV - An Integrated Theoretical Investigative Approach

Analytically, my thesis explores the green energy transition (GET) experience of SIDS, an area underexplored within leading GET-related theoretical frameworks. The literature review conducted above, provides the foundation upon which the rest of my thesis is conducted. Based on my literature review, I developed and employed a methodological schema that lends from up to seven bodies of literature relevant to SIDS' GET experience. Namely, I referenced leading GET theory under sustainability transitions and diffusion of innovation studies. My extension of sustainability transitions and diffusion studies to SIDS was further supplemented by concepts from under 5 other bodies of literature: sustainable development, the green economy, climate governance, small states, SIDS and climate change, and polycentricity theory.

Figure 4 Overview of Elements Referenced from the Varying Literature Employed in My Synthesised Investigative Approach



*Specifically refers to the literature synthesised under section 2.4.2. within this thesis.

In the first step of applying my methodological schema, I identified the main factors currently recognised across the leading literature as important overall to GET outcomes (i.e. transition determinants). However, findings from my literature review largely referred to developed and large developing country contexts (see listed in appendix 4). Hence, my search was further guided by my tailored understanding of what broadly constitutes a successful green transition and by extension green energy transition (GET) within SIDS contexts. That is, a SIDS-relevant definition of what determines an overall successful green transition (see defined under section 2.2.3.3). Furthermore, while academics have recognised the integral part that policy design and implementation play in sustainability related transitions, it has thus far received limited attention within the literature (Flannagan, et al., 2011; Markard, et al., 2012; Rogge & Reichardt, 2016; Edmondson, et al., 2018). Hence, in identifying the factors and context conditions most important to GET from a policy implementation perspective, I employed an interdisciplinary approach. For this stage of my research, I referenced up to six (6) bodies of literature: sustainable development, green economy, small states and SIDS, climate governance literature, sustainability transitions and diffusion of innovation.

I then reviewed and referenced existing literature to establish existing case country conditions or contexts within which their green transition takes place. Given the little transition-specific literature (i.e. sustainability transitions and diffusion of innovation) available on small states like SIDS, four specific supplementing bodies of literature were referenced: sustainable development, green economy, small states and SIDS, and climate governance literature. These four bodies of writings were used to more comprehensively understand SIDS' potential relevant political, social and economic conditions determining green transition outcomes and which play a significant role in driving the overall sustainable development agenda over time. The supplementary literature was also referenced to help clarify transition timelines (e.g. when SIDS began to adopt climate change and green energy related policies etc.) and in the determination of a suitable analytical starting point for my thesis.

The next steps in my methodological schema use secondary and primary data to go beyond existing academic works to consider the role of my three case countries' shared and unique characteristics on their GET outcomes observed. My integrated theoretical approach makes specific use of sustainability transitions theory lending mostly from the transition management approach (Loorbach, 2010; 2007) and referencing Ramos-Mejia, et al.'s (2018) research. I also refer to diffusion of innovation studies mostly referencing Wejnert (2002) and Rogers (1962), and to polycentricity theory guided by Aligica & Tarko (2012).

My overall examination of the GET experience borrows from sustainability transitions' multi-level perspective (Loorbach, 2007; 2010) using the process tracing technique. I specifically chose to employ the transition management (TM) approach since it especially supports research from a policy perspective. This was important since little to no in-depth analysis has been conducted, with few learning examples available to policymakers, on the outcomes that existing GET frameworks have had in SIDS' contexts (Ramos-Mejia, et al., 2018; Wieczorek, 2018; Rogers, 2016; Scobie, 2016). Understanding SIDS' RE outcomes is intrinsically tied to their regional circumstances and national characteristics

(IPCC, 2015; Government of Barbados, 2015; The Republic of Mauritius, 2015; Nurse, et al., 2014). However, leading GET-related literature has tended to stem from a technical or technological perspective and less from a comparative politics/public policy standpoint (Wittmayer, et al., 2016; Dodman & Mitlin, 2015; Foxon, et al., 2008; Wejnert, 2002).

TM outlines in a simple and clearly structured manner an approach (see table 2) that can be easily applied to case study examination and that could ideally facilitate this paper's research objective. I focus the exploration of my three case countries' societal-wide energy transformation at two main governance levels over time: the 'strategic sphere' where wider goals and visions are set, and the 'tactical sphere' where rules and regulations are introduced. I also briefly touch upon the 'operational sphere' where new technologies are deployed by looking at actor participation and via graphical depiction of transition success achieved over my analytical timeline (i.e. quantification of RE uptake over the years 2000 to 2018).

From diffusions research I reference Rogers' (1962) 'diffusion of innovation theory', which guides my graphical representation of the extent to which an innovation had been successfully adopted into the social system (see figure 3). My research gauged transition progress in terms of the diffusion of 'innovation' (i.e. observed RE uptake) on a plotted diffusion curve on a cumulative frequency basis over the defined 19-year timeframe of 2000 to 2018 (based on data availability). Where the diffusion curve is utilised in my thesis, I highlight key achievements or occurrences in the GET timeline along the plotted RE uptake trends. This visual depiction of the transition progress helped me to more easily pinpoint key moments in the GET timeline that could benefit from deeper analysis.

I used polycentricity theory (Aligica & Tarko, 2012) to categorise the extent of actor participation allowed within the respective national RE landscapes. This was done using proxy indicators (see table 3) which I adapted for my research to better suit the data availability and developing country characteristics of the SIDS cases examined (see table 10). Ramos-Mejia, et al. (2018) highlight that unlike their developed country counterparts, developing countries exhibit distinctive characteristics of poverty reproduction and capability deprivation, elements which tend to be overlooked by sustainability transitions scholars. For example, this includes characteristics such as "ill-functioning institutions", "social exclusion", among others (Ramos-Mejia, et al., 2018, p.

217). In my examination of the actor landscape, I incorporate consideration of such elements. For example, my adapted polycentricity indicator area of ‘access to opportunity’ lends from Sen and Nussbaum’s concept of access to advantage and opportunity under the ‘capabilities approach’ (see table 10). This adjusted approach allowed me to better consider characteristics relevant to innovation system functions in small developing country contexts like SIDS (i.e. actor and rules framework-focused rather than heavily technology-focused). Based on my adapted indicators, case countries’ overall GET landscapes were classified according to three main categories: participatory, partially participatory and non-participatory.

As seen outlined graphically below, the overall integrated approach of my methodological schema attempted to leverage the strength as well as compensate for shortcomings in any one theory through their combined use.

Table 4 Methodological Schema’s Complementary Strengths and Weaknesses

No	Body of Literature	Strengths	Weaknesses/ Gaps	Gaps Supplemented by
1	**Sustainability Transitions**	a. user-friendly means to analyse transition over time from policy perspective.	mainly technical/ technology focused.	5a
			developed and large developing country focused.	4a
2	**Diffusion of Innovation**	a. can visually depict transition progress via the diffusion curve.	mainly technical/ technology focused.	5a
		b. Considers significance of wider transition context.	developed and large developing country focused.	4a
3	**Polycentricity**	a. means to systematically analyse actor participation landscape.	indicators need to be adapted to SIDS’ data availability and developing country contexts.	4a
4	**Sustainable Development**	a. considers developing country conditions.	unclear how development conditions have impacted GET outcomes seen in SIDS.	1a; 2b

5	**Green Economy**	a. marries key principles of economic and environmental science.	no clear definition relevant to SIDS.	6a
6	**Small States, SIDS and Climate Change**	a. considers SIDS' characteristics.	Little empirical evidence on which transition determinants and actors matter most.	1a; 2a; 7a
7	**Climate Governance***	a. baseline of assumptions on transition actors.	developed and large developing country focused.	3a
			Unclear what GET policy approaches have been used in SIDS.	3a; 1a

*Specifically refers to the literature synthesised under section 2.4.2. within this thesis.

Utilising my methodological schema, across four academic papers (chapters 4 to 7), I examine the three case countries of Jamaica, Barbados, and Mauritius. This is done within the context of sustainable energy targets set by the countries themselves in their NDCs and national policy documents, based on what they themselves identified as a successful green energy transition. Cumulatively, across all four academic papers of this thesis, three broad questions are explored:

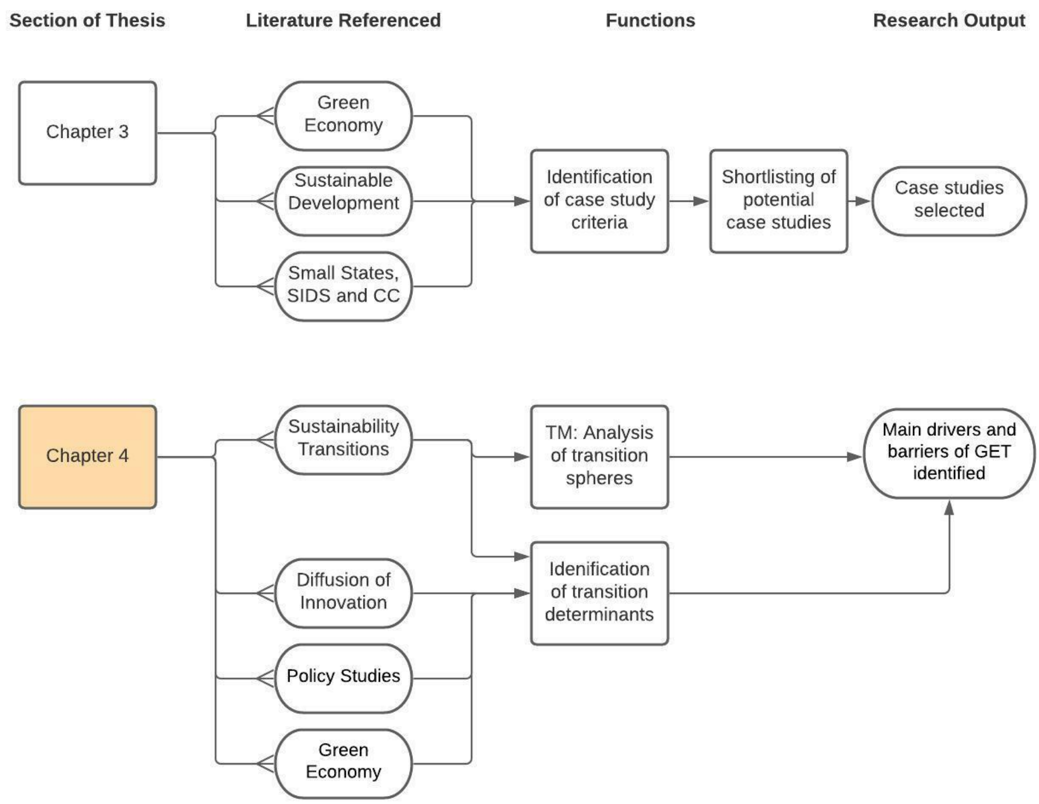
1. how have SIDS' GET ambitions materialised given their contextual conditions?
2. are certain cases trying different methods?
3. are these methods producing success or failure, and to what degree?

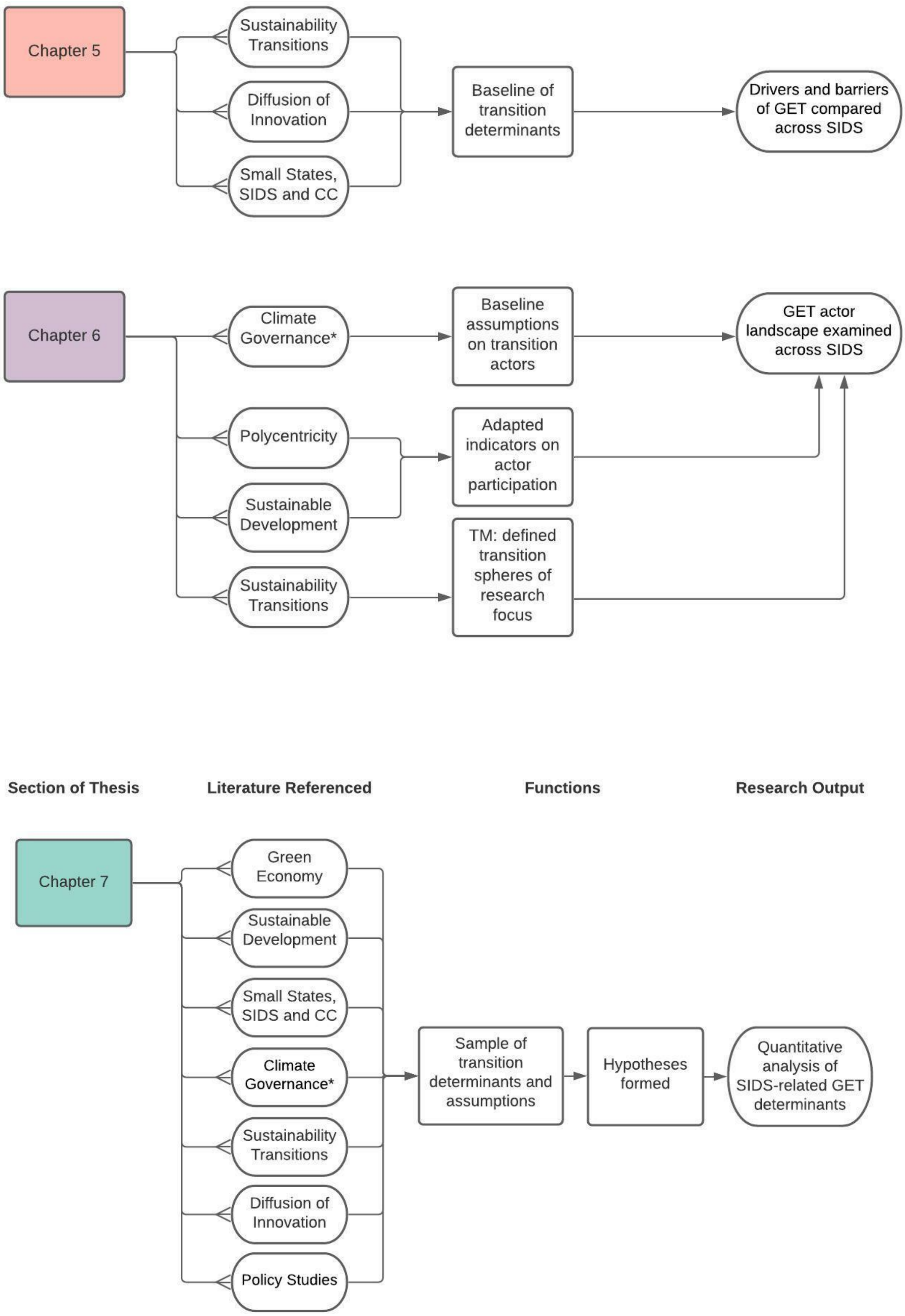
Through a mixed method approach, the answers to these questions were informed based on findings related to four sub-research questions:

1. To what extent do the main drivers and barriers (transition determinants) of GET in SIDS differ from those already recognised for developed and large developing countries? (qualitative)
2. What explains the adoption of green energy technologies across SIDS contexts? (qualitative)
3. How have key actors been able to influence renewable energy (RE) uptake in SIDS? (qualitative)

4. To what extent have the main factors identified as important to SIDS' GET experiences impacted their RE generation outcomes over time? (quantitative)

Figure 5 Breakdown of Methodological Schema's Application Throughout the Rest of the Thesis





*Specifically refers to the literature synthesised under section 2.4.2. within this thesis.

Guided by the existing scholarship I have reviewed, and my original data gathered in the field, this thesis via its integrated analytical approach aimed to answer my outlined sub-research questions which fall under the scope of the project's overarching research question: how can variances in green energy transition outcomes across small island developing states (SIDS) be accounted for?

Chapter 3: Research Design and Methodology

3.1. Overview: A Customised Approach for Exploring GET in SIDS

This chapter outlines the overall investigative approach I adopted in my thesis. As seen in the previous chapter, my investigation of green energy transition (GET) in SIDS began with a literature review. This covered the main existing findings, theories and assumptions that help to explain countries' green energy transition outcomes. At the end of chapter 2, I specified my sub-research questions which guided my case-based exploration[1] of GET in SIDS across four academic papers (chapters 4 to 7). A main benefit of case study analysis is that it knows "no intellectual boundary", allowing for the use of both qualitative and quantitative research techniques (Denzin & Lincoln, 2011, p. 600). This perfectly suited my choice of an overall mixed methods approach (Flick, 2014, p. 26; Creswell, 2014).

[1] See method details in chapter 3 annex, sections 3.6.3.

I largely utilised qualitative methods and data (chapters 4 to 6) complemented by quantitative analysis (chapter 7) in a sequential manner. Such an approach integrating qualitative and quantitative research has become increasingly common (Bryman, 2006). My mixed method design allowed me the flexibility to investigate my SIDS cases despite being faced by well documented issues of data availability[2]. Namely, across chapters 4 to 7 I made targeted use of three main techniques: thematic analysis[3] (Bryman, 2012), process tracing[4] (Collier, 2011, p. 823) and time series regression analysis[5] (Creswell, 2014).

My PhD research project sought to explain how variances in small island developing states' (SIDS) green energy transition (GET) outcomes can be explained under existing policy and actor participation structures. To do so, I developed and employed a customised research design suited to examining the distinct small developing country contexts of SIDS'. In the extension of existing theory to the cases I investigated, the customised research design I used included a novel methodological schema that lent from 7 bodies of literature (see outlined in detail under Chapter 2, section 2.5). While I reference from leading GET-related theory (sustainability transitions and diffusion of innovation), the original methodological schema draws insight from 5 additional relevant bodies of GET-related literature which supported more effective qualitative and quantitative exploration of my main research question.

The 'multi-level perspective' (MLP), 'strategic niche management' (SNM) and 'transition management' (TM) perspectives, have been the most widely used frameworks for understanding sustainability related transitions within the developed world (Wieczorek, 2018). However, critiques of the MLP have highlighted that it can neglect economic variables (Foxon, 2011), presents limited analysis of agency and actor roles (Wittmayer, et al., 2016; Smith, et al., 2005) and could benefit from greater emphasis on

[2] SIDS typically tend to have data availability issues especially relating to the areas of climate change mitigation and adaptation (Briguglio, 2018; Eckstein, 2018; Scobie, 2016; Nurse, et al., 2014).
[3] As defined by Bryman (2012), the examination of secondary and primary data to extract core themes from existing leading literature and those themes that could be distinguished within and between my cases (see chapter 3 annex section 3.6.4.1. for further method details).
[4] Understood as what David Collier (2011) describes this as "the systematic examination of diagnostic evidence selected and analysed in light of research questions and hypotheses posed by the investigator" (see chapter 3 annex section 3.6.4.2. for further method details).
[5] The design and application of a correlational statistical technique elaborated via logistic regression (Creswell, 2014) (see chapter 3 annex section 3.6.4.3. for further method details).

institutions, ideology, and politics (Kern, 2011; Meadowcroft, 2011). In addition, SNM neglects the embedding of sustainable innovations within broader societal goals (Schot & Geels, 2008). Nonetheless, the sub-field of transition management examines transition from a policy perspective and provides an easy to apply means by which one can examine how different types of governance activities influence long term change within societal transitions (Loorbach, 2010).

The analytical scope of my research was mainly guided by the transition management (TM) approach under sustainability transitions theory. TM was used to map case countries' transition journey under the multi-level governance approach's strategic and tactical spheres of transition (see table 2). That is, where wider goals and visions are set, and where rules and regulations are introduced (Loorbach, 2010). Under chapters 4 and 7, this analysis was supplemented by adapted use of the diffusion curve from diffusion of innovation studies, which graphically captured transition progress over time (see figure 3). Additional concepts under the green economy, sustainable development, small states, SIDS and climate change, climate governance and polycentricity theory were further referenced to support effective analysis of the underexplored contexts of SIDS.

My thesis drew from both secondary and primary data sources- document analysis and interviews. The remainder of this chapter details the case design rationale, selection of my cases, the methods used for data collection and analysis, as well as my ex-post reflections on implementing my investigative approach. Immediately following this chapter, are chapters 4 to 7 which contain my central findings and discussion. Lastly, chapter 8 outlines the main conclusions and recommendations of my entire thesis.

3.2. Rationale

A main setback for small island developing states (SIDS) to date has been their overall inability to capture how unique domestic challenges have either positively or negatively influenced their green transition progress (UNEP, 2015). Here, little to no in-depth analysis has been conducted on the policies structures and actors that comprise the overarching governance framework under which environmental or green transition commitments fall (Scobie, 2016; Bradnee Chambers & F. Green, 2005). To help address this information gap, I developed and deployed a customised mixed method research design. This employed mostly qualitative (chapters 4 to 6) and some quantitative (chapter 7) analysis, supported by an original integrated methodological schema on the islands of Jamaica, Barbados and Mauritius. My three cases were selected by using Yin's (2015) and Denzin's (2011) case selection criteria as guideline (please see chapter 3 annex, section 3.6.2.2. for more details).

The primary rationale for my choice of an overall mixed method approach was that it allowed me what Bryman (2006) refers to as the benefits of 'completeness' and 'process'. That is, I was able to provide a more comprehensive account of SIDS' GET experiences where qualitative findings gave insight on process and quantitative findings provided a statistical gauge of GET progress over a set timeframe. This organic and complementary process helped me to reveal how varying drivers, barriers and context conditions associated to climate governance and policy frameworks in the renewable energy sector, impacted GET progress observed at the national level over time. In doing so, I was guided by the main research question: how can variances in green energy transition (GET) processes and outcomes across small island developing states (SIDS) be accounted for?

Four additional reasons warranted my decision to design and implement a tailored approach for investigating GET in SIDS, rather than simply trying to apply existing theoretical frameworks to my cases. Firstly, existing leading GET-related literature (sustainability transitions and diffusion of innovation) are largely technical or technology-focused in nature (for example, focused on factors such as niche development and problem-solving routines) (Ramos-Mejia, et al., 2018; Dodman & Mitlin, 2015; Loorbach, 2014). However, my research question largely stems from a comparative politics, public policy and political economy driven perspective. My customised research design recognises SIDS' demonstrated stance of viewing GET as an inherent part of their wider green economy and sustainable development ambitions (see chapter 2, section 2.2.3.1.). I specifically do so by supplementing leading assumptions with additional reference to other relevant bodies of literature. These included: sustainable development, green economy, small states, SIDS and climate change, climate governance literature and polycentricity theory, in my overall exploration of the factors relevant to explaining GET outcomes.

Secondly, leading theory is largely based on assumptions derived from examination of developed and large developing country cases (Ramos-Mejia, et al., 2018; Wieczorek, 2018). Thus, existing frameworks make limited analytical consideration of SIDS' unique characteristics (see Chapter 2, section 2.3.1.) that make these countries and hence their GET experience distinctive from their developed and large developing country counterparts. I address this gap by referencing up to four (4) other bodies of literature[6] alongside sustainability transitions and diffusion of innovation theory in the identification and examination of transition determinants (see figure 4).

Thirdly, although it provides a useful baseline, existing GET-related theory (see Chapter 2, section 2.4.2.) provides limited scope for examining the actors able to participate and therefore what impact the adoption of new solutions (such as RE technologies) will have within societies, especially within small states (Wittmayer, et al., 2016; Markard, et al., 2012; Flannagan, et al., 2011). I examined the actor landscape in terms of actor participation, largely lending from polycentricity theory (Aligica & Tarko, 2012). Specifically, I developed and applied adapted indicators (see table 11) with the support of sustainable development literature (Nussbaum, 2003; Sen, 1999) to better reflect the contextual conditions of SIDS' small energy sectors. Finally, by applying sustainability transitions's TM approach, I was able to narrow the scope of my analysis to that of the strategic and tactical transition spheres (due to the limited time and finances I had available to conduct the research project).

The fourth rationale for my tailored investigative approach is explained by SIDS' limited data availability (Briguglio, 2018; Eckstein, 2018; Scobie, 2016; Nurse, et al., 2014) and inherently small sample size due to their small markets. In terms of secondary data sources, data to explore factors such as 'RE uptake' trends was only available for a limited number of years (little to none was available prior to the year 2000), other factors such as 'net development assistance' at times had missing data points over my research timeframe of interest (2000 to 2018), and other factors of interest (e.g. electricity grid investment per annum) had no secondary data available for my case countries. Furthermore, in the collection of primary data, SIDS' small energy market sizes correspondingly meant small samples composed of only a limited number of key actors (i.e. less than 30). Data availability and sample size issues meant that I had to find practical solutions to problems

[6] (i) sustainable development, (ii) green economy, (iii) small states, SIDS and climate change, and (iv) climate governance.

such as small datasets, missing data points, and small primary data sample sizes. These issues are not typically or as significantly faced when applying existing GET-related theory to developed country and large developing country cases. My customised approach provided solutions to these problems through reliance on multiple data sources or triangulation (Davies, 2001), and by leveraging my network and the professional network of others within the case countries' RE sector to collect primary data.

3.3. Data Collection

3.3.1. Step 1.1: Secondary Data- Theoretical Sampling

I started my PhD research by conducting a comparative and interdisciplinary literature review (see Chapter 2 of thesis). In doing so I aimed to identify the main thematic factors recognised by existing literature as important to GET outcomes. Across chapters 2 and 3, I employed an adjusted form of grounded theory's theoretical sampling via document analysis (Prior, 2003a). Grounded theory is one of the most commonly used approaches for research activities aimed at thematic categorisation or coding (Gibbs, 2012). Within my thesis, I adapted grounded theory to my research questions or interest. Thus, I established a preliminary list of key thematic ideas based on existing theory and literature relevant to my research focus. Through concept-driven (Gibbs, 2012)[7] thematic coding (Bryman, 2012) I generated synthesised categories and corresponding sub-categories on the leading factors generally recognised as important to countries' green energy transition (GET) outcomes. Similar to previous academic research (Gibbs, 2012, p. 8), this list was continually amended during my analysis as new ideas and thematic categories emerged from the text reviewed (see appendix 4). My data collection process began with a basic understanding that SIDS' GET outcomes could be explained by factors already recognised by existing GET-related theory, but also (and to a large extent) by factors distinct to their contexts which have yet to be fully recognised and hence explored.

The early stages of my theoretical sampling activities generally aligned with Strauss and Corbin's (1990) 'open coding' (as cited in Emmel, 2013, p. 21-23). Specifically, as a preliminary to data collection in the field, I purposively sampled (based on their relevance to my research question) existing research findings across eight bodies of literature:

[7] The categories or codes derived from thematic analysis came from previous literature, studies, books and official reports.

sustainability transitions, diffusion of innovation, policy studies, green economy, sustainable development, small states, SIDS and climate change, climate governance literature, and polycentricity theory. My openness to other perspectives was especially reflected by the inclusion of the latter six bodies of literature referenced. This allowed me to expand the scope of my study to additional factors relevant to SIDS (i.e. factors different from those already recognised by leading GET-related literature).

My approach helped me to produce two general baselines pertinent towards answering my overarching research question. These two baselines were: (i) the leading factors recognised as important to explaining green energy transition (GET) outcomes (i.e. transition determinants) based on pre-existing research (see chapter 4, table 7 and appendix 4), and (ii) the potential additional factors relevant to explaining SIDS' observed GET outcomes (see chapter 3 annex, section 3.6.2. and table 5). The two baselines contributed to the overall planning of my research in three main ways. Firstly, pertaining to my case study selection (similar to Strauss and Corbin, 1990). Baseline concepts were used to help shortlist my three case countries for comparison via the method of difference (see chapter 3 annex, table 6). Secondly, they supplied the main themes to begin my comparative analysis in chapter 4. Thirdly, baseline concepts guided the type of primary data to be collected (Emmel, 2013, p. 22) by contributing to the design of my interview instrument (see appendix 3).

In my enumeration of the main GET-related themes following (Prior, 2003a), the source documents I referenced included journal articles, academic papers and books under sustainability transitions, diffusion of innovation, polycentricity theory, and climate governance literature. In addition, I referred to official reports, relevant legal and policies documents signed at the international, regional and national levels across four (4) other bodies of literature: sustainable development, green economy, small states, SIDS and climate change (e.g. official documents that were published by or on behalf of the government, by think tanks or NGOs and other recognised bodies such as the IMF, UN, World Bank etc.). Within my research project, the content of these documents specifically functioned as a repository (Prior, 2003b) of the main factors recognised as important to impacting GET progress over time. In total, 76 documents were referenced as part of my theoretical sampling (see appendix 4; Chapter 3, table 5). The journal articles, academic papers and books I referenced were sourced from online bibliographic databases, journal or research paper repositories such as ScienceDirect.com, Academia.com, Researchgate.com, the University of York's online library or directly from the journal's webpage such as Sagepub.com. In addition, global reports, legal and policy documents were sourced from the relevant international, regional or government agency's official websites.

3.3.2. Step 1.2: Secondary Data- Document Analysis

For my first data chapter on the Jamaican case, I adapted thematic coding procedures to facilitate my data collection needs. Namely, document analysis (Bowen, 2009; Prior, 2003b)[8] was used to gather in-depth data on this single case. I deliberately referenced secondary sources[9] relevant to answering my chapter 4 sub-research question[10]. Similar to Flick (2014, p. 319), I aimed to generate thematic categories that could be used for analysis of the single case. However, unlike Flick (2014), I connected my selective coding procedure back to my initial open coding results from theoretical sampling activities. In other words, I elaborated upon my initial categories generated under open coding, to tell the story of my case country by highlighting examples and evidence relating to the relevant category (Flick, 2014). My grouping of data in this manner, allowed me to extract and demonstrate examples of where "under these conditions… this happened" (Flick, 2014, p. 312).

My selective coding procedure was executed via template analysis (King, 2004), which I used to generate thematic categories specifically pertaining to the single case of Jamaica. Under a hierarchical structure, themes I previously identified under open coding represented my 'higher order' or level 1 a priori codes and level 2 'lower-order codes' (King, 2004). Code levels 1 and 2 were what Gibbs (2012, p. 8-9) describes as concept-driven (i.e. covered central conceptual issues to the research project). On the other hand, further elaborations under sub-division levels 3 and 4 codes or 'Jamaica Specific

[8] The review of official national, regional and international reports, policy and legal documents both printed and in electronic form (Bowen, 2009). Documents reviewed functioned as a repository (Prior, 2003b) of the main factors recognised as important to impacting Jamaica's GET progress over time. In total, 17 documents were referenced (see sources for table 10 under chapter 4).
[9] Relevant official national, regional and international reports, policy and legal documents on Jamaica's green energy transition experience.
[10] To what extent do the main drivers and barriers (transition determinants) of GET in SIDS differ from those already recognised for developed and large developing countries?

Determinants' were data-driven (i.e. they reflected more in-depth case analysis)[11]. My inclusion of level 1 and 2 codes from the wider literature alongside case-specific codes allowed me to showcase their connection to relevant broader categories and corresponding sub-categories, whilst maintaining a case-driven focus in coding activities (see chapter 4, table 10). Like Flick (2014), the categories developed from chapter 4's data collection procedures on this first case were then later cross-checked and synthesised with the themes generated from my other two cases (see results in chapter 7 annex, table 17). This ultimately resulted in the generation of a list of themes that could be used to facilitate further and deeper comparative assessment (Flick, 2014, p. 319) with a wider sample of cases beyond the scope of this project.

3.3.3. Step 2: Primary Data- Exploratory Expert Interviews

In terms of primary data, I utilised exploratory expert interviews (Bogner, et al., 2009) to examine the underexplored area of GET in SIDS. Similar to other academics, I chose to utilise expert interviews since they provided me with an efficient and concentrated method for gathering detailed and innovative data results (Harvey, 2010; Bogner, et al., 2009). This suited my research project's limited finances (self-funded) and allotted maximum two-month fieldwork timeline per case country. Theoretical sampling influenced the types of questions that I asked my interviewees. Namely, I designed and deployed an interview instrument that helped me to compare my case countries' GET experiences with each other and with that of pre-existing research assumptions, in line with my overarching and sub-research questions. The interview instrument was thematised (Kvale, 2007), composed of 6 main sections. Section I General Questions were asked to all interviewees, whereas the remaining 5 sections were only asked according to the person being interviewed. For example, if the interviewee was a civil society stakeholder, after I asked them the section 'I General Questions', I would then proceed to ask section 'IV Civil Society Questions Only' (see appendix 3 for full interview instrument).

[11] The placement of these lower codes in table 10 indicate where the data collected from text reviewed linked back to a relevant theme from the literature. Colour coding indicates where it is an underexplored area despite being relevant to an acknowledged category. Although this was not the case in my analysis, where a case-specific code is completely distinct from existing recognised themes, a new level 1 and or 2 category would have been created as needed.

Purposeful (non-probability) sampling (Emmel, 2013, p. 23) determined the stakeholders that were interviewed in my case countries. Although this sampling method ran the risk of suffering from selection bias and limited potential to generalize about the wider population, given the small size of SIDS' energy markets, this form of sampling was the most realistic to employ. Due to unexpected delays (see section 3.6.1. of this chapter), as well as limited time and resources to conduct my research project, primary data was collected for two out of my three cases (Barbados and Mauritius) and secondary data alone was used to analyse my third case country (Jamaica). For the Barbados and Mauritius cases, relevant national stakeholders were invited to be interviewed via email. Accompanying the email invitations was a formal 'Fieldwork Endorsement Letter' in which I highlighted that strict procedures and rules UK's General Data Protection Regulation (UK GDPR) which is implemented under the UK's Data Protection Act (1998) (rev. 2018), would be followed in the collection, storage and use of data. The addition of an endorsement letter officially demonstrated my institutional affiliation (Harvey, 2010) to the University of York. This was used as a means to gain trust and supply added credibility to my interview invitation (Harvey, 2010), which was especially important when communicating with senior experts/ elites via formal communication channels (e.g. through their secretaries or work contact details). In the sending out of my emails I tried to avoid timelines that would likely be busy for my subjects and hence my emails ignored. For instance, in the sending out of my invitations for Mauritius, I had to ensure invites were sent at least three weeks before the start of December when persons tend to be extremely busy with end of year activities and planning the start of their Christmas season vacation time.

In the field, primary data collection was done face to face via audio recorded semi-structured expert interviews (four done virtually via skype and the remainder done face to face). Experts in my research project were defined as professional elites (from the public and private sector), persons with extensive knowledge (e.g. researchers and academics), and implementing actors with power to steer change within the renewable energy sector (regional entities, international donors, activists and civil society organisations) (Bogner, et al., 2009). Similar to Harvey (2010), I broadly considered elites as those who at the time my research was carried out occupied a senior position and were influential industry decision-makers in their organisation. I adopted a semi-structured interview approach (Leech, 2002; Mullings, 1999). This entailed previously set questions structured around my main research question, which depending on my interviewee's answers, were at times followed by open ended questions to explore further when necessary. This helped to give structure to feedback collected but also allowed persons interviewed the chance to inform the research more extensively. This approach also allowed me to identify noteworthy events over time of specific moments that characterised key steps in countries' GET process, and to analyse change and sequence (Collier, 2011, p. 824).

In advance to collecting data in the field work, I considered potential ethical dilemmas that could arise during and after interviews (Kvale, 2007). Ethical questions that guided my approach included 'what information on the study can be provided to subjects in advance?', 'how important is it that subjects remain anonymous?' and 'how can subjects' confidentiality be secured?' (Kvale, 2007). Based on my experience engaging with energy sector stakeholders in the Caribbean, the main anticipated issues included a likely desire by subjects for confidentiality given the small markets and close relationships between actors, and a desire to know beforehand the types of questions that would be asked. Before each interview was conducted, I provided each interviewee (via email) with an overview document of my thesis entitled 'Information for Interviewees'. I also indicated the estimated length of the interview as 45 mins and provided them with the interview questions to be asked beforehand.

Many of my interviewees were either elites or from respected or senior positions within their fields. For each interview, I sought to create a conversational atmosphere for the subject to share their feedback (Harvey, 2010). As a show of respect to their status, I always dressed in either a semi-professional or professional manner. This was important since many of my interviews took place at the subject's office or formal place of work. My chosen attire also added to my credibility in 'looking the part' of someone with a professional background and hence more likely to be taken seriously, which I was especially conscious of as a female doing fieldwork in a very male dominated field[12]. At first encounter with the subjects, I introduced my professional, academic and some personal background (as a fellow islander) prior to each interview and thanked the participants for their time. This friendly and informal introduction served to successfully

[12] Seventy-eight percent (78% or 36 of 46) of my subjects were male. All interview subjects treated me with respect and were polite during our interactions.

set the tone for a relaxed and open atmosphere for all my interviewees to share their feedback. Conducted face to face, once the introductory pleasantries were completed, I then formally began each interview by first asking the subject for their verbal consent to audio record the session and for their informed signed consent to conduct the interview. Interviewees were reassured that their identities would remain anonymous in the use of their feedback within my research. I collected primary data from actors across five main representative groups of the renewable energy sector: the public sector, private sector, civil society, regional organisations, and international organisations. In total 46 persons were interviewed across my two cases; twenty 20 from Barbados and 26 from Mauritius (see appendix 5 for a breakdown overview). This approach allowed me to especially explore the similarities and differences between cases, a main element of my overarching research question.

For Barbados, my initial interviewee list of 17 organisations was compiled based upon my professional contact network of experts working within the renewable energy sector. For Mauritius, I compiled an initial draft list of 12 potential interviewees based on my preparatory readings of country reports and national policy documents. I then reached out via email to a senior Mauritian academic whose profile demonstrated a strong background and network in the renewable energy sector. The academic functioned as a gatekeeper (Harvey, 2010) to other experts and elites. They requested my CV and overview information on my thesis. Once provided, they played a key role facilitating my access to several other key interview subjects. They kindly agreed to help me update my initial compiled list of 12 interview subjects to that of 15 relevant interviewees. I was also invited to present at a regional RE conference hosted in Mauritius during my fieldwork timeline. Attendance at the conference successfully provided me with further access to an additional 4 interview subjects. Through my use of the snowballing technique in the field, the final list of persons interviewed expanded to include another 3 subjects in Barbados and another 7 subjects in Mauritius who were referred to me by the subjects. At the end of all interviews, interviewees were asked to recommend other key stakeholders that should be interviewed and to facilitate an introduction where possible (see question 7, appendix 4). The snowballing technique is one often used when interviewing elites (Tansey, 2007) and was especially useful in helping me to reveal further stakeholders of influence (or experts) within the RE sector that should be interviewed, whose roles or contact details were not as publicly known.

3.4. Data Analysis

The unit of analysis in my research project was renewable energy (RE) uptake in the electricity sector of SIDS. Lending from sustainability transitions, the research project's analytical scope specifically focused on exploring the strategic and tactical spheres of transition (see Loorbach, 2010; table 2 in this thesis). Namely, I mainly focused on identifying and comparing how variances in wider goals, visions, rules and regulations impacted on case countries' GET outcomes observed.

3.4.1. Analysis of Raw Data

For the analysis of my raw primary interview data, I opted to move away from the specified and quite linear procedures of grounded theory. While I still sought to make comparisons between my empirical findings with that of existing theory, given that very limited empirical evidence existed on my research questions, my main investigative focus was realistically narrowed. To do so, I focused on providing new empirical evidence through extended application of existing GET theory around my research questions. Throughout my analysis, I also made corresponding policy insights where relevant. My first step was to organise my primary data in manner that could facilitate more in-depth analysis and comparisons with my thematically organised secondary data (see appendix 4). Raw interview recordings from the field were transcribed from audio into formal written styled text[13] (Kvale, 2007). In doing so, driven by my data (Gibbs, 2012, p. 8-9), I coded my transcribed interview texts according to the most frequently recurring themes (using template analysis by King, 2004- see method details in chapter 3 annex, section 3.6.4.1.).

The thematic analysis results from my primary data provided me with a hierarchal account of the central themes or 'list of codes' (Gibbs, 2012, p. 3) relevant to my sub-research questions (see appendix 6). The template developed was organised in a way that represented the relationships between themes, which at the broadest level fell under 'higher order' codes (level 1 codes), and at the lowest levels fell under more detailed or lower order codes (levels 2 to 4 codes). This was done both manually (guided by template analysis: King, 2004),

[13] Reporting the subject's accounts in a readable manner, leaving out fillers expressed by the speaker, such as 'ums', 'om's, 'err'.

and automatically (via n-gram analysis using statistical software)[14]. Next, across 4 academic papers (chapters 4 to 7) I sought to generate more in-depth analysis from my now organised secondary and primary data.

3.4.2. Data Analysis by Chapter

Across my four main research chapters, I employed a sequential mixed methodology approach which was predominantly qualitative in nature (chapters 4 to 6) and was supplemented by quantitative analysis (chapter 7). This allowed me to gain broader knowledge on my research question than the use of only a single approach could provide (Flick, 2014, p. 30). Another positive outcome of my qualitative and quantitative approach was its generation of complementary results that provided a fuller picture on my overarching research question. My research design was especially tailored to acknowledge and examine the distinct characteristics of SIDS, and to make the most of the data accessible despite SIDS' typical data availability issues[15]. This provided me with a more flexible approach to exploring GET in my cases which (via triangulation) drew from several methods. For my data analysis I made targeted and combined use of four main techniques according to each of my chapter's research question needs. This included the use of my own original methodological schema, thematic analysis, process tracing and time series regression analysis.

Overall, my triangulated approach proved ideal for allowing me to organise and assess data in a manner suited to the characteristics of my case country data. Specifically, it helped me to overcome gaps and weaknesses from any single data source or approach used (Goodrick, 2014, p. iii) due to working with small data samples and statistical datasets. The outputs of my data analysis (which guided my write up) were captured and presented with the support of descriptive statistics: charts, tables and graphs. This helped me to more easily identify links, patterns and common themes that arose in and across my cases. Facilitated by my original methodological schema, throughout my analysis I made comparisons between my original empirical findings with relevant leading literature (based on developed and large developing country findings), considered their potential

[14] See analytical results in Appendices 6 and 7.
[15] Limited data availability is an overall problem commonly identified when examining development within SIDS countries (Briguglio, 2018; Eckstein, 2018; Scobie, 2016; Nurse, et al., 2014).

applicability to my own cases and identified commonalities and differences. Analytic thematic analysis (Gibbs, 2012) helped me to compare the similar and differing perspectives (from primary and secondary sources) within and across my SIDS cases (see chapter 3 annex, section 3.6.4.1. for further details).

Through process tracing I sought to craft an explanation for my case countries' respectively observed RE outcomes (Centre for Development Impact, 2015, p. 2; Beach & Pederson, 2013) (see chapter 3 annex, section 3.6.4.2. for further details). Descriptive statistics and regression analysis facilitated a quantitative indication of how changes in a shortlist of main GET factors lead to changes in RE electricity generation across my cases (see chapter 3 annex, section 3.6.4.3. for further details). Collectively, analysis across my chapters aimed to more explicitly document and explain how the variations in SIDS' green energy transition processes over time have led to subsequent outcomes in their RE advancement.

In chapter 4, via the single case study of Jamaica (see method details in chapter 3 annex, section 3.6.3.1.), my data analysis explored my first sub-research question 'to what extent do the main drivers and barriers (transition determinants) of GET in SIDS differ from those already recognised for developed and large developing countries?' To this end, I employed process tracing[16] aided by the TM approach to pinpoint key developments in the diffusion curve (Rogers, 1962) (see the methodological schema, figure 5 in chapter 2, section 2.5). This contributed to the generation of descriptive statistics. Namely, it was used to trace and graphically display RE uptake trends over time, flagging key timeline developments in the RE sector (see analytical output in chapter 4, figure 8).

Lastly, concept- and data-driven thematic coding (Gibbs, 2012, pp. 8-9) supported by my original methodological schema (see chapter 2, figure 5) was used to assess the main factors impacting GET outcomes in Jamaica[17]. My concept-driven codes were initially derived under open-coding during my literature review. These level 1 and 2 codes were used as a starting point for my analysis of the Jamaican case. However, I was not tied down to my level 1 and 2 codes, allowing the case data to guide the further elaboration

[16] See method details in chapter 3 annex, section 3.6.4.2.
[17] See analytical results in chapter 4, table 10.

of my template or list of codes under levels 3 and 4[18]. According to Gibbs (2012, p. 9) the concept-driven and data-driven coding approaches are not exclusive and it is common for researchers to move backward and forward between the two during their analysis. The use of both concept- and data-driven coding allowed me to compare my original case findings with my previously identified list of codes or synthesised transition determinants from leading literature (see chapter 4, table 7 and figure 9). Similar to Flick (2014, p. 319), my results from thematic coding conducted on the single case of Jamaican (see figure 9) contributed to a harmonised list of main GET factors important in SIDS (see chapter 7 annex, table 17). This harmonised list facilitated deeper analysis on my three cases under chapter 7 via a quantitative method (see chapter 3 annex, section 3.6.4.3.).

In chapter 5, I used the comparative case study of Barbados and Mauritius[19] to explore the research question 'what explains the adoption of green energy technologies across SIDS contexts?' In this chapter, my data analysis delved deeper into the results of my thematically coded primary interview data (i.e. feedback provided under code levels 2 to 4). I comparatively assessed the top ranked common and distinct GET themes across the two cases[20]. Here, I examined details from interviewee feedback corresponding to the top emerging themes and referenced relevant supporting secondary data sources where available.

In chapter 6, via comparative case study of Barbados and Mauritius I examined the research question 'how have key actors been able to influence renewable energy (RE) uptake in SIDS?' My original methodological schema[21] helped me to design and apply adapted indicators to analyse case my countries' data on actor participation (see chapter 6, table 11). This allowed me to categorise participation in the GET landscape of Barbados and Mauritius and to highlight related policy insights (see analytical results in chapter 6, table 13 and related conclusions in section 6.6). Additionally, output from my thematic analysis of primary data[22] was used to identify the actors and corresponding

[18] Selective coding was utilised in line with Flick (2014, p. 319) and Gibbs (2012, p. 9): themes were generated based on the case. That is, I read relevant texts to flesh out 'what is happening' within the particular case context.
[19] See method details in chapter 3 annex, section 3.6.3.2.
[20] Ranking of themes was based on code level weighting by respondent consensus: see Appendix 6.
[21] Via polycentricity theory, the TM approach, and sustainable development literature: see chapter 2, figure 5.
[22] Done according to the procedures I outlined under section 3.4.1. - see results in appendices 6 and 7.

roles most impacting GET outcomes in Barbados and Mauritius (see results in chapter 6, table 12).

Throughout the thesis, in the analysis of my data, I intentionally avoided the use of any direct quotes from my interviewees. This measure was required in order to maintain both my research interests and that of the interviewees (Bogner et al., 2009). By stating at the beginning of interviews that I would avoid direct and explicit reference, I was able to obtain open and honest responses from interviewees. In addition, avoiding direct quotes was a requirement for protecting the identities of my interview subjects, several of whom explicitly requested such measures of anonymity to be taken. This is not surprising and is a measure to be expected when conducting research in such small sized markets where stakeholders often have overlapping and close relationships.

In chapter 7, I investigated the research question ‘to what extent have the main factors identified as important to SIDS’ GET experiences impacted their RE generation outcomes over time? Through the method of difference (Bennett, 2004) I conducted comparative multiple-case study analysis (Goodrick, 2014)[23]. I identified and then quantitatively gauged the relationship between transition determinants with RE uptake trends across Jamaica, Barbados and Mauritius. Guided by antecedent conditions and assumptions, I collected and analysed data that helped me to explain which of these factors were relevant to helping explain the specific outcome of interest[24]. I began with 9 main hypotheses (see chapter 7, section 7.2.1.) in the hopes that my quantitative findings would provide statistical indication of those hypotheses worthy of future large-scale testing (beyond the scope of this thesis) with a wider country sample. My hypotheses were generated based on the main thematic areas that emerged from my previous findings under chapters 4 to 6 (see chapter 7, sections 7.2.1. and 7.3.). I then collected and compiled the dataset necessary to test my hypotheses, referring to secondary database sources (see dataset description in appendix 8). Using three main techniques, I quantitatively assessed my data collected. This included utilisation of my original methodological schema (i.e. targeted use of process tracing), descriptive statistics and time series regression analysis. Through quantitative analysis of my dataset, I sought to understand the impact of the leading

[23] See method details in Chapter 3 Annex, section 3.6.3.2.
[24] As of 2018, whether or not the country was on track with its renewable energy supply target for electricity generation in and off the national grid.

themes identified (for which data was readily available) on GET trends across all three cases.

Through the process tracing technique, my original methodological schema (via the diffusion curve: Rogers, 1962) was used to trace and comparatively display RE technology advancement within my three case countries. The main output of this was the graphical representation of RE uptake trends over 2000 to 2018 period alongside key policy landscape developments in the RE sector (see chapter 7, figure 16). I utilised my previous results from thematic coding conducted earlier across chapters 4 to 6 (see tables 10 and 20) to help pinpoint a selection of variables that could be quantitatively analysed (see chapter 7, table 17). In doing so, I aimed to supplement my initial qualitative evidence with further findings that provided simultaneous comparisons within and across all three cases. Descriptive statistics (see chapter 7, table 15) were used to ascertain similarities and distinctions across my case countries' pertaining to the dependent variable (RE uptake) with 10 shortlisted independent variables (e.g. national debt, sugar production etc.). Lastly, with the support of three co-authors, I utilised an economic time series regression model that was customised to quantitatively examine the relationship between the variables within my small dataset (see method details in chapter 3 annex, section 3.6.4.3. and chapter 7, section 7.3.). I then proceeded to analyse my results[25] and make general deductions. My analysis also outlined additional areas for future research (which take into consideration existing GET-related frameworks), in a manner that could facilitate future subsequent testing (not within the scope of this project) among a larger number of cases.

3.5. Ex-post Reflections on the Methods Used in this Thesis

3.5.1. Research Validity, Reliability and Generalisability

This methods chapter provides a detailed breakdown of the overall steps and specific techniques I used in this thesis. In its design and execution, I sought to provide sufficient details that enabled readers to ascertain the robustness of my results and to facilitate replication of the investigation. To this end, I found that several key elements helped me

[25] See regression results in chapter 7, table 16.

to ensure the overall validity, reliability and generalisability of my qualitative and quantitative research work executed.

Qualitative Analysis

As outlined above, my qualitative analysis utilised both primary and secondary data sources. For my primary data, I ensured research validity and reliability of my interview analyses through what Kvale (2007) describes as intersubjective agreement. That is, through a certain minimum degree of intersubjective agreement which was documented by coding interview text into quantifiable categories (e.g. see chapter 5, figure 10). Here, reliability and objectivity were determined by the measured amount of agreement among independent coders (i.e. arithmetic intersubjectivity) (Kvale, 2007). The coders in my research were the 46 interview subjects represented by the codes $BB_{1\ldots 20}$ and $MS_{1\ldots 26}$. The minimum accepted degree of intersubjective agreement for further exploration of a code was guided by Eftimiades (1994, as cited in Davies, 2001)[26].

Similar to my primary data analysis, I ensured the validity and reliability of my secondary data which was collected using document analysis by arithmetic intersubjectivity (Kvale, 2007). Under section 3.3.2. I document and provide details on my method procedure and sources. A total of 17 documents were referenced: relevant official national, regional and international reports, policy and legal documents on Jamaica's green energy transition experience. I also provide the list of sources for readers (see located at the bottom of table 10 under chapter 4 annex).

Within the scope of this thesis, under chapter 7 I developed generalisations across my 3 case countries based on the quantified coded categories of both my primary and secondary qualitative data (Kvale, 2007). Generalisations on the relationship of these categories with RE uptake were facilitated through a customised quantitative model. In addition, across my academic chapters I provided future researchers with rich contextual central findings that could facilitate future analytical generalisation on a wider sample of cases beyond the scope of my study (Kvale, 2007).

[26] A minimum of two independent interview sources were required for any thematic area to be considered of real significance, or to qualify as what I termed as 'low level consensus' (see appendix 6).

Quantitative Analysis

Research validity under my quantitative stage was generally guided by (Payne & Payne, 2004). I considered validity as the extent to which my chapter 7 research question27 or 'concept being studied' (Payne & Payne, 2004), was accurately measurable then measured. The type of quantitative model designed and applied was based on the purpose of the study, the nature of the phenomenon of interest (i.e. RE uptake over time), and the characteristics of the variables (i.e. continuous, categorical and ordinal- see appendix 8).

Research reliability was understood as the consistent measurement of the phenomenon of interest in a manner that could be repeated no matter who uses it, provided the basic conditions remained the same (Payne & Payne, 2004). To ensure the robustness and reliability of our conclusions, chapter 7 data analysis was conducted in sequential steps, the last of which employed regression analysis. With the help of co-authors, first adopted a similar approach to section 3.2 of Isensee, et al.'s (2020, p. 4) for data extraction and analysis. Specifically, thematic coding (Gibbs, 2012) was conducted both manually (via template analysis (King, 2004- see results in appendix 6) and automatically via n-gram analysis (from 1- to 4-grams) using the tm package 0.7-8 (Feinerer & Horni, 2020; Fenierer et al., 2008) in R 3.6.3 statistical software (R Core Team, 2020) (see results in appendix 7). A dataset was then compiled based on the main emerging themes from thematic coding results (see appendix 8). We also utilised descriptive statistics which provided added transparency on the relationship between our variables of interest (see chapter 7, section 7.5.1.). Finally, we then designed and applied a statistical model to best fit our small dataset (see chapter 3 annex section 3.6.4.3. for further details).

In the design and running of our time series model, we faced the issues of a small dataset and some missing values for exogenous variables. Available secondary data was supplemented by my initial qualitative research findings. Namely, 'social phenomena' that were identified as important to GET under my qualitative research phase were translated into measurable variables which were further examined quantitatively alongside the other identified exogenous variables. My 'social phenomena' variables were that of renewable energy (RE) roadmap, rule enforcement, and utility ownership. Limited data availability

[27] To what extent have identified GET factors impacted the uptake of renewable energy electricity generation across SIDS?

is an overall well referenced issue in examining development policy topics within SIDS countries (Briguglio, 2018; Eckstein, 2018; Scobie, 2016; Nurse, et al., 2014) and which could not be avoided. Nevertheless, within the limitations and constraints we faced, we found the values available to be sufficient to run our model. Similar to Beck (2001, p.p. 277-278), we determined that the most accurate approach was to run varying iterations of a time series regression to determine the best fit model. The results of our initial model 1 (M1) raised concerns regarding an inflated adjusted R^2 value. This motivated us to do additional transformations to our continuous variables to deal with across-time autocorrelation (Bell, et al., 2018; Gurka, et al., 2012). Consequently, transformation of the data was conducted where we also reported results using a baseline year with respect to 2000 levels (M2), and a growth rate transformation (M3). Based on our M3 results, for which the R^2 value was the least inflated of the three models, we analysed and presented conclusions based on our M3 random effects model. The Hausman test results from our M3 model (4.14) accepted the random-effect assumption (Wang & Chen, 2014), indicating a random effect model was the best fit. Despite some missing data points, statistical tests found the dataset to be strongly balanced, given that most of the values were available for each exogenous variable for the time period examined. Furthermore, our findings proved especially valuable given the serious lack of any existing statistical evidence on the topic.

The quantitative findings of the analysis I ran together with my co-authors (see chapter 7), gave insightful and novel statistical indications concerning the quantified coded categories from my initial qualitative work. However, in terms of generalisations, we also acknowledged that to increase the robustness of our conclusions and to translate the results to cases of countries that were not included in the study, further and more extensive research is needed. The quantitative findings in this thesis hence provide a premise upon which future research can build and outlines multiple areas that can benefit from further study (see chapter 7, section 7.6). To this end, within my conclusions (see chapter 8, section 8.6.), guided by our novel findings I make recommendations on topic areas that could benefit from future research looking at a wider sample of countries.

3.6.1. Cultural Considerations: Planning and Conducting of My Expert Interviews

At the onset of my research project, my initial aim was to select three suitable case countries that covered a geographic spread of the three main regions where small island developing states (SIDS) could be found: the Caribbean, the Pacific, and the Atlantic, Indian Ocean, Mediterranean and South China Sea (AIMS).

Initially, one of my suitably identified case selections included Fiji of the Pacific region. However, In the commencement of my fieldwork preparation I encountered several setbacks. Namely, initial introductory email invitations for interviews went unanswered or received extremely late responses, at times even three months after first sending. Phone call follow ups and messages left for potential interviewees also met with the same very low response rate. Efforts to leverage my professional contacts provided some initial progress in the outreach to potential interviewees but soon tapered off after a few exchanged emails and introductory calls. I was able to conduct only two virtual interviews and upon receiving advice from a Fijian colleague, I was advised that due to their island's culture the most effective approach would be to physically visit Fiji to make my interview requests in person. Given the research timeline delays already experienced, Fiji's geographic remoteness, the costs and suggested time required (at least two to three months) to plan and conduct fieldwork on the ground, I made the decision to change my third case country to one that was more accessible and that could be suitably compared to my other two cases[28]. Ultimately, I chose to replace Fiji with the island of Jamaica, a country for which secondary data was more readily available and suitable for comparison with the data on my two other cases Barbados and Mauritius.

To a far lesser extent, similar cultural issues affected my access to key stakeholders in the planning and conducting of data collection in Barbados and Mauritius. In both islands, very few interviewees wanted to conduct virtual interviews, preferring first to meet me in person and to briefly get to know me face to face for our interview sessions. Coming from an island myself, I understood this element of 'island culture', where persons tend to prefer face to face interactions where they build some form of introductory rapport before engaging in more formal interactions. Additionally, given the high profile and senior positions of interviewees, in order to secure interviews in a timely manner I had to

[28] See chapter 3 annex, section 3.6.2. for case selection procedure.

leverage my credibility as a professional in the field or through a contact who possessed such reputation. Having a direct relationship or being introduced by a reputable in-country contact helped me to secure interviews in a timely manner. In Barbados, this was largely facilitated by my own existing and past professional relationships working with RE stakeholders. In Mauritius, a country located in a region where I had never worked before, I sought to reinforce my credibility by first reaching out to a fellow academic in a senior position and whose profile indicated relevant industry experience. Their input played an important role in helping me to finalise my draft interviewee list by highlighting key stakeholders I may have left out from my initial secondary research. They also facilitated my direct access to key industry stakeholders via email and by inviting me to present as a guest speaker at a regional RE conference. This connection forged with someone on the ground, was crucial in helping me gain access to key interview subjects who otherwise I would have otherwise spent months back and forth trying to secure interviews with.

Snowballing was particularly useful in identifying other relevant private sector and civil society interviewees. Personal introductions were facilitated by some of my interview subjects. This allowed me to secure interviews with stakeholders that otherwise would have been impossible or much more difficult to gain access to within the limited time I had to conduct my fieldwork. On any given day I attempted to schedule no more than 2 interviews, one in the morning and one in the afternoon. My scheduling sought to be flexible and considerate of the busy schedule senior experts tend to have, as well as of 'island culture' where individuals can at times be late for an appointment or may go well over arranged meeting times when they are in a relaxed setting.

3.5.2. Positionality, Credibility and Ethics in the field

From the onset of this research project, a major challenge I faced was that the small energy markets of SIDS. This equated to inherently small data samples, a small sample number of actors (leading to issues of positionality, credibility and ethics in the field), and small statistical datasets due to limited data availability. These characteristics shaped my overall data collection, research design and the methods that I could realistically and effectively employ.

In terms of positionality, I adopted a stance that sought to be open and free from bias in my data collection and analysis process, namely, a stance that tried to be as undistorted as reasonably possible by my personal bias (Kvale, 2007) or bias by subjects in the field. In this regard, I was able to positively leverage my 'insider' and 'outsider' (Harvey, 2010); Mullings, 1999) status during the conducting of interviews. As a fellow islander I was able to relate with my interview subjects as an 'insider' to the island experience of responding to climate change amidst the context of small country energy needs. However, I was also able to adopt the stance and be seen as an 'outsider', as someone not originally from the case countries of my focus[29]. This was especially important in Mauritius where RE sector advancement was a more political topic when compared to Barbados.

I started all interviews with an introduction of myself in a friendly informal manner to help create a relaxed and open tone for the interview session. In my introduction, I also made clear to interview subjects my aim to remain neutral in my investigation of the topic and an openness to capture all details provided to me on the experience of the stakeholders I was able to interview. To this end, I avoided stating my personal opinion even when prompted by the interviewee to do so. In those instances, I gave my general opinion about the RE sector in SIDS and redirected the topic back towards my desire to learn from the collective insight of actors such as themselves who were more intimately involved in the country's specific RE development journey. Such neutrality was also important when personal opinions were shared by interviewees about other subjects. I took care to avoid any prejudice on interview subjects going into new interviews based on feedback from previous interviews conducted. To avoid bias, I noted all feedback provided. My ultimate reported findings were determined by the most frequent themes that emerged from reviewing all my collected data via thematic analysis30.

Elements relating to credibility also impacted my methodological approach. Coming from a small island myself, I was prepared for certain elements of 'small island culture' that would impact on my data collection in the field. Although I sent out formal requests for interviews via email to all my interviewees, in almost all cases I relied on my own

[29] This applied to me more so in the Mauritian case where I had never worked in or visited before my fieldwork. I had previously worked and lived in Barbados beforehand where I had a professional network that I could access.
[30] See method details in chapter 3 annex section 3.6.4.1. and primary data analytical results in appendix 6.

professional relationships or that of a contact in the field to help secure an interview. My use of the snowballing technique was also important in providing me credibility among interviewees. Through snowballing I was directly referred via email or a quick phone call by several of my interviewees to another new interview subject. My professional and academic introduction conducted before the start of each interview, alongside my probing follow-up questions (similar to Mullings, 1999) demonstrated my knowledge on the RE sector in island contexts and created a friendly open demeanour with interviewees. This was especially useful with new subjects, with whom I had no direct connection prior to the interview. Specifically, it reinforced my credibility and encouraged many interview subjects by the end of the interview to facilitate new introductions to other interviewees.

In terms of primary data, ethical issues concerning interview design, transcription and reporting also arose (Kvale, 2007). Specifically, I had to consider the possible consequences of the study for the stakeholders I interviewed and to secure their confidentiality. When conducting expert interviews, Bogner et al. (2009) highlight the need to be sensitive to the vulnerabilities and interests of the expert while also maintaining the purpose of one's own study. The need to similarly achieve this balance was also experienced in my thesis with methodological consequences pertaining to how results could be presented from data collected. A small number of key stakeholders influenced renewable energy sector developments in my cases; less than 30 key interviewee organisations in each fieldwork country. This meant that across my case countries, many interviewees knew one another in a professional and or personal capacity. For example, one interviewee had previously worked for another interview subject for several years before moving on to their current senior position in another organisation. These ties benefitted me via the snowballing technique which was especially useful for conducting data collection within such small markets.

Thus, I was able to gain timely access to key influential actors in the RE sector for interviews. However, the close interrelations within my small sample size also meant that acquiring open and honest responses could have potential negative implications on subjects' careers, professional interests, or personal relationships. Several interview subjects explicitly requested that their identities remain anonymous given the small number of players within the national energy market. Therefore, anonymity was essential in how I ultimately presented expert interview data. Hence, almost no direct quotes from interviewees were included in my analysis. Any quotes included were short and paraphrased in formal prose format (Kvale, 2007). In addition, corresponding primary sources were referenced using a code identifier that protected the identity of each interviewee. For example, feedback from my 20 Barbadian interview subjects were represented by the codes $BB_{1...20}$ and from the 26 Mauritian interview subjects were represented by the codes $MS_{1...26}$. The reassurance of such a measure of anonymity to subjects, in almost all instances encouraged persons to be very open and frank in their interviews. Most of my interviews conducted went way over the allotted time of 45 mins; the longest one lasted almost two hours despite the inteviewee's very busy schedule. Conversely, in at least a handful of interviews, it appeared that the subject chose to only give responses that reflected the official company position rather than a personal reflection of experience. These subjects tended to give curt responses where the overall interview time was much shorter compared to the others conducted, lasting around 20 to 30 mins in length.

Throughout my thesis I supplemented primary data findings and triangulated evidence (Harvey, 2010), especially where interview feedback related to a theme that was not frequently raised (i.e. by raised by more than 2 interviewees) (Davies, 2001). According to McDowell (1998), interview subjects may at times share more or different types of information in different settings (as cited in Harvey, 2020). This applied to at least one of my interview subjects who shared more details on my research topic at a public forum versus within our one-on-one interview at their office, despite my several attempts to rephrase questions asked. In this case, I was able to supplement my interview data with their publicly published findings. Overall, interview inserts were contextualised (Kvale, 2007) within my thesis by referencing them under the relevant chapter sections where feedback made a thematic contribution. To do so, my write up under respective chapter headings reflected the central emergent themes from interview feedback and outlined the corresponding responses from relevant interview question(s) asked on that theme. For instance, responses to the interview question 'to what extent has access to varying consumer financing options played a role in the uptake of Renewable Energy technology?' formed part of the write up for chapter 5, section 5.4.1.1. 'Access to Resources'[31].

[31] See appendix 11 for further full interview instrument.

A critical issue I encountered was the limited data available for my quantitative analysis on case countries from secondary statistical databases on RE and the relevant trends over time (e.g. RE uptake, corruption levels, etc.). For my study, this meant a relatively short[32] research timeline of 19 years (2000 to 2018) and a few missing data points for some years. This resulted in a research timeline with a small number of data points (timeseries covering only 19 years per case country) limiting the type of quantitative models that I could use. Alongside my co-authors, guided by previous academic research this problem was addressed by specially designing a regression model that could work with our small dataset. In our time series analysis, we aggregated the data for all three case countries rather than running the regression model on each one, in order to obtain statistically significant results that could then be analysed and inform future potential larger-scale research (see method details in chapter 3 annex, section 3.6.4.3.).

A main benefit of adopting the overall mixed methods approach of this thesis, was the ability to supplement and elaborate upon my initial qualitative findings using quantitative analysis. This added further depth to my overall findings and conclusions presented in chapter 8. Together, the combined results provided a more robust understanding of the overarching research problem. Triangulation was both an intended and unanticipated consequence of my mixed methods strategy (Bryman, 2006). On the one hand, triangulation[33] intentionally allowed me to collect and analyse data for my cases despite their inherently small data sample sizes and dataset availability. On the other hand, in the course of interpreting my data, I unintentionally discovered an inconsistency between my qualitative and quantitative findings. This is typical when applying mixed methods, where at times surprising findings can emerge (Bryman, 2006). A main and unexpected finding of my thesis was the statistical indication that the presence of official national RE roadmaps negatively impacted RE uptake in the electricity sector over the 2000 to 2018 period across my three SIDS cases (see chapter 7, section 7.5.2.3.). This contrasted with my initial qualitative findings which identified official RE roadmaps as a perceived driver of GET (e.g. see chapter 5, section 5.4.1.2.).

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[32] The access to at least 25 years of data to reflect a long-term policy planning and implementation cycle (Eatzaz, et al., 2012) would have been more ideal.
[33] That is, the use of multiple approaches and data sources (Goodrick, 2014, p. iii; Davies, 2001).

Overall, through the mixed methods approach I designed, I was successfully able to empirically explore relationships within and across my case country sample. The internal validity of my initial qualitative results and findings were bolstered by the findings of the quantitative analysis stage. However, it should be noted that to extend the validity of my conclusions to other SIDS cases, further research is needed. To this end, in my conclusions (see chapter 8, section 8.6.) recommendations are made on topic areas that could benefit from future research looking at a wider sample of countries.

3.6. Annex

3.6.1. Overview

The overall research design of this thesis entails two main phases: a stage 1 qualitative phase which composes the bulk of my investigative work across chapter 4 to 6, and a stage 2 under chapter 7 containing supplementary quantitative analysis. Under Stage 1, a literature review was conducted. Here I identified the main political, economic, environmental and social/ behavioural factors relevant to explaining SIDS' GET experiences. To do so I referenced secondary sources from leading global institutions, academics, and relevant national reports. Based on this survey of the literature, I pinpointed those factors highlighted as critical to a country's ability to successfully respond to climate change, and hence achieve its green energy transition (GET) goals. Guided by these identified factors, from the pool of 58 United Nations listed SIDS (United Nations, 2020), a narrowed down subset of three countries were selected for closer examination through detailed case study analysis.

In my case country selection, I was also guided by Briguglio (2016; 1995; 1994), Benedicto (2014), Grote (2010), Campling (2006), Crowards (2002) and Armstrong, et al. (1998) in the definition of a SIDS. That is, according to the parameters of population size, land area, income, and level of vulnerability. My final selected cases were countries with a population of 3 million or less (small or limited domestic markets), a land area of 15,000 km^2 or less, physically isolated (i.e. with a geographic boundary completely surrounded by water), high public debt or chronic fiscal deficits, high energy and transport costs, as well as high economic and environmental vulnerability. In the selection of these countries, I used the Method of Difference. Namely, a comparative method that entails a small N study examining a small number of deliberately selected cases in depth (Yin, 2015).

Under Stage 2, I conducted case study analysis. Here, the theoretical problem of the thesis was analysed across the most prominent thematic areas that emerged from further examination of the main factors affecting GET across the three cases. A comparative politics perspective was used to identify the differences between, and similarities among the countries (Casey, 2009). In this regard, targeted use of process tracing helped to explore causal relationships between the factors that led to renewable energy adoption outcomes in the selected case countries over time. My data sources included primary expert interview feedback and secondary data from statistical databases, and official reports. These findings were then supplemented with a quantitative assessment which revealed the statistical correlation between factors identified with countries' RE outcomes.

3.6.2. Research Design Stage 1: Literature Review, Identification of Key Thematic Factors and Case Selection Procedure

3.6.2.1. Literature Review and Key Thematic Factors Identified

The choice of case study conditions for examination was driven by this thesis' overarching research question[34], and prior scholarship concerning what matters for a country to be able to respond to the implications of a changing climate. Relevant theoretical and substantive knowledge in the existing literature, helped to pinpoint a selection of those major causal conditions relevant towards a country achieving successful green energy transition outcomes. Namely, the various combinations of conditions that might generate the desired outcome of increased green energy uptake was focused upon. For example, according to the IMF (2017, p.133), where a country reflects certain political and socio-economic characteristics, they were likely to have a strengthened "ability to cope with climate change". Additionally, factors related to behaviour, lifestyle and culture have been found to have an influential role on the success of climate policy, especially in the energy sector (IPCC, 2015). From my review, 19 main political, economic, environmental and social/ behavioural factors, particularly those relevant to small island settings, were extracted (listed below) and used to aid in the selection of three suitable case countries for deeper analysis under this thesis.

To ensure the focus of the thesis was manageable, during the literature review, where possible, a streamlining process of the causal conditions was done loosely lending from Ragin's (2008) Qualitative Comparative Analysis (QCA) approach. Specifically, where appropriate, several conditions were combined into one when they appeared to be

[34] How can variances in green energy transition (GET) processes and outcomes across small island developing states (SIDS) be accounted for?

substitutable. For example, the ‘Economic Vulnerability Index’ was used to examine multiple exogenous economic factors such as ‘the degree to which an economy depends on exports and imports’, and the ‘degree to which an economy depends on a narrow range of exports’ etc. (Ragin, 2008). Each of the factors used to aid in case selection were defined, to help in clearly measuring their presence in the potential case countries looked at (see table below).

Table 5 Relevant green energy transition factors used to support case country selection from the existing literature, their definitions, and sources

No.	Factor	Definition	Relevant Source(s)
1.0	**POLITICAL**		
1.1	Impartial Administration Attribute	The Global State of Democracy Initiative’s was used as a measure of corruption in this thesis. They do so by measuring fair and predictable public administration via the impartial administration attribute. It explicitly refers to corruption in the government measured via 5 sub-indicators (see chapter 7, annex 2) (International IDEA, 2019a). Scoring runs from 0 to 1, impartial administration scores closer to 1 represent less corruption and vice versa (International IDEA, 2019b). I considered scores below 0.4 to be categorised as high corruption levels, from 0.4 to 0.59 were considered reasonably high corruption levels, from 0.6 to 0.79 reasonably low corruption, from 0.8 and above as low corruption levels.	(IMF, 2017); (IPCC, 2015); (Jones & Carabine, 2013); (Dfid, 2009); (Read, 2001).
1.2	A national plan for green energy transition outlined	The presence of a relevant national strategy, plan or framework that clearly outlined energy transition goals and their implementation.	e.g. (Ministry of Energy & Public Utilities, 2019); (Government of Barbados, 2018); (Government of Mauritius, 2017); (Ministry of Energy

			and Mining Jamaica, 2009).
1.3	Renewable Energy (RE) Regulatory incentives introduced	Guided by Lewis and Garmon's (1997) definition of 'incentive regulation' – I viewed this as the use of rewards and penalties to induce an actor to achieve the desired RE goals, where the actor is afforded some discretion in achieving the goals (as cited in Berg 1997, p.37). While the authors write in referral to utility regulation, this thesis instead expanded this to the presence of any incentives that sought the above for actors within the renewable energy sector as a whole, i.e., a feed in tariff (FiT), net metering/ billing, interconnection standards, tax credits, tax reductions or exemptions, public loans/ grants, independent power producers (IPPs) permitted, and green public procurement.	(NREL, 2015); (Global Renewable Energy Islands Network, 2014); (Berg & Public Utility Research Centre, 1997).
1.4	Colonial historical experience	Whether or not the country has ever experienced colonisation. That is, been subject to the action or process of being settled in and having control forcibly established by external parties over the indigenous people and geographic area.	(Oxford University Press, 2018)
1.5	Decentralised decision-making structures	Confirmation on whether there is presence of a democratic political system. Also guided by the OECD's (2017) concept of *open government initiatives* - existing government frameworks and strategies that effectively allow for wider stakeholder/ citizen participation.	(Central Intelligence Agency , 2018); (OECD, 2017).
1.6	No occurrence of political instability or	Political instability or civil unrest, here was defined as political	(Commonwealth Secretariat, 2018);

	civil unrest within the last 30 years	exchange that violated the laws of the society or violated the regular system of political exchange.	(Ake, 1975, pp. 273-274).
1.7	A historic monopoly national electricity grid	Confirmation on whether there has been a monopoly for most of the last 30 years. That is, a vertically integrated utility with exclusive rights for the generation, transmission, distribution, and sale of electricity.	(Cambridge University Press, 2020); (REEEP, 2013).
2.0	**ECONOMIC & ENVIRONMENTAL**		
2.1	Is classified as a Small Island Developing State (SIDS)	Confirmation guided by the United Nation's SIDS lists (UN-OHRLLS, 2020).	(IMF, 2017); (IMF, 2016); (World Bank, 2016); (Brito, 2015); (Read, 2001).
2.2	Is classified as an Upper Middle- to High-Income Country	Based upon per capita gross national income (GNI) as of 2018 that is more than US$3,956 and less than US$12,235 classified as an upper middle-income country, and more than US$12,235 as high income.	(OECD, 2018); (The World Bank Group, 2018).
2.3	A Very High World Risk Index (WRI)	"The World Risk Index calculates the risk for 171 countries worldwide based on the following four components: • Exposure to natural hazards such as earthquakes, hurricanes, flooding, drought, and sea-level rise. • Vulnerability as dependent on infrastructure, nutrition, living conditions and economic circumstances. • Coping capacities as dependent on governance, preparedness and early warning measures, access to healthcare, social and material security. • Adapting capacities with respect to impending natural events, climate change and other challenges."	(Chen, 2017); (UNSD, 2017); (Briguglio, 1995, p. 1615).

		A ‘very high’ index was considered a value between 10.49 and 36.45 (calculated mean based on the years of 2012 to 2016) (Bundis Entwicklung Hilft, 2017, p. 8).	
2.4	High Economic Vulnerability Index (EVI)	“Economic vulnerability can be defined as the likelihood that a country’s economic development could be hindered by unforeseen exogenous shocks (Guillaumont, 2009; 2008)”. Guided by Briguglio’s approach (2014; 1995) to measuring vulnerability - four variables used to comprise a composite index: (i) **trade openness** (i.e. the average of exports and imports of goods and services as a percentage of GDP), (ii) **export concentration** (i.e. the sum of the three broad groups of exports of goods and services which together take the highest percentage of total exports of goods and services, expressed as a percentage of total exports of goods and services), (iii) **dependence on strategic imports** (i.e. the import of food and fuel as a percentage of total merchandise imports), and (iv) **proneness to natural disasters** (i.e. calculated as money damage in relation to the country’s GDP). Everything else including GDP per capita remain constant. The EVI indices range from 0 to 1 where the higher the index the greater the vulnerability. A country with an index figure above 0.5 for this thesis was considered to have a high level of vulnerability.	(Feindouno & Goujon, 2015, p. 2); (Briguglio, 1995, p. 1619; 2014, pp. 29-32).
2.5	High Energy Costs	Measured using net energy imports (% of energy use). A country’s energy costs for this	(The World Bank Group, 2018); (UNSD, 2017);

		thesis was considered high if its % use was above that of the world annual average. Or where data was unavailable, was guided by national energy balance - high energy costs was denoted by a negative balance.	(Garcia & Meisen, 2008).
2.6	High Human Development Index (HDI)	A composite index measuring the average achievement of a country in three basic dimensions of human development: health, education, and income. A high HDI was defined as one that was less than or equal to 0.8 and more than 0.7 as at 2017.	(United Nations, 2017)
2.7	Chronic Fiscal Deficits	A fiscal deficit was defined as when a government's total expenditures exceeded the revenue that it generated, excluding its money from borrowings. A chronic deficit was considered when a country experienced more years of annual deficits than surplus over a defined period.	(Investopedia LLC, 2018); (IMF, 2018); (Trading Economics, 2018).
2.8	A High Public Debt Average	According to the World Bank a tipping point value of the debt to GDP ratio is when it exceeds 77 for developed markets and 64 for emerging markets. Every percentage point of debt above this level costs a country 1.7 percent and 2 percent in economic growth, respectively. Based on the above, a moderate public debt was considered one that ranged between 44 percent to 64 percent. A high public debt was considered one that exceeded 64 percent.	(Amadeo, 2018); (IMF, 2018); (Central Intelligence Agency , 2018); (Trading Economics, 2018).
3.0	**SOCIAL/ BEHAVIOURAL**		
3.1	A homogeneous ethnic group	Defined as a society that was composed of one major ethnic	(Central Intelligence Agency , 2018);

		group, race, or religion. That is, one group formed more than 50% of the society.	(Oxford University Press, 2018); (Fearon, 2003, p. 205).
3.2	Presence of RE awareness actions/ pilot projects	This condition was satisfied where any national actions or projects existed that aimed to create consumer awareness and buy-in e.g. via demonstration projects, school education campaigns etc.	(Government of Barbados, 2018); (ICAO, 2018); (ACP Secretariat, 2017); (SPREP, 2017); (Doris, et al., 2015); (Ackbarally, 2013).
3.3	Prominent presence of relevant active non-state actors	Presence of a prominent non-state actor found to be actively conducting work that supported the national renewable energy agenda or promoted the use of renewables.	(Moore, et al., 2014); (Ministry of Environment Mauritius, 2017)
3.4	Access to financing	Satisfied where any local financial institutions or other like entities were providing financial support to purchase renewable energy technology to the private sector and or to the average household consumer.	(Grant, 2015); (Caribbean Policy Research Institute, 2014); (MCB, 2020); (SUNREF, 2020)

3.6.2.2. Case Selection Procedure

The above factors were used to help shortlist 3 suitable case countries to be comparatively examined using the most similar case design (Yin, 2015) and in line with my research project's definition of a SIDS (see section 3.6.1). A number of procedures are available for conducting case study analysis (Creswell, 2013; Merriam, 1998; Stake, 1995; Yin, 2009; Denzin, 2011). In terms of specific case selection criteria, my research especially referred to those elaborated in Yin (2015) and Denzin (2011). Yin (2015) recommends that the following key factors be considered in selection of appropriate cases for examination:

1. Investigator has sufficient access to case data (people, review documents, records etc.).
2. The case(s) will most likely illuminate relevant research questions of "how" and "why".

3. Articulation of study propositions- for this study some main propositions included that:
    a. The green energy transition structures established within SIDS are largely determined by both their international commitments made, and their relevant national sustainable development targets set.
    b. National economic constraints faced by SIDS have severely restricted RE outcomes achieved and hence overall progress towards green energy transition targets set.
    c. SIDS who have adopted a more innovative and participatory approach in the governance of their green energy transition (GET) process, have achieved greater progress towards GET targets.
4. Investigator has determined unit of analysis- this can be an industry, an economic policy (Yin, 2015), an action, or a nation state (Denzin & Lincoln, 2011). Swanborn (2010) further explains that cases can be located at the micro, meso or macro levels, an involve one or multiple actors (as cited in Denzin & Lincoln, 2011, p. 600). The unit of analysis in my research project represented an industry at the macro level, with feedback gathered from multiple actors. Namely, national renewable energy progress in the electricity sector of SIDS.
5. Bounding of the case- the immediate topic of the case study distinguished from those outside of it e.g. relevant policy makers, top private sector actors, main civil society actor etc. This also includes time boundaries (Yin, 2015, pp. 60-70). My thesis covered relevant renewable energy sector experts[35].

My case study sample selected was also based upon my access to important contacts (Yin, 2015) in the public sector, private sector, relevant regional and donor organisations and civil society. I was also determined by my financial resources available to conduct field work as a self-funded PhD.

Based on all the above, Barbados, Jamaica, and Mauritius were selected as the case studies for my thesis. The three countries shared largely similar characteristics in the above main political, economic, environmental and social/ behavioural factors identified

[35] Experts in my research project covered five main actor groups: public sector, private sector, civil society, regional entities, and international organisations. This included professional elites, persons with extensive knowledge (e.g. researchers and academics), and implementing actors with power to steer change within the renewable energy sector (Bogner, et al., 2009).

relevant to GET. I sought to explore what combination of these factors had led to the specific outcome: as of 2018, Country was on track with its renewable energy supply target for electricity generation in and off the national grid. That is, to what extent have which combinations of factors produced the outcome observed across the three cases?

Table 6 Contextual GET Conditions Present in three Shortlisted SIDS Cases (political, economic, environmental and social/ behavioural factors), 2000 to 2018

Thematic Area	Contextual Factor	Barbados	Jamaica	Mauritius
Political	Reasonably low to low corruption levels	✓	✓	X
	A national plan for green energy transition outlined	X	✓	✓
	RE Regulatory incentives introduced	✓	✓	✓
	Colonial historical experience	✓	✓	✓
	Decentralised decision-making structures	✓	✓	✓
	No occurrence of political instability or civil unrest within the last 30 years	✓	✓	✓
	A historic monopoly electricity grid	✓	✓	✓
Economic & Environmental	A Very High World Risk Index (WRI)	X	✓	✓
	High Public Debt Average	✓	✓	X
	Is classified as a Small Island Developing State (SIDS)	✓	✓	✓
	Is classified as an Upper Middle to High-Income Country	✓	✓	✓
	High Economic Vulnerability (EVI)	✓	✓	✓
	High Energy Costs	✓	✓	✓
	High Human Development Index (HDI)	✓	✓	✓
	Chronic Fiscal Deficits	✓	✓	✓
Social/ Behavioural	A homogeneous ethnic group	✓	✓	X
	Prominent presence of relevant active non-state actors	✓	X	✓
	Presence of RE awareness actions/ pilot projects	✓	✓	✓
	Access to financing	✓	✓	✓
GET OUTCOME	As of 2018, country is on track or ahead of its renewable energy supply target for electricity generation in and off the national grid	X[36]	✓[37]	✓[38]

[36] Based on the national target to achieve 65% renewable electricity generation by the year 2030. As of 2018, RE was approximately 3.5% of total electricity generation, that is, 9.5 percentage points (p.p.) behind its 2018 estimated benchmark target (Government of Barbados, 2015; United Nations, 2018).
[37] Based on the national target to achieve 20% renewable electricity generation by the year 2030. As of 2018, RE was approximately 15% of total electricity generation, that is, 11 p.p. ahead of its 2018 estimated benchmark target (TAPSEC, 2018).
[38] Based on the national target to achieve 35% renewable electricity generation by the year 2025. As of 2018, RE was approximately 21% of total electricity generation, that is, 10 p.p. ahead of its 2018 estimated benchmark target (MARENA, 2018).

3.6.3. Research Design Stage 2: Case Study Analysis

Of the 19 factors compared during the case selection process, discrepancies among 6 especially stood out between the 3 countries: corruption levels, presence of a national plan for green energy transition, world risk index, public debt, national ethnic group classification, and the presence of relevant active non-state actors. These initial observations pertaining to the cases' similarities and differences piqued my interest and hence their selection for deeper investigation under this thesis. For instance, Mauritius portrayed GET outcomes ahead of it stipulated national target despite high corruption levels, and a very high world risk index. Amongst the three countries, the Jamaican case proves interesting in that despite the further challenges of high public debt and a lack of relevant active non-state actors its GET outcome was positive. Barbados stood out in that although it displayed seemingly more favourable conditions (IMF, 2017) such as lower corruption levels and a low world risk index compared to its counterparts, the country was behind its national RE target.

My case selection finalised, I then proceeded to employ an overall mixed method approach (Creswell, 2014, p. 44) to examine each country's GET experiences more critically across 4 academic papers. This began with a critical single case study in chapter 4, followed by comparative multiple case study analysis under chapters 5 to 7 (see sections 3.6.3.1. and 3.6.3.2. below). The case study approach proved especially ideal for my thesis given the nature of my overall research question (Yin, 2015). I sought to answer an overall question of 'how' pertaining to the relatively recent[39] (over the last 20 to 30 years) experiences of GET in SIDS. In addition, given the limited application of leading relevant theories on the topic, I sought to generate empirical evidence that contributed more in-depth description of GET within these contexts.

While my overall research focus was ideally suited to the case study approach, several weaknesses were also considered and acknowledged in its overall utilisation. Its use

[39] From a policy design and implementation perspective (Eatzaz, et al., 2012). In their analysis the authors consider a long run period to be 25 years (1984-2009) within their empirical model. Detailed national RE sector policy planning documents in Barbados, Jamaica, and Mauritius have emerged in relatively recent years: (2019-2030), (2009-2030), and (2009-2025) respectively (Government of Barbados, 2018; PAGE, 2015; Ministry of Energy and Mining Jamaica, 2009).

required close scrutiny of each of my cases. This limited the number of cases that I realistically had the time and resources to gather data on and examine within this research project (Collier, 1993). In addition, the technique itself is more oriented towards highlighting the presence or absence of factors in different cases rather than evaluating the relative importance of them. To address this shortcoming, quantitative analysis (in chapter 7) was used to supplement my qualitative findings across chapter 4 to 6.

3.6.3.1. Chapter 4- Critical Single-Case Study

Based on the above observations, under the first paper of my thesis (chapter 4) I opted to begin my case exploration with the critical single-case study analysis (Yin, 2015, p. 92; Creswell, 2013) of Jamaica. My qualitative exploration (Bowen, 2009) was based on the assumption that the main drivers and barriers (transition determinants) of GET in SIDS mostly differed from those already recognised for developed and large developing countries under leading GET-related theory. Using concept-driven (Gibbs, 2012)[40] thematic coding (Bryman, 2012), I identified a synthesis of existing GET-related assumptions from the existing literature (see results in chapter 4, table 7) that could potentially help explain observed RE outcomes in the Caribbean case country. Namely, I referred to diffusion of innovation research, sustainability transitions, policy studies and the green economy literature. I then employed the process tracing technique to identify those factors specific to explaining RE progress in Jamaica's electricity sector using secondary data sources. Lastly, I compared the assumptions from the literature with my case-specific findings to explore the extent to which my initial proposition held true. Specifically, I used the findings from my Jamaican case to determine the extent to which leading assumptions held true within a SIDS' context. In this regard, Yin (2015, p. 92), highlights the important role that the single case can contribute to knowledge and theory by confirming, challenging, or extending upon it.

[40] The categories or codes derived from thematic analysis came from previous literature, studies, books and official reports.

3.6.3.2. *Chapters 5, 6 & 7- Most Similar Case Design (Method of Difference)*

In chapters 5 to 7, I utilised a comparative multiple-case study approach (Goodrick, 2014). I specifically employed the most similar case study design (method of difference) (Bennett, 2004). That is, guided by the above antecedent conditions, I collected and analysed data that helped me to explain which of these factors were relevant to helping explain the specific outcome of interest[41]. According to Lijphart (1971), the case study method can and should be closely connected with the comparative method. The practice of focusing on a small number of cases has achieved great legitimacy in recent years within the fields of comparative and international studies (Collier, 1993). It can be compared to others such as the experimental and statistical methods (Yin, 2015). The experimental method, ideal for scientific explanation, offers the ability to eliminate rival explanations through experimental control. However, it is impossible to "generate appropriate experimental data for most topics relevant to political analysis (Collier, 1993) and hence was complemented by other research techniques within my thesis (see section 3.4.).

Comparative case studies cover two or more cases aimed at producing generalizable knowledge about causal questions, that is, "how and why particular programmes or policies work or fail to work". They "are particularly useful for understanding and explaining how context influences the success of an intervention, and how better to tailor the intervention to the specific context to achieve intended outcomes" (Goodrick, 2014). This aspect of comparative case studies was especially desired for this research project where I sought to better understand how existing climate governance regimes in island states resulted in green energy transition outcomes observed.

Chapters 5, 6 and 7 or the remaining three academic papers of this thesis, incorporated intra- and inter-regional case comparisons (Caribbean and African regions) using the cases countries of Barbados, Jamaica, and Mauritius, three SIDS who have made renewable energy (RE) targets in their Intended Nationally Determined Contributions (INDCs), and relevant national strategies. Through a comparative politics approach (Goodrick, 2014; Casey, 2009; Bennett, 2004; Lijphart, 1971), I thematically explored

[41] As of 2018, whether or not the country was on track with its renewable energy supply target for electricity generation in and off the national grid.

patterns, processes, and regularities among the different case settings. Namely, I looked for trends, processes, regularities, and changes in patterns, as well as attempted to develop general propositions or hypotheses that described and explained these trends.

In Chapter 5 case study analysis involved qualitative comparative assessment of the Barbadian and Mauritian cases, under the lenses of diffusion and sustainability transitions research. This article was guided by the hypothesis that ‘SIDS-specific factors largely influence the adoption of green energy technologies across SIDS’. Chapter 6 builds on Chapter 5 to qualitatively explore GET actor participation across the two island cases of Barbados and Mauritius based on the proposition that ‘a more participatory green energy transition actor landscape can potentially be more efficient than one that is state-dominated’. Finally, Chapter 7 comparatively examines all three cases of Barbados, Jamaica and Mauritius using a quantitative approach based on the hypothesis that ‘to date, SIDS-related factors have had the most significant impact on their GET outcomes’. Multiple regression analysis was used to empirically measure the significance of the main factors identified as influential to the GET outcome of interest (RE uptake over time) across the SIDS contexts (based upon the secondary and primary research efforts across chapters 4 to 6). In chapter 8, the main findings across all 4 chapters or academic papers were then synthesised, with main overarching assumptions, conclusions and recommendations made.

3.6.4. Research Methods

In this thesis, I adopt an exploratory sequential and mostly qualitative mixed method approach (Creswell, 2014). Across chapters 4 to 6, I first conducted qualitative research (supported by several techniques which are outlined further below) that explored the views of interview subjects (primary data) and those contained within available secondary reports. Similar to Isensee, et al., (2020), to ensure robustness of conclusions, thematic analysis of primary and secondary data was done both manually and automatically. For primary data, manual thematic assessment was guided by template analysis (King, 2004) and for secondary data was done via a loose form of grounded theory’s theoretical sampling (Strauss and Corbin, 1990 as cited in Emmel, 2013). Automatic thematic analysis was conducted via n-gram analysis using statistical software (please see appendix 10 for R software code used). The results from initial analysis (please see chapter 4, table 8; appendices 6 and 7) guided my critical write up across chapters 4 to 7. Results also helped to specify variables relevant for future research beyond the scope of this project (see chapter 7 annex, table 17), as well as to guide the design of a quantitative research instrument that best fit the study sample (see section 3.4.3. below). Following my qualitative analysis, the quantitative tool was then implemented, the results from which built upon my initial qualitative results and helped to explain them in greater detail (see chapter 8 conclusions).

Qualitative Phase

3.6.4.1. Thematic Analysis

Throughout my research project I employed the thematic analysis technique. I examined secondary and primary data to extract core themes from existing leading literature and those themes that could be distinguished within and between my cases (Bryman, 2012). Based on my raw data (which was both secondary and primary), I engaged in both descriptive and analytical thematic coding (Gibbs, 2012, p. 6). Namely, lower-level codes (3 and 4) closely reflected the interviewees' words or that of the source document's text, whereas higher-level codes (1 and 2) reflected more analytic or theoretical codes (Gibbs, 2012, pp. 6-7).

Thematic analysis was an especially useful tool for exploring my research question. It provided me with a useful means of organising my data in which I was able to connect varying passages of text to common overarching thematic ideas or categories (Gibbs, 2012). I specifically employed the process of thematic coding in two overall steps. First, I deployed open coding under theoretical sampling generally based on Strauss and Corbin, 1990 (as cited in Emmel, 2013, p. 21-23). This helped me to organise and analyse secondary data under my literature review process (chapter 2). Secondly, I conducted selective coding (Flick, 2014, p. 314), via template analysis (based on King, 2004) to facilitate both single (of Jamaica under chapter 4) and comparative (of Barbados and Mauritius) case study analysis. Despite only having access to secondary data for the Jamaican case, thematic coding allowed me to generate results (i.e. broader abstracted thematic concepts) (Flick, 2014, p. 307) that could be later compared (under chapter 7) to the primary data results generated from my two other cases. In my following chapters 5 and 6, I used thematic analysis to examine my primary data collected from stakeholder interviews in Barbados and Mauritius. I sought to make sense of my raw audio data recordings from interviews done in the field through the thematic coding of my transcripts (Bryman, 2012, p. 13).

Linking back to my main research question[42], I determined King's (2004) template analysis especially suitable for conducting my case-driven or selective coding. King (2004), presents template analysis as a varied group of techniques, rather than a distinct methodology, for thematically organising and analysing textual data. I produced a list of codes or a 'template' that represented themes identified within secondary and primary textual data reviewed. Some themes were defined a priori, many of which were later modified, and others added as I continually reviewed and interpreted textual data available. The final template developed was organised in a manner that represented the relationships between emergent themes using a hierarchical structure.

I adopted a positivistic position that sought the underlying causes and results of human action in the context of climate mitigation and adaptation targets specifically related to the renewable energy sector. To this end, the use of the template analysis approach was ideal, where my main aim was to compare the perspectives of different groups of stakeholders within the specific context of small island developing states. For my case examination, this qualitative analytical approach was preferred to others, such as 'grounded theory', which tend to be "too prescriptive in that it specifies procedures for data gathering and analysis that *must* be followed" (King, 2004, p. 257). In contrast, template analysis provided a more flexible technique with fewer specified procedures, permitting me to tailor its use to match my own requirements. The technique was also less time consuming when compared to others such as 'interpretative phenomenological analysis' and could handle larger datasets more comfortably. For example, it is common for template analysis studies to usually have around 20 to 30 participants.

While template analysis was deemed to be an appropriate tool to support case-driven thematic coding within my thesis, I also experienced some common disadvantages or issues in its use. In developing the initial template, I found it difficult to determine how extensive the initial

[42] How can variances in green energy transition (GET) outcomes across small island developing states (SIDS) be accounted for?

template should be. King (2004), highlights that there can be a danger of starting with too many pre-defined codes. This could negatively affect analysis preventing one from considering data that conflicts with one's assumptions. At the other extreme, commencing with too few codes could leave one lacking in any clear direction and feeling overwhelmed by the mass of rich, complex data (King, 2004). To address this concern, my initial template constructed was guided by my set of interview question areas, as well as by the academic literature, anecdotal and informal evidence from stakeholders in the renewable energy sector of the case countries. This template was continuously revised during the analysis of transcript data from interviews conducted, which resulted in additional themes emerging identified by the interview subjects themselves. This strategy proved valuable to expediting a clear set of results. Due to the large number of transcripts, and in order to keep the template from becoming too detailed, I was forced to justify the inclusion of any additional code, and to (where possible) merge or update previous codes for clarity and efficiency.

My resultant template[43] (see Appendix 4) was composed of seven 'high order codes' or 'Level 1 Codes' which in turn have been subdivided into one, two or three levels of 'lower-order codes' (Level 2 to 4 Codes). The extent of sub-division broadly reflected the depth of analysis, where code levels 2 and 3 cover central issues to the research project. Level 4 codes were those elements highlighted by interviewees that while they added important depth to the research, tended to be secondary to the main aim of the research study but still worth mentioning.

3.6.4.2. Process Tracing

David Collier (2011, p. 823) describes this as "the systematic examination of diagnostic evidence selected and analysed in light of research questions and hypotheses posed by the investigator". It focuses on the unfolding of events over time, taking good snapshots at a series of specific moments to characterise key steps in a process, which allow good analysis of change and sequence (Collier, 2011, p. 824). Alongside case study analysis, a theoretically guided form of process tracing was a research method utilised in this thesis (Tannenwald, 2015; Mahoney, 2012; George, 2005) to support exploration of my sub-research questions under chapters 4 and 7. This entailed testing causal mechanisms that could be generalised across my bounded context of cases (Beach & Pederson, 2013).

[43] From primary data analysis (Barbados and Mauritius).

Namely, my research sought to pinpoint and explain the causal relationships between green transition commitments, processes and outcomes over a defined timeline across three SIDS. To effectively achieve this, Collier (2011) adds that "the fine-grained description in process tracing sometimes relies on quantitative data". In line with this viewpoint, my research on SIDS' GET experience was be supplemented by statistical data which depicted the relationship between the most important themes of GET on observed RE outcomes.

Trampusch & Palier (2016) identify process tracing as "arguably the most important tool of causal inference in qualitative and case study research" (p. 441). The technique is especially useful for evaluating hypotheses about the causes of a specific outcome in a case(s) (Mahoney, 2012). My methodological approach was largely qualitative in nature, mainly using theory-oriented process tracing to help highlight key occurrences in case countries' GET timelines in relation to their outcomes observed across the selected SIDS cases. Specifically, I adopted an integrated theoretical approach which employed elements from two main theoretical concepts: sustainability transitions and diffusion of innovation research.

Data sources drawn from included document analysis, interviews (with 46 subjects- see appendix 3 for interview questions)[44], and secondary statistical databases. For example, review of relevant legal documents and policies signed at the international, regional and national levels related to the green energy transition, statistical databases such as IRENA's Trends in Renewable Energy, and primary data collected in case countries from relevant key stakeholders in the public sector, private sector, regional bodies, donor community and civil society via expert interviews.

Process tracing is also useful in testing theories with multiple interaction effects, where it is difficult to explain outcomes in terms of two or three independent variables (George, 2005). The method allowed me to consider alternative paths to the observed outcome (equifinality), along with the ability to possibly map out different causal paths that were consistent with the outcome and the process-tracing evidence across the cases (George,

[44] Based on the feedback of 20 Barbadian interviewees' transcripts, and 26 Mauritian interviewees' (9 of which were gathered from workshop participation).

2005). Guided by hypotheses[45], in chapter 7 I also used quantitative analysis to supplement findings from my initial qualitative assessments. Namely, to help to numerically gauge the extent to which pinpointed patterns or "causal effects," identified by primary data from interview subjects[46] (George & Bennett, 2005) impacted GET outcomes observed across the SIDS cases.

While there were advantages to using process tracing within this thesis, several limitations were also noted in its use. Namely, it required enormous amounts of information, and was weakened when data was not accessible on key steps in a hypothesised process. This limited which case countries could be selected for final examination under the project. In addition, a strong basis for causal inference can only be found if it can establish an uninterrupted causal path linking causes to observed effects at appropriate levels as according to the theory being tested (George, 2005). However, even with its limitations, the process tracing method was useful for generating and analysing data on causal mechanisms. Process tracing also proved a complementary approach to another research method (George, 2005) that was used in this thesis - thematic analysis.

Quantitative Phase

3.6.4.3. Time Series Analysis

Time-series cross-sectional (TSCS) panel analysis was applied under this thesis' quantitative phase of analysis. This was determined to be the most appropriate tool in exploring my sub-research question: to what extent have the main factors identified as important to SIDS' GET experiences impacted their RE generation outcomes over time? Under Chapter 7 of this thesis, with the support of co-authors, I examined the relationship between RE electricity generation (Gwh) with the main factors identified as important to RE uptake rate under the study's qualitative phases. Cross-sectional variation was comparatively examined, as well as longitudinal data within my three case countries over time. This allowed us to assess how changes in the GET factors shortlisted, lead to changes in RE electricity generation at the national level.

[45] To date SIDS-related factors have had significant influence on their GET outcomes.
[46] That is, the expected value of the change in outcome when - in theory – the exogenous or independent variable changes.

In the areas of both political and environmental science, researchers have relied on time series analysis as an analytical tool to better understand public policy outcomes. For instance, in the fields of comparative politics (Loftis & Mortensen, 2017; Bradley & Stephens, 2007), gender and public health (Gunn, et al., 2019; Molefi, 2018), environmental studies (Gokmenoglu & Baris Memduh, 2019; Singh & Pozo, 2019), among others.

We designed and applied a correlational statistical technique elaborated via logistic regression (Creswell, 2014), to describe and measure the relationship between one endogenous (i.e. dependent) variable (renewable energy electricity generation in Gwh or RE uptake) with up to 10 exogenous (i.e. independent) variables over the 19-year period of 2000 to 2018 (see appendix 8 for dataset description). An Ordinary Least Square (OLS) model (please see appendix 9 for regression code details) was employed to investigate the relationships of interest.

The OLS regression model was specified as follows:

$$y_{it} = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \dots \beta_k x_k + u_{it}$$

Where y_{it} (i=country and t=2000-2018) is Renewable Energy Electricity Generation and $x_{1 \dots k}$ is the exogenous variable with $\beta_{1 \dots k}$ being the coefficient for that variable. The model disturbance is u_{it}.

With the equation for the fixed effects model becoming:

$$y_{it} = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \dots \beta_k x_k + \alpha_i + u_{it}$$

Where α_i (i=1…n) is the n entity specific intercept.

and the random effects model being:

$$y_{it} = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \dots \beta_k x_k + \alpha + u_{it} + \varepsilon_{it}$$

Where ε_{it} is the within-entity error, and u_{it} is the between-entity error.

The model enabled us to explore how past events of select exogenous variables determined future renewable energy generation trends, with all other exogenous variables being fixed. Within the model we control for certain contextual variables, hence allowing us to account for individual countries' heterogeneity - presence of a national RE roadmap, level of rule enforcement within the RE sector, and utility ownership status. Our hypotheses were tested through fixed and random effects panel regressions. All continuous variables underwent a natural logarithm transformation aiming to resolve heteroskedasticity problems. We employed the Hausman test to determine the most appropriate model.

A challenge faced in implementing the quantitative phase of this thesis was narrowing down the exact exogenous variables (based on findings under the previous qualitative phase) to test against our dependent of interest (RE uptake). Ultimately, the three main thematic areas of overcoming poverty, resource allocation, and SIDS' case specific developing country conditions, were examined via 10 proxy sub-indicators (see chapter 7- research design). Due to limited time and financial resources preventing more extensive data collection, another limitation of this study was its small sample size (i.e., in terms of data inputs available). Insufficient data inputs (prior to the year 2000) were available on our endogenous variable (RE electricity generation) for each country to run our model. Consequently, statistically significant results could not be generated on an individual country basis.

To address this issue, the time series model was run collectively for all three case countries. For insight at the country level, we utilised descriptive statistics accompanied by exploratory statistical analysis (the correlation coefficient), which aided in the interpretation of our model's aggregated results. Given noted limitations, we viewed any regression model outputs generated as only, but nonetheless valuable, indication of the relationship between variables. We recognise the need for greater data collection and recommend future research utilising a much larger dataset compiled for model inputs.

Chapter 4 (Paper 1): The Distinct Factors Shaping Green Energy Transition Outcomes in Small Island Developing States: Exploring Renewable Energy Progress in Jamaica

Manuscript prepared for submission to the Island Studies Journal

Abstract

Small island developing states (SIDS) have made some of the most ambitious green energy targets in the world. However, limited literature exists that applies leading theoretical concepts to examine green energy transition (GET) progress within these countries. Additionally, available writings tend to stem from a technical or technological standpoint.

From a policy implementation perspective, I explore the relevance of leading assumptions under GET-related literature to SIDS' contexts via the case study of Jamaica. I evaluate the advancement of renewable energy in Jamaica's electricity sector and explore the main factors that have influenced observed trends over time. My findings revealed that while several of Jamaica's main determinants of GET overlapped with those recognised across the leading literature for developed and large developing countries, the majority were distinctive to the Jamaican context. For instance, oil price and supply volatility, and a proactive national utility company.

Using an integrated theoretical approach, my findings contribute to existing GET literature on SIDS. My tailored method for investigating GET within SIDS can be similarly applied to other small developing country cases. This approach, along with my conclusions may prove especially relevant for GET implementing actors interested in understanding the extent to which small developing country settings impact upon GET ambitions. By extension, my findings are also relevant to policymakers and other stakeholders interested in reflexive policymaking and implementation.

4.1. Introduction

Climate change poses a more immediate challenge to small island developing states (SIDS) [1] when compared to their global counterparts (GFDRR, 2017; Kopf & Isbell, 2016). These countries "suffer additional handicaps arising from the interplay of factors such as smallness, vulnerability to natural disasters" (Briguglio, 1995, p. 1615), human, financial, physical and capital constraints, a highly limited internal market, and a heavy reliance on imported fossil fuels (Commonwealth Secretariat, 2018; World Bank, 2016). Notwithstanding, SIDS have made some of the most ambitious green energy targets in the world (Ourbak & Magnan, 2018; Robinson, 2018). Existing literature has already recognised that SIDS' uniqueness plays a key role in their associated climate change impacts and responses (Oretes, 2019; IPCC, 2018; UNEP, 2014; Boto & Biasca, 2012; UNEP, UNDESA and FAO, 2012; UN-OHRLLS, 2011). Despite such recognition, leading green energy transition (GET) literature such as sustainability transitions, and diffusion research has yet to pay much attention to these cases (Ramos-Mejia, et al., 2018; Wieczorek, 2018; Scobie, 2016). Green energy transitions in the contexts of SIDS thus remain underexplored.

In this article, I seek to address this knowledge gap: first, by reviewing and synthesising relevant existing theoretical literature; and second, by applying the concepts and insights derived from this to the specific SIDS case of Jamaica. Facilitated by thematic coding (Flick, 2014, p. 319; King, 2004), I compare leading assumptions from the wider literature with that of case specific data. In 2018, Jamaica was ahead of its estimated renewable energy (RE) benchmark target by around 11 percentage points (p.p.) (Bloomberg NEF, 2018), and was one of the Caribbean countries most ahead in terms of its enabling regulatory framework (see table 8). An understanding of Jamaica's progress can provide valuable insight into the main drivers and barriers determining green energy transition (GET) within SIDS. For the purposes of this article, I define GET as a state acting to secure circumstances that maximise possibilities for a progressive and environmentally sustainable societal shift (EBRD, 2015; Kemp, et al., 2005) towards energy systems of higher efficiency (Chen, et al., 2019; Gielen, et al., 2019). The progress of such ambitions is influenced by varying factors, or what I refer to as 'transition determinants'. Transition determinants are understood as the drivers and barriers that influence the rate at which transition takes place within a social system (Rogers, 1962), depending on case-specific conditions (IMF, 2017). These conditions either help to speed up, or slow down the rate of innovation uptake, defined as a new idea, practice or object (Rogers, 1962), in this case renewable energy (RE).

Jamaica is the second largest electricity consumer in the Caribbean (McIntyre, et al., 2016) and generates over 94% of its electricity from imported fossil fuels (NREL, 2015). GET has thus been identified as a crucial component of its national sustainable development agenda. The Government has set the target of an increased "share of renewable energy sources in its primary energy mix to 20% by 2030", to be achieved in a manner that supports "long-term economic and social development and environmental sustainability" (The Government of Jamaica, 2015, p. 2; The Ministry of Energy and Mining Jamaica, 2009). This corresponds with the wider goal of energy security (The Government of Jamaica, 2015), and Jamaica's efforts to achieve SDG 7 - "access to affordable, reliable, sustainable and modern energy for all" (United Nations, 2019; Planning Institute of Jamaica, 2018).

Applied to this specific case, I seek to identify and evaluate what are the main drivers and barriers (transition determinants) of green energy transitioning in Jamaica and to measure the extent they conform to or differ from those already recognised in the broader GET literature? Within the rest of this article, I review and synthesise relevant GET theory via thematic analysis (King, 2004). I then proceed to comparatively examine the factors influencing Jamaica's RE uptake with existing theoretical assumptions. Specifically, I employ a qualitative case study methodology (Yin, 2015; Creswell, 2013; Bowen, 2009) to explore renewable energy uptake in Jamaica's electricity sector in line with my research question. My analytical starting point is the 1992 signing of the UNFCCC, which represented an investigative timeframe of 26 years as of 2018. I go on to empirically gauge Jamaica's energy system transition in terms of uptake trends in RE technologies over time.

Through process tracing (Beach & Pederson, 2013; Collier, 2011, p. 824) I utilised the transition management approach (Loorbach, 2010) to examine the unique factors influencing Jamaica's green energy uptake trends, looking specifically at those activities within Jamaica's tactical and operational spheres of governance. Noting its national and regional context, I referenced secondary sources to examine the outcomes of Jamaica's specific policies, strategies and actions deployed aimed at increasing RE technology uptake in the electricity sector. I then utilised an adapted version of Rogers' (1962) diffusion curve to narrow down key timeline moments in Jamaica's RE transition. This was then followed by thematic analysis and corresponding discussion on the main emerging themes, and corresponding brief final remarks. My source materials draw from in-depth documentary analysis (Bowen, 2009; Prior, 2003b).

4.2. GET Theoretical Perspectives & SIDS

Both diffusion (e.g., Zhang, 2018; Rogers, 2016; Wilson, 2012; Geroski, 2000; Rogers, 1962), and sustainability transitions research (e.g. Geels & Schot, 2010; Smith, et al., 2005; Geels, 2002), have attempted to explain the main factors that either drive or hinder green energy uptake within countries. The bulk of this research has stemmed from technological or technical perspectives and has largely focused on a developed- and/or large developing-country contexts. Nevertheless, the integrated application of elements from both bodies of literature provides valuable means by which the underexplored topic of GET in SIDS can be examined. In what follows, I further augment this theoretical synthesis by incorporating the lens of policy implementation by borrowing from additional bodies of literature: green economy and policy studies.

Diffusion research provides an especially useful means to gauge green energy uptake over time, in terms of the 'diffusion of an innovation' into a social system (Rogers, 1962). Rogers (1962) identifies seven main characteristics of innovations that can influence the rate of adoption: relative advantage, compatibility, complexity, trialability, observability, social structure, and external or social conditions. For the uptake of energy technologies at the individual and industry level, later writers have point to the importance of factors such as: market structure, communication, size of sunk costs, costs of adoption (Hall, 2004), technology characteristics, system integration, experimentation and learning, and the upscaling of energy technologies (Wilson, 2012). Rogers' (2016), evaluation of Barbados' solar water heater sector, further describes the importance of functions such as: incentives, resource mobilisation and legitimacy for technological innovation systems. Wejnert (2002) elaborates that "innovations are not independent of their environmental context" but rather they "evolve in a specific ecological and cultural context" (p. 310).

Namely, geographic setting, societal culture, political conditions, and globalisation and uniformity (Wejnert, 2002).

Policy studies further highlight a number of SIDS-related national level challenges that can influence a transition. These challenges can include small market size (Read, 2001), fiscal deficits, high economic vulnerability, and inequality (Brito, 2015), weak institutions and insufficient human capacity (Global Renewable Energy Islands Network, 2014). These issues can differ substantially between countries, with varying climate policy responses, as well as geographic, ecological, and economic impacts (IMF, 2017). Despite this, it is also recognised that “well-designed domestic policies can reduce the direct human and economic costs of climate change” faced (IMF, 2016, p. 1). Due to SIDS’ vulnerabilities to climate and non-climate stressors (Briguglio, 2014; Nurse, et al., 2014), the balance between socio-economic and environmental objectives is one of especial importance. In this regard, other factors that can either drive or hinder transition progress can include environmental, technological, economic, social/ cultural, institutional, and geophysical feasibility and good governance (IPCC, 2018).

Core principles of sustainability transitions literature provide further analytical means for assessing SIDS’ GET experience. According to this research, such a transformation requires a mix of policy changes (Kern & Rogge, 2016; Meadowcroft, 2009; Jacobsson & Lauber, 2006) which are only likely to happen when changes in economic frame conditions occur, e.g., taxes, subsidies, regulatory framework etc. (Geels, 2011). Within the developed world, ‘strategic niche management’ (SNM), the ‘multi-level perspective’ (MLP) and ‘transition management’ (TM) perspectives have been the most widely used frameworks for understanding sustainability transitions, with later applications made on large developing regions such as the Asian economies and least developed economies of Africa (Wieczorek, 2018).

SNM theory assumes that transformation is a result of the destabilisation of the existing regime due to internal problems and bottom-up processes, not initiated by the government, but through internal drivers to the niche (Geels & Schot, 2010; van den Bosch, 2010; Schot & Geels, 2008). Examples of these internal drivers can include price or performance improvements, scale and learning economies, development of complementary technologies and infrastructures, etc. (Geels, et al., 2017). A main shortcoming of SNM is that it neglects the embedding of sustainable innovations within broader societal goals, as well as the contexts that influence the involvement of outside actors to the niche (Schot & Geels, 2008).

MLP theorists meanwhile address some of SNM's shortcomings. The former refers to four main types of transitions (Berkhout, et al., 2004), the first being driven by regime actors which consciously respond to perceived pressures using internal resources (Geels & Schot, 2007). The second type is the result of an either internal or external shock to the regime, which is followed by a response by regime actors using internal resources. The third type occurs from uncoordinated pressures outside the regime, often driven by small and new firms. The final fourth type is purposely driven through intended and coordinated change processes that emerge from outside the existing regime, towards an explicit set of societal expectations or interest (Geels & Schot, 2007). Despite its broader scope than SNM, critiques of the MLP have highlighted its neglect of economic variables (Foxon, 2011).

Green economy literature helps address some of these unanswered issues. It highlights the important role of government, the regulatory and legal framework, as well as the effect of promoting private and public investment in certain sectors that in turn will drive green transition (SELA, 2012; Yang, et al., 2019). According to green economy literature, transition reform must involve self-organisation of stakeholders, as well as cooperation and enterprise to existing economic activities concerning (Geoghegan, et al., 2014; Spash, 2012; Unmussig, et al., 2012). This requires coherent legal frameworks, private sector investment, targeted government expenditure and interventions if systemic and substantial changes are to occur (Droste, et al., 2016; Loiseau, et al., 2016). In the context of SIDS however, the required large-scale private sector investment tends to be slow to evolve, leaving this process instead to be largely driven by the state (CARICOM, 2013). Furthermore, evidence-based knowledge revealing how to precisely achieve such a societal shift remains limited for developing countries in general (Ramos-Mejia, et al., 2018; Wieczorek, 2018). In this regard, principles borrowed from the transition management (TM) approach also proved relevant and useful for analysing Jamaica's GET experience.

TM scholars view social change as “a result of the interaction between all relevant actors on different societal levels” (Kemp, et al., 2005, p. 9). The effective management of societal transformation is seen as important (Loorbach & van Raak, 2006) and can be examined under four different types of governance activities that influence long term change: the ‘strategic sphere’, where wider goals and visions are set, the ‘tactical sphere’ where rules and regulations are introduced, the ‘operational sphere’ where new behaviours and technologies are deployed, and finally the reflexive sphere which involves the monitoring and evaluation of policies and societal change (Loorbach, 2010). Easy to employ, I utilised the transition management approach to trace key occurrences in Jamaica’s GET over a twenty-seven (27) year period (1992 to 2018, see results in chapter 4 annex). Transition direction is observed to be mainly determined by that of shared problems, long term goals, visions and learning-process, rather than the trajectory of technologies or technological systems (Loorbach & van Raak, 2006). In short, the required innovation is social and political, rather than solely technological in nature.

4.3. A Synthesis of Leading Literature: Factors Recognised as Influential to GET

A concise literature review of 38 scholarly articles from across the fields of diffusion research (7 sources), sustainability transitions (13 sources), policy studies (10 sources) and the green economy (8 sources), reveal that despite their nuanced views, notable overlap exists on the existing factors considered important to overall GET progress in developed and large developing countries (see table below). Four main thematic groupings with corresponding thematic sub-groupings of transition determinants emerge, under which almost all identified factors of influence can be categorised. These include: ‘climate governance’, ‘social, market and external conditions’, ‘technology characteristics, experimentation and learning’ and ‘national capacities’.

Table 7 Transition Determinant Themes Recognised Across 4 Strands of GET Literature

No.	Main Determinant Category	Determinant Sub-category
1.0	**Climate Governance**	Political action and regulatory framework (16 sources)

	a respective total of 33 corresponding sources	Decentralised/ democratic decision-making (11 sources)
		Institutions and implementation capacity (6 sources)
		Access to resources (6 sources)
		Role of government (5 sources)
		Reflexive behaviour (4 sources)
		Legitimacy (3 sources)
		Key adaptation leaders and advocates (3 sources)
2.0	**Social, market and external conditions** a respective total of 27 corresponding sources	User preferences, cultures, perceptions, and power relations (7 sources)
		Economic feasibility (7 sources)
		External market factors (6 sources)
		National market characteristics (6 sources)
		Public and private investments (2 sources)
		Development of positive externalities (1 source)
		Contesting values (1 source)
		Level of consumption (1 source)
3.0	**Technology characteristics, experimentation and learning** a respective total of 15 corresponding sources	Knowledge/ uncertainties on development, benefits, risks, and diffusion (8 sources)
		Experimentation, learning, improvements, and adaptation (7 sources)
		Technology improvements and adaptation (7 sources)
		Technological, environmental and social feasibility (3 sources)
		Costs of adoption and sunk costs (2 sources)
		Upscaling of technologies (1 source)
4.0	**National Capacities** a respective total of 10 corresponding sources	Resource mobilisation, foreign collaborations, and interlinkages (8 sources)
		Physical capital (1 source) Overcoming poverty (1 source)

Note: See appendix 4 for source details.

The thematic areas of 'climate governance' and 'social, market and external conditions' were the most recognised transition determinants across the referenced strands of literature. These thematic areas are mentioned as important to the transition process in around 92% and 72% of the reviewed source materials respectively. The below sections investigate the extent to which all four of the above thematic category areas already recognised across the literature, also played a role in Jamaica's GET uptake over the 1992 to 2018 timeframe.

4.4. GET in Jamaica's Electricity Sector

4.4.1. Overview in Regional Context

Jamaica is one of only six Caribbean countries on or ahead of its 2018 benchmarked national green energy adoption target. Nevertheless, it is important to note that within a regional context Jamaica's target is much less ambitious when compared to its neighbours such as Grenada or Guyana. However, with a total grid capacity of 941 MW, Jamaica's commitment of 20% by 2030 (or 188.2 MW) represents a much higher contribution to the region's RE progress than, for example, Grenada's 100% commitment (equating to approximately 51 MW of total installed capacity). Hence, Jamaica's RE progress is still a noteworthy one within the regional landscape.

Table 8 Installed Power Capacity (MW) and Percentage Share of Renewables in Caribbean Countries, as of 2018

Country	2018 Renewable Share of Installed Power Capacity (%)	National RE Electricity Target (Base year 2015)	Remaining to be achieved by 2018 (pp.)	2018 Progress Benchmark	2027 Progress Benchmark
Antigua & Barbuda	4%	15% by 2030	0 pp.	4%	12%
The Bahamas	0.17%	30% by 2030	9 pp.	9%	24%
Barbados	4%	65% by 2030	8 pp.	13%	50%
Belize	53.1%	85% by 2030	-36 pp.	17%	68%
Dominica	28.6%	25% by 2010	-4 pp.	25%	100%
Dominican Republic	21.9%	25% by 2025	-14 pp.	8%	25%
Grenada	4.2%	100% by 2030	16 pp.	20%	80%
Guyana	14%	90% by 2027	9 pp.	23%	90%
Haiti	20%	47% by 2030	-11 pp.	9%	38%
Jamaica	**15.3%**	**20% by 2030**	**-11 pp.**	**4%**	**16%**
St. Kitts & Nevis	5.7%	50% by 2030	4 pp.	10%	40%
St. Lucia	3.5%	30% by 2020	15 pp.	18%	30%
St. Vincent & The Grenadines	11.7%	60% by 2020	24 pp.	36%	60%

Suriname	46.1%	>25% by 2025	-39 pp.	8%	25.1%
Trinidad & Tobago	0%	5% of peak demand or (60 MW) by 2020	3 pp.	3%	5%
Grouping Total	**15.5%**	**Regional Target 47% by 2027**	**-3.7 pp.**	**11.8%**	**47%**

Sources: (Bloomberg NEF, 2018; Francis, 2018; IRENA, 2018; Rocky Mountain Institute, 2018; TAPSEC, 2018; Ince, 2017; IRENA, 2016; Ochs, Alexander, et. al., 2015, pp. 41, 92).

In 2015, Jamaica's enabling framework for renewable energy was amongst the top five most advanced in the Caribbean region, where the only regulatory condition not formally in place was that of a feed in tariff (FiT) regime (see table below) [2].

Table 9 Comparative Overview of Select Caribbean Countries' Renewable Energy Policy and Regulatory Framework (as of 2015)

Country	Feed-in Tariff	Net Metering/ Billing	Interconnection Standard	Tax Credits	Tax Reduction/ Exemption	Public Loans/ Grants	Green Public Procurement	IPPs Permitted
Jamaica								
Dominican Republic [3]								
Barbados								
Antigua & Barbuda [4]								
Grenada								

Key:

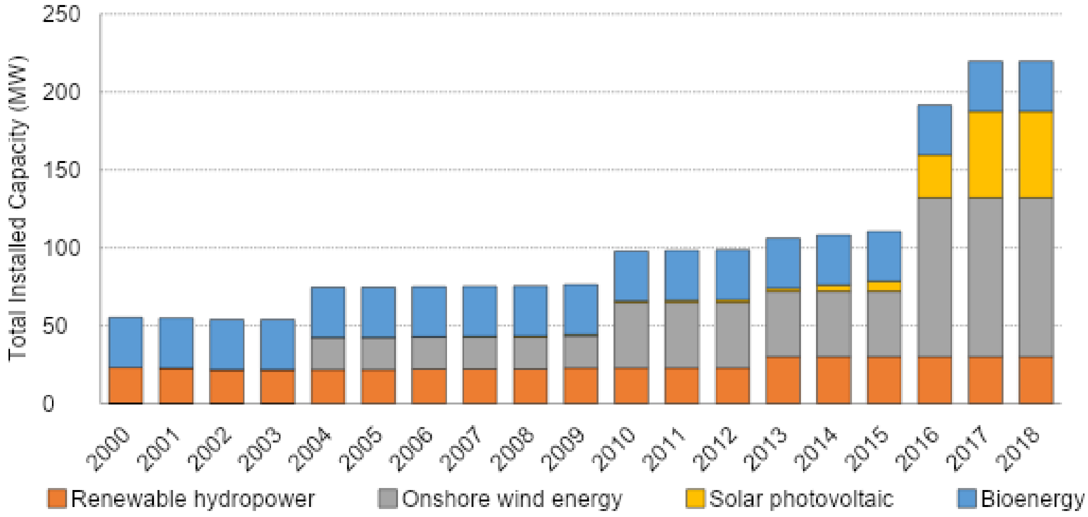
In place
In development
Not known to be in place

Sources: (Bloomberg NEF, 2018; Planning Institute of Jamaica, 2018; TAPSEC, 2018b; IRENA, 2016; Doris, et al., 2015; Espinasa, et al., 2015; NREL, 2015; Ochs, Alexander, et. al., 2015, p. 78; CAPRI, 2014; Makhijani, et al., 2013; Government of Jamaica, 2010; The Ministry of Energy and Mining Jamaica, 2009; National Contracts Commission, 2001).

4.4.2. A Fresh Look at Jamaica's National Renewable Energy Trends

Descriptive statistics show that Jamaica's oldest existing RE sources during the 2000 to 2018 period were hydropower (existing since the 1940s) (Makhijani, et al., 2013), and bioenergy (existing since the 1980s) (Knoema, 2017). Over the 19-year timeframe, neither technologies demonstrated huge increases, with bioenergy remaining at 32 MW the entire period and hydropower growing by a modest 30% from 23 MW to 30 MW by 2018. In comparison, technologies introduced later such as onshore wind in 2004 with 21 MW and solar in 2008 with 1 MW, recorded drastic increases over shorter timespans. By 2018, wind energy was around 5 times its 2004 value at 102 MW and solar energy 56 times its 2008 value.

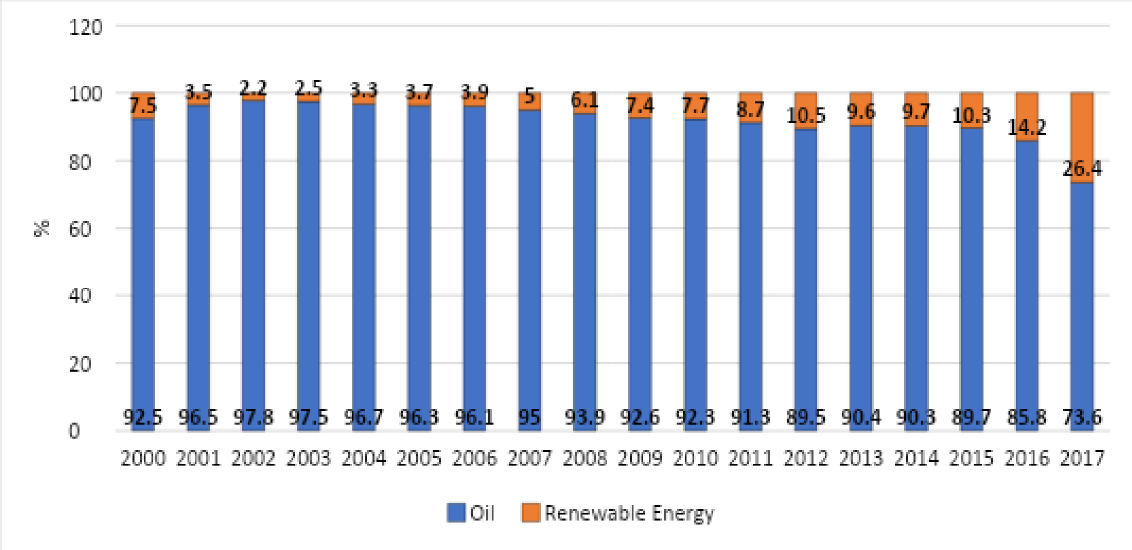
Figure 6 Jamaica's Cumulative Renewable Energy Capacity Uptake by Sub-Sector (MW), 2000 to 2018



Data Source: (Barrett, et al., 2013; Francis, 2018; IRENA, 2019).

Over the 2000 to 2017 timeframe, Jamaica's total electricity generation sourced from renewable energy more than tripled from around 7.5% to 26.4% (IEA, 2019). Sharp rises in its use were especially observed in the years 2004, 2016 and 2017 when RE use increased from the previous year by approximately 32%, 38% and 86% respectively (IEA, 2019).

Figure 7 Jamaica's Electricity Generation by Source (GWh), 2000 to 2017



Source: (IEA, 2019).

I provide deeper insight on the above statistics based on the results of my data collection and analysis activities. Covering a research timeline of 1992 to 2018, I produced three important empirical outputs[47]. Namely: (i) results from process tracing (Beach & Pederson, 2013; Collier, 2011, p. 824)[48] of Jamaica's GET experience aided by the TM approach (see appendix 12), (ii) the plotting of an adapted diffusion curve (Rogers, 1972)[49] showcasing key moments in Jamaica's renewable energy uptake (see figure 8 below), and (iii) the alignment of key timeline 'points of interest' observed on the diffusion curve with wider themes abstracted from the literature via thematic coding procedure (Gibbs, 2012, pp. 8-9)[50] (see table 10). Based on my cumulative evidence, I discussed the main themes that stood out, noting the extent to which they conformed or differed when compared to existing assumptions synthesised from under relevant accepted literature (see table 7).

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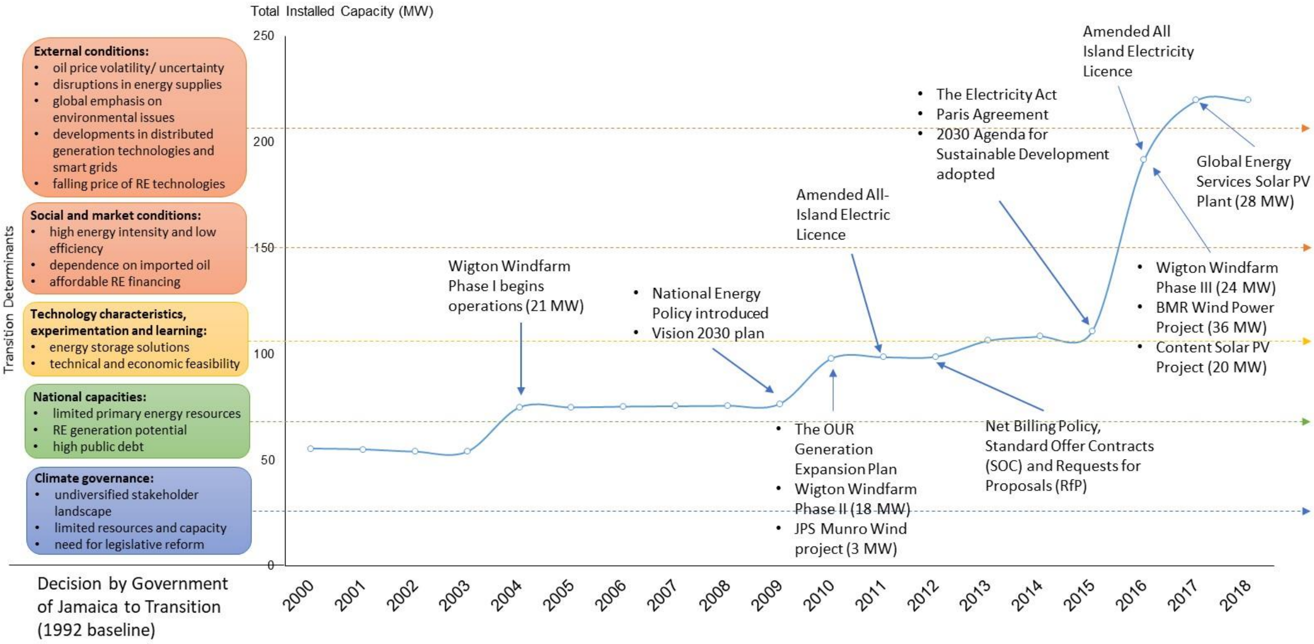
[47] Based on document analysis of secondary sources. I reviewed official national, regional and international reports, policy and legal documents both printed and in electronic form (Bowen, 2009). Documents reviewed functioned as a repository (Prior, 2003b) of the main factors recognised as important to impacting Jamaica's GET progress over time. In total, 17 documents were referenced (see sources for table 10 in chapter 4).
[48] See methods chapter 3, sections 3.4.2. and section 3.6.4.2. for further details.
[49] See details on Rogers' (1972) original diffusion curve in chapter 2, section 2.4.1.2. which guided my development of figure 8 in this chapter.
[50] See methods chapter 3, section 3.4.2. for further details.

Over the 27-year period of 1992 to 2018, Jamaica signed on to at least 6 regional and international agreements and introduced varying legal and policy reforms relevant to renewable energy advancement (see appendix 12). Findings across available country assessments and reports attribute several specific legal and regulatory reforms as the main transition drivers of Jamaica's renewable energy uptake over time: (i) the Electricity Act (2015), (ii) amended All Island Licence (2011, 2016), (iii) Net Billing Policy and Standard Offer Contracts (SOC) pilot programme (2015), and (iv) revised Act for the Office of Utilities Regulation (2015) (Barrett, et al., 2013; Planning Institute of Jamaica, 2018). Using an adapted version of the diffusion curve (Rogers, 1962), a fresh perspective is gained on these developments. Below, a graphical timeline showcases these main identified drivers and other relevant developments identified during my process tracing exercise alongside the country's RE trends.

Figure 8 Jamaica's Main Renewable Energy Developments Alongside Cumulative Capacity Uptake Trends, 2000-2018



Data Sources: (BMR Energy Limited, 2019; IRENA, 2019; Francis, 2018; Planning Institute of Jamaica, 2018; Clover, 2017; Barrett, et al., 2013; OUR, 2010; The Ministry of Energy and Mining Jamaica, 2009).

My above combined depiction of the country's key developments and annual RE uptake trends via the plotted diffusion curve above, provides added insight into Jamaica's overall GET experience beyond that already recognised in secondary reports. For instance, specific 'points of interest' stand out in the years 2004 to 2009 when RE uptake plateaued, and in the years 2004, 2010, 2016 and 2017 when suddenly increased. Additionally, certain actions taken under the tactical and operational transition spheres coincided with RE 'points of interest' identified. For example, after the 2015 Electricity Act is introduced, in 2016 RE significantly increased. A large proportion of the increase has been attributed to the Electricity Act, which newly enabled private sector involvement in large-scale RE projects such as the BMR Wind Power Project (World Bank , 2018).

Other noteworthy developments in the timeline I identified included the government's Wigton Windfarm phases (in 2004, 2010 and 2016) and the Vision 2030 Plan (2009 and 2015). In addition, I was also able to pinpoint relevant barriers and context conditions that coincided with key timeline moments (see chapter 4 annex, table 10). For example, no relevant regulatory reform occurred until the year 2011. This coincided with a plateau in RE uptake during the years 2004 to 2009.

The identified 'points of interest' across Jamaica's transition spheres echo wider existing themes from GET-related literature previously synthesised in this paper. My case data analysed[51] was categorised as either drivers or barriers under 'Jamaica Specific Determinants' or as a 'Relevant underlying SIDS characteristic' (see table 10 in chapter 4 annex). When thematically coded (Gibbs, 2012, pp. 8-9), my empirical results revealed that a total 13 sub-categories of transition determinants influenced Jamaica's overall GET progress.

[51] Under document analysis (Bowen, 2009; Prior, 2003b).

4.5. The Key Factors Distinguishing Jamaica's GET Experience from Developed and Large Developing Countries

Case data showed that Jamaica's overall GET progress, in some way, could all be linked back to factors under the 4 main themes already identified from the wider existing literature as relevant to developed and large developing countries (see table 7). Namely, to the 4 overarching themes of 'climate governance', 'national capacities', 'technology characteristics, experimentation and learning', and 'social, market and external conditions'. Of the 13 transition determinants identified as important to understanding Jamaica's overall GET progress, 5 aligned with themes from existing literature or with the documented experiences of other countries in scholarship (see highlighted in figure below in blue). The majority (8) of Jamaica's GET determinants were distinct to the country or were less prevalently mentioned within the wider literature (see highlighted below in orange in figure below).

Figure 9 Overview of How Jamaica's Main Renewable Energy Transition Determinants Aligned With Leading Accepted Assumptions (1992- 2018)

Jamaica's sub-categories common to the wider literature	**Broad Determinant Categories from the wider literature**	**Jamaica-specific sub-category determinants**
(1) role of government (2) political action and regulatory framework	**Climate governance**	(6) a proactive utility company (majority private-owned)
	National capacities	(7) government driven investments (8) blended financing (9) grid modernisation
(3) costs of adoption (4) technology improvements and adaptation	**Technology characteristics, experimentation and learning**	(10) compatibility issues with national conditions/ facilities
(5) national market characteristics	**Social, market and external conditions**	(11) global discourse and emphasis on environmental issues (12) oil price and supply volatility

	(13) national incentives

Source: Based on original empirical data collected via document analysis (Bowen, 2009; Prior, 2003b) and analysed via thematic coding (Gibbs, 2012, pp. 8-9) (see table 10 in annex).

The majority (7 of 8) of the country's distinguished transition determinant sub-categories, acted as transition drivers to renewable energy uptake, the exception being 'compatibility issues with national conditions/ facilities' which hindered advancements in hydropower and bioenergy. Further assessment of Jamaica's RE landscape reveals how these factors have influenced Jamaica's observed GET outcome.

SIDS' distinctive characteristics have often been viewed as an obstacle in their pursuit of sustainable development and policy objectives (Dagher, 2019; Petzold & Magnan, 2019; Ababa, 2015). While indeed Jamaica's characteristics as a SIDS has in several cases hampered its ability to advance RE uptake[52], in other instances some of these very traits have also worked as drivers of green energy transition (see table 10). Namely, a state-dominated landscape, an energy sector landscape of 2 decision-making veto power stakeholders, and a vertically integrated monopoly utility. Ultimately, the country's chosen responses to its varying characteristics as a SIDS equated to an overall positive outcome, advancing rather than hindering GET ambitions. The specifics of this outcome are attributable to the interplay between Jamaica's 13 main thematic GET drivers and barriers, as well as corresponding context conditions. Based on these 13 sub-categories, I discuss in further detail below three core analytically abstracted thematic areas (Gibbs, 2012) relevant to understanding Jamaica's GET outcome compared to other countries. These are: (i) .the significant and dual role of transition actors, (ii) a crucial role for integrated planning and implementation in Jamaica's GET, and (iii) SIDS-related conditions have largely steered GET progress.

[52] For example, a state-dominated landscape, an energy sector landscape of 2 decision-making veto power stakeholders, a vertically integrated monopoly utility, small markets with limited economies of scale, high public debt, infrastructure limitations, need for legislative reform, limited human and institutional capacity, environmental preconditions, social concerns etc. (see table 10 in annex).

4.5.1. The Significant and Dual Role of Transition Actors

The small market sizes of SIDS' can enhance the effect transition actors have on the renewable energy landscape. For example, due to the distribution of power or their ability to participate in the transition (The World Bank, 2019). A main conclusion reached from my empirical evidence was that, in the small island setting, a few transition actors possessed veto power and played dual roles that bore significant impact on GET progress. Less than a handful of transition actors have both enabled and hindered green energy transition in Jamaica's electricity sector: the government and the utility company.

4.5.1.1. The Government

The net influence (which can be either positive or negative) of Jamaica's underlying characteristics as a SIDS, as well as that of other transition actors, have been ultimately determined by the type of government interventions introduced. For instance, regulatory reform liberalised and increased overall transparency within the electricity sector (OUR, 2016). However, reforms made only expanded inclusion of other RE participants to the area of power generation (OUR, 2016; Barrett, et al., 2013). Based on Jamaica's RE electricity generation trends and secondary accounts, government involvement appeared to have had an overall positive effect on GET progress. This was especially depicted by the transition determinants of: 'key adaptation leaders and advocates', 'physical capital' and 'costs of adoption' (see table 10 in annex).

Guided by government intervention, the utility company (majority privately-owned) who was a key adaptation leader, proactively took part in facilitating the introduction of REs through independent and joint initiatives. Pilot projects and upgrades like grid modernisation to the main electricity infrastructure network, successfully enabled vast advancements for wind and to a lesser extent solar technology (Francis, 2018; Barrett, et al., 2013). Falling RE technology prices accompanied by government incentives also had a positive effect on solar energy, despite high investment costs and the conditional contract terms of pilot projects for small generators (Doris, et al., 2015; Barrett, et al., 2013).

4.5.1.2. The Utility Company

As a vertically integrated monopoly, Jamaica's already high electrification rate granted the utility company (80% private-owned) especial influence over the integration of REs into existing physical infrastructure (Planning Institute of Jamaica, 2018; NREL, 2015). This manifested both positively and negatively on transition progress. The utility's already existing environment portfolio (JPS, 2019), alongside enablers such as government reform and efforts to include their private sector interests through joint initiatives, prompted utility-driven RE investments (Francis, 2018; Barrett, et al., 2013). Combined, this created a key adaptation advocate, leader and partner that helped to facilitate the progressive uptake of REs in Jamaica. The utility continues to maintain a dominant position in Jamaica's electricity sector, where RE uptake efforts have focused on grid integrated approaches (Francis, 2018; Doris, et al., 2015; Barrett, et al., 2013). Pilot projects such as the 2012 Net Billing Policy provided critical opportunities for small power generators. However, programme conditions also limited the nature of uptake and acted to secure the utility's interest respectively through caps on generation capacity and the requirement that one had to remain a client of the utility (Barrett, et al., 2013).

The concentrated ability of only two main actors to significantly impact the RE landscape in Jamaica, suggests that the roles played by transition actors (especially those with veto power) can significantly aid in understanding RE outcomes in SIDS. However, the impact of actors on GET outcomes has overall received limited attention within GET-related research (Wittmayer, et al., 2016; Markard, et al., 2012; Flannagan, et al., 2011; Wejnert, 2002). Hence, future research conducted in this area can provide a useful extension to existing literature, particularly when also applied to the underexplored small developing country context.

4.5.2. A Crucial Role for Integrated Planning and Implementation in Jamaica's GET

My data analysis indicated that the extent to which adoption of a RE technology is interconnected to a country's wider development and SIDS-related conditions, impacts that technology's transition speed and achievable scale. Jamaica's green energy transition progress was directly impacted by its sustainable development challenges. The country's hydro and bioenergy sectors provide empirical examples of what SIDS detail as the intrinsic link between development and their green energy transition (GET) experience (UNFCCC, 2015).

In Jamaica, national vulnerabilities and capacity constraints significantly limited the uptake of hydro and bioenergy technologies (Brito, 2015; OUR, 2010). Specifically, the adoption of hydropower and bioenergy technologies posed greater implications to pre-existing environmental and social concerns (Barrett, et al., 2013), This made increased uptake of these technologies more complicated when compared to other RE technologies such as solar and wind. Expansions in hydroelectricity were hampered due to unreliable rainfall patterns and the need to make allocations for social water and environmental water demands (Barrett, et al., 2013). Furthermore, legislative and regulatory gaps, infrastructural constraints in transportation, storage and piping facilities hindered advancements of bioenergy, the uptake for which remained the same throughout the entire observed period of 2000 to 2018 (Bandy, 2016; Barrett, et al., 2013).

The challenges faced to hydroelectricity and bioenergy uptake in Jamaica reiterate that for GET to be successful within SIDS', they must first be able to clearly gauge and understand the extent to which GET outcomes are interlinked with wider development areas. This entails simultaneous consideration on multiple areas of their main development concerns. However, SIDS may not have the resources to comprehensively execute such an integrated planning and implementation process on their own, due to inherently small and uncompetitive markets, high debt as well as limited human and institutional capacity (Chen, 2017; Winters & Martins, 2004; Briguglio, 1995).

For Jamaica's hydropower and bioenergy sectors, integrated planning and implementation meant considering issues beyond energy sector supply and demand. For instance, obstacles to hydropower and bioenergy adoption included scarce resources (high public debt), resource depletion (water and food supply), infrastructural limitations (e.g. outdated power plants), weak governance institutions (limited human and institutional capacity), small markets with limited economies of scale (equating to high RE investment costs), and relatively small watersheds (see section 4.7 annex). Subsequently, Jamaica's GET progress was limited by the extent to which RE adoption allowed for harmony between economic growth and environmental responsibility, sustainability[53], effective resource management (to address scarcity), and water management (see chapter 2, section 2.2.3.3. of thesis).

Such interconnectedness can mean that the uptake of some technologies may take longer than others due to their connection to the practices in other sectors that may also require reform. For example, under Jamaica's Vision 2030, the agriculture and land use policy plan forms a key part of its strategy for biofuels. Towards GET it specifically outlines conflicts of land and water use for food versus biofuels and the corresponding need for energy conservation in agriculture via water conservation systems (The Ministry of Energy and Mining Jamaica, 2009). Depending on the country and the RE technology, such integrated planning and implementation may be required not just in one but in multiple other sectors before large-scale RE uptake can occur. Hence, future research that can more clearly distinguish and help measure the relationship between RE uptake with development conditions may be crucial for understanding existing RE outcomes involving certain technologies and for successfully supporting their large-scale adoption. In this regard, research questions that could be explored include: which development or SIDS-related conditions impact most on RE adoption? How can one effectively measure the level of interconnectedness/ relationship between development conditions with the adoption of varying RE technologies? and what implications will this interconnectedness/ relationship likely have on the rate and scale of adoption in SIDS compared to other countries?

4.5.3. SIDS-related Conditions Have Largely Steered GET Progress

Characteristics directly related to Jamaica's small island developing state setting largely influenced its GET progress. In the Jamaican context, 5 SIDS characteristics appeared to bear the most influence on its GET outcome (see table 9). The most recurrent characteristic of influence was an energy sector landscape comprised of 2 decision-making veto power stakeholders (the state, and the utility company), which was relevant for up to 4 transition determinant sub-category areas. This was followed by high public debt, small markets with limited economies of scale, and outdated transmission and distribution networks, which were respectively relevant for up to 3 determinant sub-category areas. Lastly, infrastructural preconditions proved relevant for up to 2 determinant sub-category areas.

[53] Sustainability in this sense was viewed from the standpoint of overcoming poverty (Ramos-Mejia, et al., 2018).

Furthermore, certain SIDS' characteristics stood out due to their dual role as both driver and barrier to GET. These were: (i) small market size and limited economies of scale, (ii) a state-dominated landscape, (iii) an energy sector landscape comprised of 2 decision-making veto power stakeholders, and (iv) a vertically integrated monopoly utility. These factors' overall influence on RE uptake was ultimately positive due to interventions adopted by the Jamaican government. In varying instances, government's transition strategies either leveraged or helped to overcome underlying national constraints faced.

4.5.3.1. Small market size and limited economies of scale

Jamaica's electricity market is one characterised as small with limited economies of scale and a limited number of veto actors (TAPSEC, 2018a; Barrett, et al., 2013). This proved to be both an advantage and disadvantage in its energy transition experience. Although a small market size made it difficult to initially attract RE investments (Barrett, et al., 2013), this characteristic alongside a state-dominated landscape allowed government to effectively control and drive initial uptake of RE through pilot programmes targeting small generators and via large-scale public wind farm projects executed over a thirteen-year period (2004 to 2016) (IRENA, 2019; Francis, 2018).

4.5.3.2. A state-dominated landscape

A state-dominated landscape (i.e., where more than 50% of RE projects are initiated and or managed by the government), allowed for straightforward advancement of RE uptake, especially in wind and solar technologies, through government interventions. However, this also meant that where the government lacked the resources or human capacity to enact change, RE uptake made little to no advancement (Barrett, et al., 2013). This was especially demonstrated by the bioenergy sector where the government lacked the financial, human and institutional capacity to advance all required elements for its increased uptake (Barrett, et al., 2013). Hence, while a dominant state role sped up transition for solar and wind technologies through strategic interventions, a limited stakeholder landscape stifled growth for bioenergy where resources and capacity were limited or lacking.

However, there were instances where the government found ways to overcome these constraints. For example, limited fiscal space due to high public debt led to an innovative blended financing approach of projects: through equity, loans, grants and foreign collaborations under arrangements such as PetroCaribe (Myers, 2015; Chin Lenn, 2012). In addition, the presence of a vertically integrated utility led to several collaborations with the government on pilot projects, feasibility studies and infrastructure upgrades, that allowed for progressive RE uptake over time (Francis, 2018; Doris, et al., 2015; Barrett, et al., 2013).

4.5.3.3. Few veto power stakeholders in the decision-making landscape

Two main actors have influenced Jamaica's GET progress: the government and the national utility JPS (Barrett, et al., 2013). Small size can influence the extent to which competition within a certain market is feasible (Symeou, 2009). Hence, small economies commonly tend to be characterised by utilities that are natural monopolies (Symeou, 2009). This less complex (i.e., comprised of few veto powers) stakeholder landscape provides these countries two main advantages: (i) a reduced need for lengthy and mass consultations, and (ii) fewer competing interests to be satisfied towards the desired change. Jamaica was able to quadruple total national RE generation and capacity over a time span of 18 years (IRENA, 2019; Francis, 2018). To do so, the Jamaica government via its own large-scale projects and initiatives worked closely with the vertically integrated monopoly utility (Planning Institute of Jamaica, 2018; Barrett, et al., 2013). However, government actions still recognised the importance of allowing wider participation in the electricity sector, demonstrated through progressive legislative reforms that gradually liberalised and allowed some inclusion of other power generators [5] (BMR Energy Limited, 2019; OUR, 2016; Doris, et al., 2015).

4.5.3.4. A vertically integrated monopoly utility

In small economies, policymakers via the legal framework tend to support monopolies due to the market failures associated with the absence of scale economies (Bushnell, et al., 2019; Symeou, 2009). In the Jamaican context, although the Jamaican government has liberalised power generation, the utility company maintains exclusive legal rights over national electricity transmission and distribution (Planning Institute of Jamaica, 2018; OUR, 2016). The majority-private owned utility company (Jamaica Public Service Limited or JPS) also owns the main generation, transmission, and distribution infrastructure for electricity (Planning Institute of Jamaica, 2018), making it a veto power within the national energy market.

This landscape setting worked in favour of the Jamaican government's RE ambitions, by facilitating a rather straight forward integration of REs into the existing electricity market and infrastructure. Upon securing the utility as a partner, the integration of REs occurred through the adaptation and upgrading of system facilities, working closely with the government (Planning Institute of Jamaica, 2018). Nevertheless, a monopoly presence can retain some form of exclusion to other participants, as the existing monopoly entity would unlikely be willing to completely forego its dominant market position (Symeou, 2009). In Jamaica, this may be, for example, demonstrated by the utility's maintained exclusive legal rights over national electricity transmission and distribution (Planning Institute of Jamaica, 2018; OUR, 2016).

4.6. Conclusion

Using the case of Jamaica, this research revealed several useful insights concerning green energy transition (GET) within a SIDS context. I did so by identifying and exploring some of the main thematic factors determining GET success in Jamaica's electricity sector. My cumulative empirical findings indicated that the distinct characteristics as a small island developing state mattered the most in explaining Jamaica's GET progress. My main findings were summed up under three core conclusions. The first related to transition actors. In the small island setting, less than a handful of actors (in Jamaica the government and utility company) can hold veto power and play dual roles that bear significant impact on GET progress. Consequently, it is important to understand the main actors involved in the GET and how they are able to shape GET outcomes over time. However, the overall impact of actors on GET outcomes has received limited attention within existing GET-related research. Given that the small market sizes of SIDS' can enhance the effect transition actors have on the energy landscape (The World Bank, 2019), their role and impact warrant more comprehensive research.

The second major conclusion I arrived at was that the extent to which adoption of a RE technology is interconnected to a country's wider development and SIDS-related conditions, impacts that technology's transition speed and achievable scale. Hence, a successful GET requires an integrated planning and implementation process that may span direct and indirect activities of not just one but many interrelated sectors (e.g. agriculture, water and waste management etc.). GET implementing actors within SIDS could benefit from future research that helps to measure this relationship between GET and development and which explores effective integrated planning and implementation strategies towards RE adoption. Lastly, my third conclusion was that SIDS-related conditions have largely steered Jamaica's RE progress, making its GET experience distinct from existing research on developed and large developing countries. Therefore, to better understand GET in SIDS we must further understand how these distinct factors impact GET outcomes observed within and across varying SIDS contexts.

My findings form only part of a wider analysis on GET in SIDS, from which broader assumptions and conclusions will be made concerning these countries' overall GET experience. With much on the topic yet to be explored, my findings alongside other future research topics, can prove especially relevant for those interested in reflexive policymaking and implementation efforts. For instance, given their unique characteristics, comparative analysis on the main factors determining GET outcomes across other SIDS, is another potential area for further research. In addition, further study that helps to quantitatively capture the relationship between GET factors with transition outcomes across SIDS could also be explored.

4.7. Notes

1. The term small island developing states (SIDS) in this research refers to a group of 58 countries that are spread over three geographical regions; namely the Caribbean, the Pacific, and the Atlantic, Indian Ocean, Mediterranean and South China Sea (AIMS), as listed by The United Nations Department of Economic and Social Affairs (UNDESA, 2019).

2. The extent to which a national energy policy or action plan has been accompanied by legislative reform and regulations. Determined according to eight main regulatory framework areas I used to assess transition progress, guided by existing research (Bloomberg NEF, 2018; REN 21 Secretariat, 2018; TAPSEC, 2018b; NREL, 2015; Auth, et al., 2013).

3. As of 2018.

4. As of 2016.

5. As of 2018, three utility-scale independent power producers (IPPs), households and commercial entities only through the utility JPS in line with its terms and conditions.

4.7 Annex

Table 10 Detailed Thematic Overview of Jamaica's Renewable Energy Transition Determinants (1992- 2018)

Level 1 Code	**Level 2 Code**	**Level 3 Code**		**Level 4 Code**
Main Determinant Category	**Sub-category from the wider literature**	**Jamaica Specific Determinants**		**Relevant underlying SIDS characteristic, 2015-2017 (where findings were available)**
		Drivers	**Barriers**	
1.0. Climate Governance	1.1. Role of government	1.1.1. Pilot Projects and joint initiatives- 2012 National Net Billing Policy and Standard Offer Contracts	A vertically integrated utility with monopoly power (majority private-owned)	• A large public sector/ state dominated landscape (i.e., where more than 50% of RE projects are initiated and or managed by the government). • An energy sector landscape of 2 decision-making veto power stakeholders (the state, and the utility company).
	1.2. Political action and regulatory framework	1.2.1. Unbundling and liberalisation of the electricity generation market- amendments to the All-Island Electric Licence (2011, 2016)	• A vertically integrated utility with monopoly power. • No regulatory reform- until the year 2011, coincides with uptake plateau during 2004 to 2009.	• An energy sector landscape of 2 decision-making veto power stakeholders. • Need for legislative reform.
		1.2.2. Strategic planning- Introduction of national energy policy (2009), Vision 2030 plan (2009), and OUR Generation Expansion Plan (2010).	Infancy of waste management regulation (bioenergy)	Limited human and institutional capacity
			Fiscal constraints (e.g., tipping fees for bioenergy)	High public debt
		1.2.3. Legitimacy- enhanced transparency amongst electricity sector participants and an empowered regulator (The Electricity Act, 2015). IPPs emerge in 2016 and 2017.	Further research needed (FRN)	An energy sector landscape of 2 decision-making veto power stakeholders
	1.3. Key adaptation leaders and advocates	1.3.1. A proactive utility- hydro plant upgrade in 2013.	• Requirement to remain a utility customer under net billing. • Utility maintained exclusive rights on electricity transmission and distribution. • Utility caps on RE programme output allocation.	• An energy sector landscape of 2 decision-making veto power stakeholders. • 80% utility ownership by foreign entities with an existing environmental focus. • Vertically integrated monopoly utility company.

2.0. National capacities	2.1. Resource mobilisation, foreign collaborations, and interlinkages	2.1.1. Government driven investments- Wigton Windfarm phases in 2004, 2010 and 2016.	FRN	Small markets with limited economies of scale
		2.1.2. Blended financing of large-scale projects- equity, loans, grants		High public debt
	2.2. Physical capital	2.2.1. Grid modernisation (solar, wind, hydro)	• Lack of piping infrastructure in place at municipal solid waste disposal facilities (bioenergy). • A modest RE target.	• Infrastructural limitations- outdated transmission and distribution networks • A 99.5% electrification rate.
3.0. Technology characteristics, experimentation and learning	3.1. Costs of adoption	3.1.1. Falling RE technology prices	Initial infrastructure and total system costs	Small markets with limited economies of scale
		3.1.2. Government incentives	Conditional pilot programmes	
	3.2. Technology improvements and adaptation	3.2.1. Developments in distributed generation technologies and smart grids (solar, wind).	RE variability Grid stability	Outdated transmission and distribution networks
		3.2.2. Upgrading of existing hydro capacity infrastructure by the utility.	FRN	Infrastructural limitations
	3.3. Technological, environmental, and social feasibility		Compatibility issues with national conditions- environmental, social, and infrastructural facilities (hydro, bioenergy)	• Environmental preconditions • Social concerns • Infrastructural limitations
4.0. Social, market and external conditions	4.1. Development of positive externalities	4.1.1. Global discourse and emphasis on environmental and sustainable development issues (Vision 2030 agenda, 2009 and 2015)	FRN	Effects of climate change- susceptibility to natural disasters, economic loss and damage
	4.2. External market factors	4.2.1. Oil price and supply volatility	FRN	• High energy imports • Highly open economy
	4.3. National market characteristics	4.3.1. High energy costs and existing renewable energy generation potential.	FRN	An inefficient energy sector- high energy intensity, low efficiency, an almost complete dependence on imported oil, limited primary energy resources
	4.4. Economic feasibility	4.4.1. National Incentives- providing increasingly affordable RE power generation terms for small producers.	Prohibitive investment costs, payback period and operational costs	Small markets with limited economies of scale

Key:

	Determinants found less commonly in the wider referenced literature

Note: The above results are based on thematic coding conducted guided by Flick (2014, p. 319) and King's (2004) template analysis, referencing secondary data sources.

Sources: (BMR Energy Limited, 2019; IRENA, 2019; Francis, 2018; Planning Institute of Jamaica, 2018; Clover, 2017; The World Bank Group, 2017; OUR, 2016; WRB Enterprises, 2016; Doris, et al., 2015; Patterson, 2015; The Government of Jamaica, 2015; Briguglio, 2014; CAPRI, 2014; Barrett, et al., 2013; Makhijani, et al., 2013; OUR, 2010; Briguglio, 1995).

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Chapter 5 (Paper 2): The Key Factors Distinguishing GET Outcomes Across Small Island Developing Country Contexts: Barbados and Mauritius

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Abstract

Major transition-related academic frameworks provide little to no insight into SIDS' cross-country green energy transition (GET) experiences. Like other developing countries, SIDS demonstrate added elements that make their GET distinctive from that experienced by developed nations. Through comparative analysis of the Barbadian and Mauritian cases, this article expands available literature on SIDS under the lenses of diffusion and sustainability transitions research.

Despite their similarities, the countries depict contrasting green energy transition outcomes. Primary feedback from national energy sector stakeholders revealed that this difference could be attributed not only to their case distinctive factors- historical context, culture, and a need for continuous learning and reform, but also to those which were common but noticeably nuanced- financial savings, access to external resources, information deficit, and inhibiting veto actors. Our analytical approach can be applied to a wider sample of countries, especially useful for policymakers and GET implementers interested in better understanding the key factors distinguishing GET progress across small developing country contexts.

5.1. Introduction

The costs of energy services in small island developing states' (SIDS) [1] are among the highest in the world (IRENA, 2018; Feinstein, 2013; UN-OHRLLS, 2011). Consequently, energy security has received growing attention from policymakers within their national sustainable development agenda (Chen, et al., 2017; Climate Institute, 2014). Globally, SIDS have some of the most ambitious renewable energy targets (Ourbak & Magnan, 2018; Robinson, 2018). At least 23 SIDS make specific mention to renewable energy (RE) targets in their Nationally Determined Contributions (NDCs) to the United Nations Framework Convention on Climate Change (UNFCCC) (UNFCCC, 2015). However, SIDS' leaders as well as academics have also acknowledged that the achievement of such goals may prove difficult due to their inherent vulnerability stemming from regional circumstances and national characteristics (IPCC, 2015; Government of Barbados, 2015; The Republic of Mauritius, 2015; Nurse, et al., 2014). Renewable uptake trends and a number of writings highlight that RE deployment across SIDS such as Barbados have made little progress or could be implemented at a much greater pace such as in Mauritius (IRENA, 2019; UNEP, 2014).

Research focused on green energy transition (GET) progress in and across SIDS remains lacking, with few learning examples available to policymakers (Ramos-Mejia, et al., 2018; Wieczorek, 2018; Rogers, 2016; Scobie, 2016). In this article, we address this research gap by utilising case study methodology to offer a SIDS-appropriate approach for comparatively exploring their GET experiences. Specifically, we borrow from existing principles of diffusion of innovation, and sustainability transitions research to answer the main research question: to what extent do SIDS' common and distinctive case variables explain their respective GET outcomes?

We define GET as the adoption and implementation (or uptake) of renewable energy (RE) technologies. Over the last two decades, over a hundred academic articles have been written concerning SIDS' renewable energy adoption and implementation (Surroop, et al., 2018) that attempt to pinpoint the barriers and corresponding countermeasures influencing RE development. According to Raghoo et al., (2018), Surroop et al., (2018) and Timilsina and Shah, (2016), SIDS' energy sectors are faced with a 'trilemma' of: low energy access, energy insecurity vulnerability due to a high dependence on oil imports and, substantial barriers to renewable energy sector development such as institutional and regulatory obstacles (as cited in Surroop, et al., 2018). Compared to their more developed country counterparts, developing countries rely more heavily on foreign sources of technology, knowledge, and financial resources, including donor interventions (Hansen, et al., 2018).

Proposed countermeasures for harnessing REs in SIDS have included: policy and legislation reform to meet policy objectives; shifting of subsidies and investments from carbon-intensive energy sources to RE; and tax incentives for investment in RE (UNEP, 2014). According to UNEP (2014), the governments of SIDS would also need to play an important role in terms of policy, institutional, and regulatory interventions and should include energy efficiency and energy use in the transportation sector, cooperation among SIDS, with the international community and public-private partnerships. Although the literature available on SIDS has increased over time, analytical approaches have differed (IPPC, 2014). A systematic framework remains lacking which examines comparatively the factors influencing SIDS' overall ability to enact their green energy transition (GET) goals. Furthermore, most SIDS lack the capacity to research, monitor and facilitate continuous learning on the evolving processes shaping their societal transformation (IPPC, 2014).

The rest of this article outlines our case selection process, materials and methods employed, details the results and discussion of findings, then presents the main conclusions based on our findings.

5.2. A SIDS-Appropriate Approach to Exploring Green Energy Transition (GET)

Multiple factors can influence a country's GET progress positively and/or negatively over time. Elements taken from diffusion and sustainability transition writings provide a valuable means by which such factors can be identified, then comparatively examined within SIDS. Diffusion researchers recognise that a broad array of contextual variables can significantly influence the probability of whether an innovation will be adopted (Wejnert, 2002). Rogers (1962) identifies five main characteristics specific to the innovation [2] itself that can influence transition - relative advantage, compatibility, complexity, trialability and observability. For example, according to Rogers (1962), an innovation that is incompatible with existing social values and norms (i.e., which first requires the adoption of a new value system), will not be adopted as rapidly as one that is compatible with existing systems. Furthermore, the more complicated or less readily understood an innovation is, the more slowly it will be adopted. Relevant to this supposition, is the scholarship under behavioural economics which asserts that consumers tend to resist change even where alternatives may yield better personal or collective outcomes, especially where the amount or complexity of information increases (Frederiks, et al., 2015).

Ormrod (1990), stipulates that the successful adoption or diffusion of a new technology does not solely rely on the nature of the technology itself (Wejnert, 2002). It also depends on the innovation's suitability to the new environment that it enters - geographic settings, societal culture, globalisation and uniformity (Wejnert, 2002). Climate scientists and sustainability transition writers acknowledge that varying challenges and costs can significantly influence energy consumption trends. For example, regional circumstances and national characteristics of the existing energy system in place, behaviour (IPCC, 2015) and external market factors (Clausen & Fichter, 2019; Yang, et al., 2019; Loorbach, 2010; Kemp, et al., 2010; Loorbach, 2007; Rogers, 1962). However, additional characteristics distinctive to developing countries such as "ill-functioning institutions", "market imperfections", "social exclusion" have tended to be overlooked (Ramos-Mejia, et al., 2018, p. 217). Hence, Ramos-Mejia et al. (2018), highlight the importance of understanding sustainability transitions from the standpoint of overcoming poverty, among other challenges facing middle- and low-income countries (Ramos-Mejia, et al., 2018).

The exact nature of these context-specific development challenges and adaptive capacities within-country and across SIDS still need to be better understood (Nurse, et al., 2014). Especially needed is research that considers a wide variety of different island situations (Petzold & Magnan, 2019). SIDS possess specific characteristics that particularly affect their adaptability to climate change (Petzold & Magnan, 2019). These include factors such as socio-economic conditions, island geographies and political circumstances (Petzold & Magnan, 2019; Wejnert, 2002). Foxon et al. (2008), further highlight that social rule systems tend to be defined in terms of existing technologies. Consequently, significant institutional change will also be needed. In this regard, through varying lenses, transition academics have highlighted the important role to be played by actors such as national governments (IPCC, 2015; SELA, 2012; Flannagan, et al., 2011; Kemp, et al., 2010; Loorbach, 2010; Loorbach, 2007), the private sector (IPCC, 2014; Geels & Schot, 2010; van den Bosch, 2010; Schot & Geels, 2008; Kemp, et al., 1998), and key adaptation leaders and advocates (IPPC, 2014; Unmussig, et al., 2012; Spash, 2012) in facilitating change.

At the industry level, transition can be viewed in terms of bottom-up processes of niche innovation (Geels, 2002). Steering from within leads to evolution from an old technological regime into a new one (Geels & Schot, 2010). At a broader or multi-level perspective, transition outcomes could be attributed to one of four main categories. ‘Endogenous renewal’- steered by national actors with their interests, values and problem-solving approaches; ‘emergent transformation’- a result of interactions between existing national actors with new external actors; ‘reorientation of trajectories’- an uncoordinated response to stimulus that originates either from within (endogenous) or externally (exogenous); and ‘purposive change’- allowing participation of external actors whose interests and resources help facilitate the transformation (Köhler, et al., 2019; Sagar & Majumdar, 2014; Berkhout, et al., 2004). Of the four typologies, it is the highly coordinated efforts under ‘endogenous renewal’ and ‘purposive change’ that are more likely to result in radical change (Sagar & Majumdar, 2014).

We seek to understand the main factors which have shaped the green energy transitioning experiences of Barbados and Mauritius according to feedback from national stakeholders themselves. We also seek to highlight the extent to which our findings overlap with the above main presumptions and findings within existing scholarship. To this end we employ comparative case study analysis - our case selection process, methods and data sources seen outlined below.

5.3. Case Selection, Methods and Sources

5.3.1. Case Selection and Methods

The countries Barbados and Mauritius were selected and analysed using the most-similar comparative case study method (Yin, 2015; Yin, 2009; Seawright, 2008) over the 2000 to 2018 period. The two countries share similar political, socio-economic, and environmental conditions (Briguglio, 2014). Briguglio (2014) classifies them as 'self-made' countries due to their similarly high vulnerability and resilience scores (Briguglio, 2014; 2016). However, noticeable distinctions exist concerning their main determinants of GET, alongside the research outcome of interest (% renewable energy share of electricity production as of the year 2017). Whereas Mauritius was around 10 percentage points (p.p.) ahead of its 2018 benchmark target with approximately 21% RE share of electricity production (Gwh) [3], Barbados was approximately 9.5 p.p. behind its own at around 3.5% RE share of electricity production (Gwh) [4] (IRENA, 2019; MARENA, 2018; United Nations, 2018; Government of Barbados, 2015).

Our main research aim is to examine these two SIDS of comparable social and economic structures and resource constraints, yet which have demonstrated different GET outcomes as of the year 2019 according to their own renewable energy (RE) electricity generation targets set. To do so, we employed thematic analysis to draw inference on the extent to which countries' common and distinctive case variables were related to their respective RE progress outcomes as of 2019. To ensure robustness[54] of our conclusions thematic analysis was conducted both manually guided by King (2004) and verified via statistical software using n-gram analysis- see appendecies 6 and 7 for results. While our statistical

[54] Similar to the methods employed by Isensee, et al., (2020, p. 4) under their data extraction and analysis.

findings proved insightful and represent primary feedback from across at least 5 RE stakeholder groups, limitations include a relatively small stakeholder sample size (Barbados 20, and Mauritius 26 total interview subjects respectively) due to time and financial constraints. Hence, expert interviews were conducted rather than wider survey tools deployed. This approach provided us with richer detail for analysis.

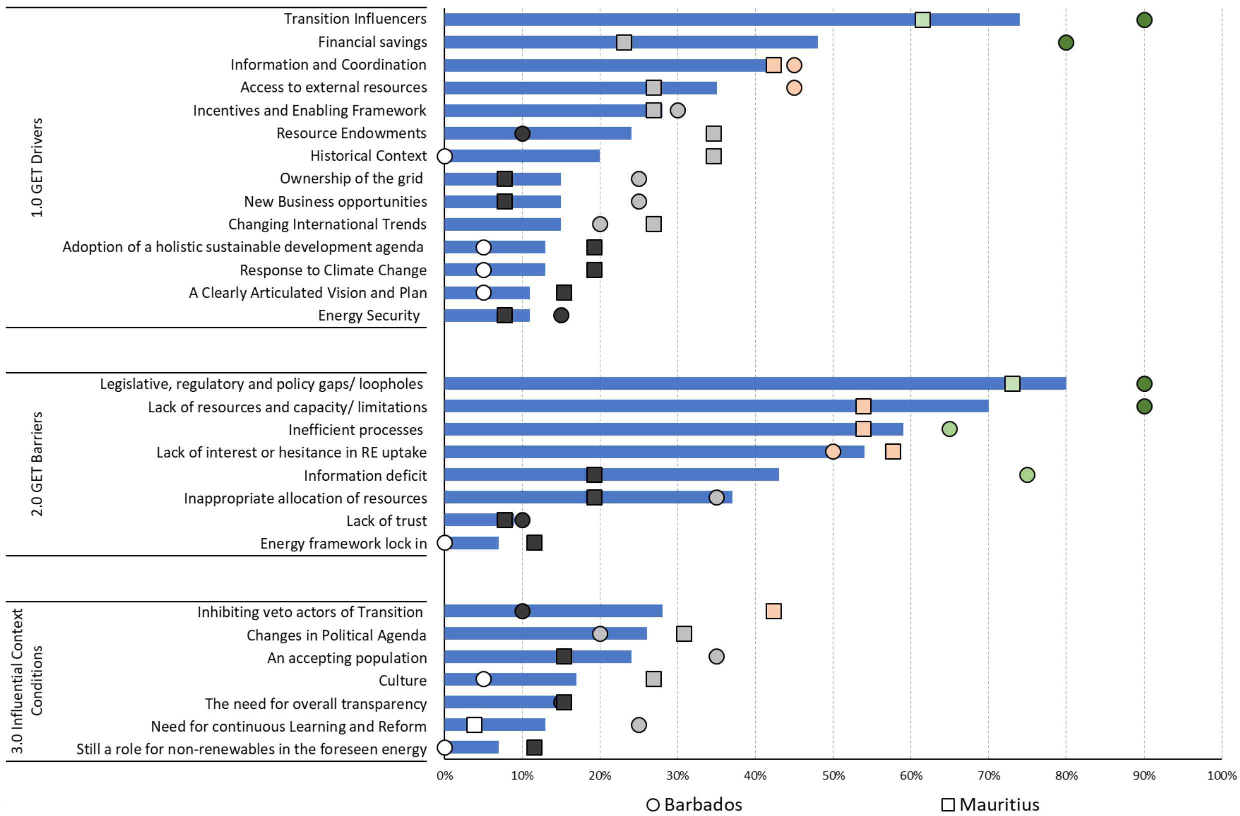
5.3.2. Sources

Primary data was collected via expert interviews (Creswell, 2014; Bogner, et al., 2009; Creswell, 2013; Lilleker, 2003; Davies, 2001), from a total of 20 and 26 relevant national energy sector stakeholders in Barbados and Mauritius respectively (see appendix 5). Semi-structured, open-ended questions (Leech, 2002) were used to collect detailed interview feedback (see appendix 3 for interview questions). Interview subjects represented individuals from across five main groups: the public sector, private sector, regional bodies, international donors and civil society. Triangulation (Davies, 2001) or the cross-referencing of findings was also performed, to supplement primary feedback collected. This was done via documentary analysis (Bowen, 2009; Davies, 2001) of available secondary quantitative and qualitative secondary sources [5]. Eftimiades (1994), guided our approach to primary data analysis - a minimum of two independent interview sources were required for any thematic area to be considered of real significance, or to qualify as what we termed as ‘low level consensus’ (Davies, 2001). Feedback from Barbadian interview subjects was represented by the code $BB_{1...20}$ and Mauritian interview subjects were represented by the code $MS_{1...26}$.

5.4. Similar Yet Distinct: The Key Nuances Explaining Variances in GET Progress Across Barbados and Mauritius

According to primary feedback from a cross-sector of national stakeholders, a cumulative total of 29 main thematic drivers, barriers and influential context conditions helped to explain green energy transition (GET) progress thus far observed across Barbados and Mauritius.

Figure 10 Main Factors Identified as Important to GET Across Barbados and Mauritius, 2018/2019



Legend:

(dark green)	Very High consensus	> 79%
(light green)	High consensus	60% to 79%
(peach)	Reasonable consensus	40% to 59%
(light grey)	Low consensus	20% to 39%
(dark grey)	Very Low consensus	8% to 19%
(white)	Not applicable to case	< 8%

Data Source: (stakeholder interviews, Mauritius, 2019; stakeholder interviews, Barbados, 2018- see appendices 6 and 7) [6].

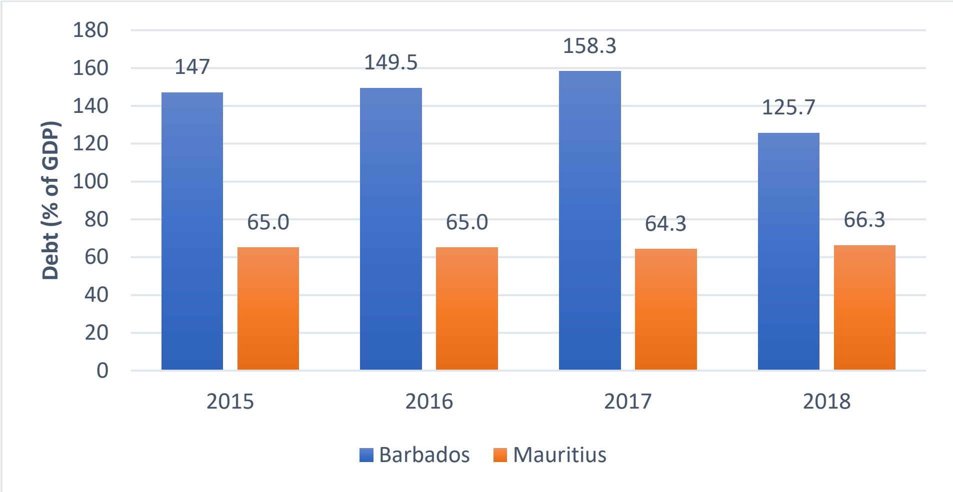
Seven (7) factors especially stood out as important for national green energy transition (GET) progress: namely, those that depicted a notable difference in stakeholders' consensus [7] between the two cases, and where at least one of the countries had at minimum a reasonable level of stakeholder consensus on its importance. This applied to the 2 drivers of financial savings, access to external resources, the barrier information deficit, and the influential context condition of inhibiting veto actors of transition. In addition, 3 themes emerged which were distinct to only one case country and which possessed at least a low level of stakeholder consensus as being important to GET- the driver historical context and the 2 influential context conditions of culture, and a need for continuous learning and reform. Under four overarching thematic sub-headings, all seven factors are reviewed in more detail below.

5.4.1. Crucial Capacity to Transition: Access to Resources

Ramos-Mejia et al. (2018), emphasise the importance of a developing country's ability to counteract what Sen (1999) refers to as processes of poverty reproduction and capability deprivation. Financial savings on imported energy, stemming from high oil prices, was an important driver of energy transition for both Barbados and Mauritius. However, this driver was identified to a far greater extent by Barbadian compared to Mauritian interviewees. The difference between the cases can be explained by several other GET factors also pinpointed by stakeholders particularly connected to their availability of resource endowments- financial, and knowledge-related.

According to one Mauritian stakeholder interviewed "the government has the finances available" to realise the transition (MS3, 2019). Since its 2015 NDC submission to the UNFCCC, Mauritius appeared to have greater availability of indigenous resources than Barbados to support their transition. During the 2015 to 2018 period, its debt to GDP ratio (of 63% to 65%) ranged just around the World Bank's threshold level (64%) beyond which developing countries tend to experience negative implications to economic growth (Caner, et al., 2010). Conversely, for the same period Barbados' average annual public debt (of 142%) was significantly and steadily above the World Bank's estimated tipping point beyond which debt tends to have negative implications for national growth.

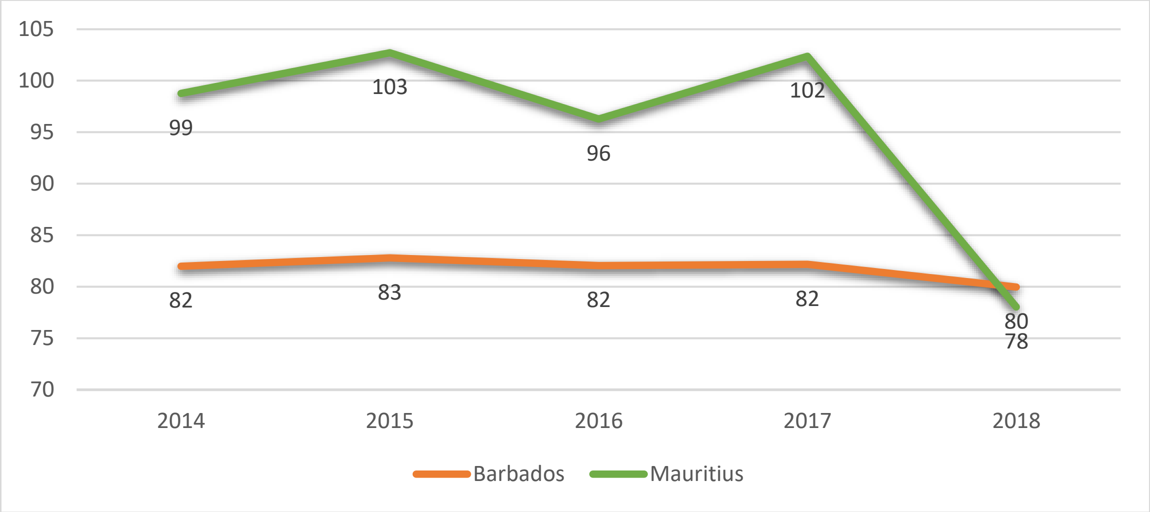
Figure 11 Barbados' and Mauritius' Public Debt Compared, 2015 to 2018



Sources: (IMF, 2019a; IMF, 2019b; Countryeconomy.com, 2018).

Within Mauritius, financing has been easily accessible for both small and large-scale RE systems (MS6, 2019) and independent power producers (IPPs) have been able to secure their own funding (MS11, 2019). According to one private sector interviewee, compared to other African countries, the Mauritian market was an attractive one to invest in due to its political stability, high income per capita compared to the rest of Africa and economic liquidity (MS6, 2019). The Mauritian private sector benefited from financing options readily available from local commercial banks (MS11, 2019). Over the last five years, domestic financial resources provided to the private sector per annum by financial corporations, were approximately twice that provided to the Barbadian private sector (World Bank Group, 2020). This included domestic credit in the form of loans, grants of non-equity securities, and trade credits and other accounts receivable, that established a claim for repayment.

Figure 12 Domestic credit provided to private sector (% of GDP), 2014 to 2018



Source: (World Bank Group, 2020).

Compared to Barbados, financing options for the public and private sector in Mauritius appeared to be more readily available and diversified. In addition, the potential for a broad scope of on- and off-grid RE service opportunities such as solar, biomass, hydro, wave and offshore wind, provided attractive new business opportunities to investors (MS1; MS5; MS6; MS14, 2019). A minimal consensus of Barbadian stakeholders interviewed recognised the importance of lending agencies. The Caribbean country demonstrated far less access to indigenous resources for their green energy transition, hindered to a much larger extent by a lack of resources and capacity limitations in several areas. For the majority of Barbadian interviewees, the most serious of these constraints faced was in the availability of financing options and resources. Furthermore, in the instances where local financing was available, the structure of these arrangements required the recipient to take on too much debt. Other obstacles faced included administrative hurdles in taking up financing opportunities, difficult to meet credit requirements for green loans (BB2), and little to no incentive based on required collateral and RE system investment payback period (BB6).

Despite these differences in internal capacity, access to external resources such as international platforms and financiers was commonly identified as an important driver to GET in both countries.

In Barbados it provided access to financing where little indigenous resources existed, whereas in Mauritius it supplemented already existing financing options. According to Barbadian stakeholders interviewed, resources from bilateral (e.g. the United Arab Emirates) and multilateral (e.g. IRENA, IDB and GCF) partners played a key role in funding studies, training and capacity building, RE projects and installations, technical assistance and financing for SMEs (BB4; BB8; BB9, 2018). In Mauritius, external resources were used to finance green loan schemes and social projects such as the purchase of solar home PV kits for low-income households (MS6; MS8; MS11; MS14, 2019), working with partners such as the European Union (EU) and United Nations Development Programme (UNDP). These primary findings suggest that donor funding and other external resources have played an integral role in filling capacity gaps (financial and human) needed to support the transition. Furthermore, even when national governments possess the finances to largely support the transition, donor funding or other external resources still play an important supplementary role.

5.4.2. When External Resources to Transition Outweigh Internal Resources GET is Negatively Impacted

Regime transformation relies largely on a combination of resources (such as factor endowments, knowledge, and capabilities) and the coordination of responses which constitute the adaptive capacity for transformation (Wieczorek, 2018; Sagar & Majumdar, 2014; Smith, et al., 2005). However, many SIDS have little to no internal resources available to finance the transition and hence must rely, if not largely to some extent, on external bilateral and multilateral support (Watson, et al., 2017; World Bank, 2016).

Our case data comparisons showed that where external resources outweighed internal resources to transition, the country had less control over its GET process. This in turn lead to an overall negative impact on observed GET outcomes. The inappropriate allocation of resources was a main barrier identified by stakeholders interviewed across both countries. However, the exact nature of this issue varied between the cases. For Barbados, the main problems faced reflected a lack of power or ability to determine how external resources pledged by international donors to their GET were allocated (BB5, 2018). Findings echoed existing characteristics already outlined by academics under emergent type transformations: namely, that their heavy reliance on external resources tends to result in a lack of coordination, making transformation slow and uncertain (Sagar & Majumdar, 2014).

The external agenda of international funding agencies heavily influenced the way in which GET funds were spent, and project objectives at times did not align with country needs (BB5, 2018). For example, the way in which technologies were introduced depicted a short sightedness focused mainly on solar PV and wind (BB16, 2018). Interventions also demonstrated a need for increased stakeholder collaborations e.g., across sectors and ministries (BB7, 2018). Donor funds for GET were often restricted to implementation through government agencies which are not the best implementers (BB15, 2018). Some projects have had significant time delays by years, with minimal opportunities available for public-private partnerships or joint collaborations with business organisations (BB15, 2018). Other times pledged funds went unused or were under-utilised (BB15; BB16, 2018) due to overly complex donor frameworks and mechanisms (BB16, 2018).

On the other hand, Mauritius' more coordinated GET experience could be categorised as 'endogenous renewal' with elements of 'purposive change'. However, despite being ahead of Barbados in terms of their RE uptake, Mauritius also faced resource allocation issues, mainly concerning how RE technologies were introduced. Concerns raised related to indigenous resource coordination and RE selection by the government. For example, insufficient adaptation to the local environment that lacked consideration of effective land use, climate change and natural disasters (MS7; MS16, 2019). The RE framework designed by key players excluded local stakeholders, favouring foreign researchers and companies (MS2, 2019). Short-sighted or corrupt politicians who signed 5-year or 10-year contracts without consideration of planning for the future (MS2, 2019) or who utilised national finances on coal and heavy fossil fuel projects rather than on RE (MS3, 2019).

While Mauritian GET was only supplemented by external resources, they too were hampered by limited control over external interests and hence its allocation. Like Barbados, this entailed problems related with donor pledged funding. Interview subjects highlighted that social and economic factors were not sufficiently considered in funding allocation done by donors (MS10, 2019) and that little to no real transfer of technology occurred (MS3, 2019). Most funds went to large contractors. Other national stakeholders such as NGOs or social enterprises, were excluded from receiving funds (MS10, 2019). In addition, the negative impacts of donor interests at times outweighed the benefits of receiving the funds at all. For example, from the US embassy which offered money only in exchange for a military base, or from Japan, only in exchange for licence to fish in the Mauritian Exclusive Economic Zone (MS3, 2019).

5.4.3. An Important Role for Learning and Reform

The more complicated or less readily understood an innovation is, the more slowly it will be adopted (Rogers, 1962).

Another key difference between the two countries was the presence of domestic knowledge on how to appropriately allocate and use available resources towards transition efforts. While both countries possessed RE potential and some form of financing available, Mauritius also had the "know how" on how to organise existing resources towards RE ambitions (MS3, 2019). Ramos (et al., 2018), pinpoint the role of knowledge intermediaries in the developing world as a key influence on the quality of sustainability in socio-technical change processes. Within the African island, "many studies have been completed" (MS9, 2019) and research conducted to help guide implementation efforts (MS4, 2019). A clearly defined road map has helped to steer the country's resource mobilisation efforts (MS4; MS13, 2019), accompanied by a set renewable energy electricity tariff which assisted in raising investor interest (MS11, 2019).

Despite also having completed several studies, the majority of Barbadian interviewees identified an information deficit as a main barrier to GET. Rogers (1962) refers to this problem under what he termed as 'complexity'. A distinctive theme to Barbados was the overall need for continuous learning and reform. At the macro and microeconomic levels, transitions requirements still need to be identified (BB1; BB2, 2018). For instance, the benefits, costs and impacts of transition clearly outlined (BB5; BB7; BB9; B11; BB13; BB14; BB17, 2018), according to "baseline scenario, ideal scenario, projected scenario, from a policy and actor perspective, legislative changes needed, key influencers identified etc." (BB1, 2018). Other areas also requiring clarity include the best way to expand RE (BB9, 2018), grid transparency e.g. public reporting on RE saturation levels per district

(BB1, 2018), and the tracking of success or how the market has evolved over time (BB8, 2018).

Furthermore, where information did exist, it at times was not effectively communicated to key target groups. For example, difficult access to information on incentives available to the private sector (BB2, 2018) and lending institutions like commercial banks (BB19, 2018). Information gaps include the need for a more economic and policy perspective and understanding the net effect on actors e.g., demand for the utility, on jobs etc. (BB1, 2018).

Information deficits experienced in Mauritius' were far less varied in comparison. Those obstacles pinpointed by interviewees, related more specifically to a need for educating and motivating government towards more ambitious GET targets. For instance, the introduction of policy briefs on key GET issues (MS13, 2019) and educating ministers on the importance of a transition (MS5, 2019), its opportunities and impacts (MS4; MS18, 2019).

5.4.4. Transition Quality vs Quantity: The Significant Role of Historical & Influential Context Conditions

Historical context was a GET driver distinctive to Mauritius. The emergent sub-themes emphasised by stakeholders were a strong sugarcane industry, the transition out of a colonial economy, and the early adoption of REs.

5.4.4.1. A strong sugarcane industry

Several interview subjects emphasised the important contribution of Mauritius' sugarcane industry to its present RE advancement (MS1; MS4; MS5; MS12; MS14; MS16, 2019). Most of Mauritius' sugar factories generate around 30 kWh surplus electricity per ton of sugarcane by-products, such as wet bagasse and dried fibres (BizVibe, 2020). From the 1920s, Mauritius was a leading source of sugarcane exports as a colony of the British Empire (Robertson, 1930). The sector continues to be a large economic contributor to the country at an estimated output of 6 million tonnes annually and accounts for a significant share of power and electricity generation (BizVibe, 2020). Our interviewees elaborated that during the crop season, bagasse is used by sugar factories which need reliable energy.

This led to the emergence of thermal power plants that “began to furnish bioenergy and steam”, and to the eventual “export of residual energy produced onto the national grid” (MS14; MS16, 2019).

Sugar residue presents a valuable resource for production of energy. Mauritius’ advancements in technology, accompanied by changes in user practices, regulation, industrial networks, infrastructure, and culture, could be seen as a form of niche innovation according to sustainability transitions literature (Geels, 2002). The African island is widely recognised as a success story for targeting bagasse, the energy rich residue of sugar to produce electricity (ABREC, 2013). Over the 2000 to 2018 period, approximately 53% of national RE output was attributed to bioenergy (IRENA, 2019). Conversely, although Barbados’ sugar industry electricity production was also mainly fuelled by bagasse (Division of Energy and Telecommunications, 2017), during the decade of the 1970s, the country’s overall sugar industry had significantly declined, a trend the industry was never able to reverse (Goddard, 2001).

5.4.4.2. Transition out of a colonial economy

Actions to enhance competitiveness of the sugarcane sector associated to Mauritius’ transition out of colonisation, also bore a strong influence on their early RE advancements. For instance, the introduction of policy, legislative and regulatory reforms such as under the Sugar Sector Strategic Plan (SSSP), the ‘Multi Annual Adaptation Strategy’ (MAAS) - Action Plan 2006 to 2015 (Ministry of Agro Industry and Food Security, 2006), and initiatives like the 1990s Bagasse Energy Development Programme (MS11, 2019) aimed at reducing oil dependency supported advancements in bioenergy (Ministry of Agro Industry and Food Security, 2006). Under the MAAS, millions of euro were spent on major sugar industry projects (MS8, 2019). This involved investments and incentives to modernise and update sugar factory power plants inclusive of RE technologies, the commissioning of new power plants, signing of power purchase agreements for the supply of electricity during crop season using bagasse, and an ambitious research programme for commercial cultivation towards improved sugar and energy production (Ministry of Agro Industry and Food Security, 2006; MS8; MS14, 2019). Progress was also attributed to a Mauritian business culture where “SME's were always willing to take chances and to try new fields provided funds are obtained from local institutions" (MS15, 2019).

However, in its post-colonial shift, also distinctive to Mauritius, was the issue of 'compatibility' (Rogers, 1962) or what interview subjects referred to as conflicting interests. Civil society has called for reform towards increased RE uptake and democratisation of energy production (MS3, 2019). However, such calls conflict with the interests of other veto actors such as the 'Sugar Oligarchy' (MS3, 2019). According to interviewees, Mauritius' existing RE framework reflects one of a missed opportunity for energy sector democratisation. The former sugar companies are still the big players in the economy, which have shifted into the RE sector alongside foreign French companies they have partnered with (MS8, 2019). This can be further linked to ethnic and socio-economic, or what Wejnert (2002) and the IPCC (2015) characterise as 'cultural' issues. In Mauritius, centralised ownership of RE assets such as RE co-generation bagasse plants are still owned by the descendants of colonisers or Franco-Mauritians (MS7, 2019). Hence, a strong need remains for legislative and regulatory framework reform towards democratisation of the energy sector (MS1; MS6, 2019). Although both Barbados and Mauritius were former British colonies (Commonwealth Secretariat, 2020), differences in their shift out of colonisation, especially within their sugar industries, can be noted within their present day RE uptake trends.

Whereas the Mauritian government actively explored RE opportunities related to sugar production while also enhancing sector competitiveness, this was not done in Barbados. For example, in Mauritius energy audits were carried out under the Sugar Sector Strategic Plan (2001-2005) which led to the more optimised use of bagasse in biomass without negatively affecting sugarcane production (Ministry of Agro Industry and Food Security, 2006). Other actions such as transformation of the sugar industry into a sugar cane cluster, led to diversification within the sector from that of producing solely raw sugar product to include several types of sugar, as well as electricity from bagasse and ethanol from molasses (Mauritius Sugar Syndicate, 2013; Ministry of Agro Industry and Food Security, 2006). Conversely, the Barbadian sugar sector was characterised by the government's decision to cut production and the permanent closure of sugar factories in the 1980s to early 1990s (Drummons & Marsden, 1995; Goddard, 2001). However, in recent years, actors in Barbados' agricultural sector have expressed increasing confidence that there can be greater use of biomass and biogas in the country's energy sector (Ministry of Energy & Water Resources, 2019) [8].

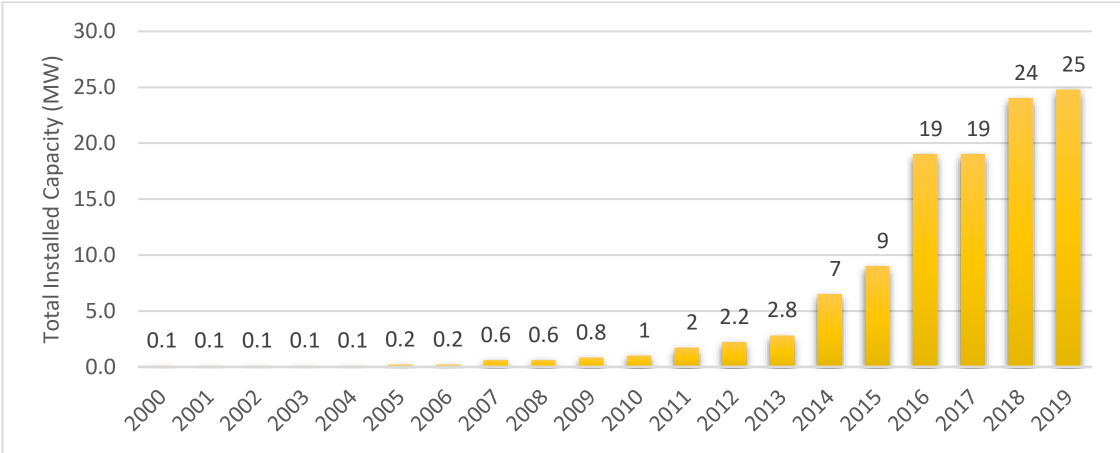
5.4.4.3. Early adoption of REs and Other Influential Context Conditions

In the early 1900s Mauritius was once 100% RE powered. However, "with a growing national energy demand, in the 1950s they took recourse to thermal oil" (MS4, 2019). As far back as data was available (1990), in Mauritius RE contributed at minimum 20% to total electricity production (World Bank Group, 2020). Even less data was readily available for Barbados. That which was indicated that any significant introduction of RE in the Caribbean island was more recent in comparison. RE uptake generally began to occur within the last two decades (2001 to 2017), during which Barbados' RE contribution to electricity production (GWh) grew modestly from around 0.02% to 2.8% (IRENA, 2019; United Nations, 2017). Mauritius, on the other hand, has had a long-standing independent power producer (IPP) structure since 1991 via the amended Electricity Act, Electricity Regulations and CEB Act of 1939. Within this framework, the African island has already had 20-year contract tenders, which have expired and been renewed (MS6, 2019). This framework built upon Mauritius' already existing experience with RE within the sugarcane industry since the 1900s (MS11, 2019) and the use of hydro for more than 100 years (MS11; MS14, 2019). In more recent years, RE in Mauritius has become more diversified, especially when compared to its Caribbean counterpart.

Differences in the countries' RE mix can be attributed both to variances in historical experience, as well as influential context conditions across both countries. Furthermore, whereas Mauritius has RE potential in up to five areas- bioenergy, hydroelectricity, wind, solar, and ocean energy (Bundhoo, 2018), Barbados' RE potential is more limited to the three sub-sectors of wind (40 MW), solar (39.7 MW) and biomass (23.5 MW) (TAPSEC, 2018). Over the 2000 to 2019 timeframe, both Barbados and Mauritius have demonstrated a steady increase in their renewable energy (RE) adoption, albeit with some noted differences. As of the year 2019, Barbados' adoption of RE has only included solar technology (see figure 12 below). Up until 2013, RE adoption has been slow and incremental, growing at no more than 1 MW per annum. Solar energy adoption especially picked up from the year 2005, doubling from 0.1 MW of total installed RE capacity to

0.2 MW. Since then, it has steadily increased at an average annual rate of 36%, with significant jumps occurring in recent years (2014, 2016 and 2018 respectively).

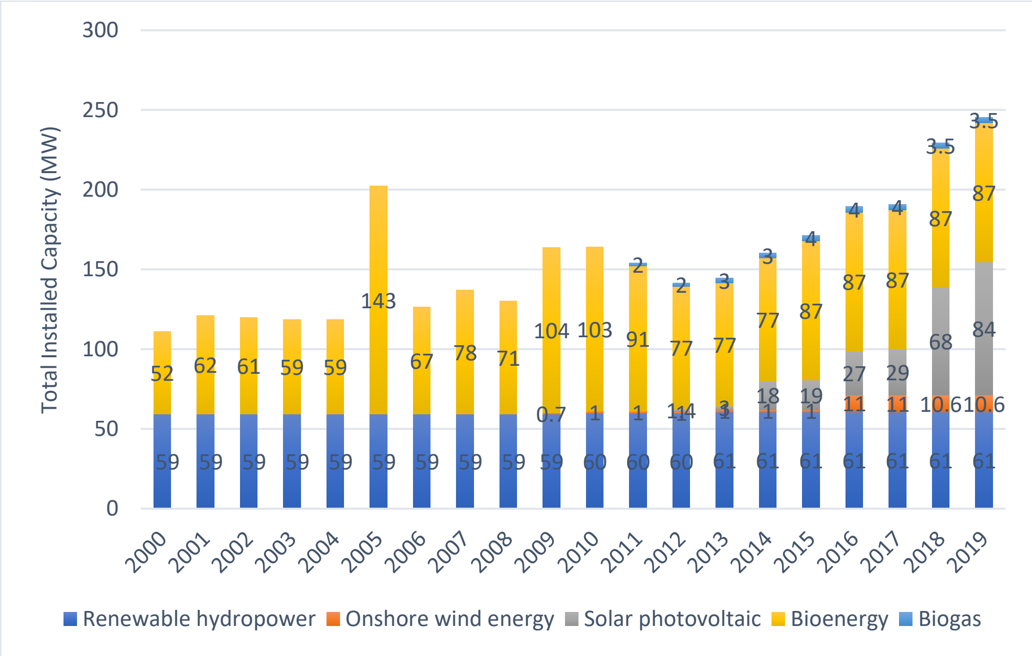
Figure 13 Barbados' RE Electricity Capacity (MW), 2000 to 2019



Source: (IRENA, 2019).

In 2000, Mauritius already had as much as 111 MW of pre-existing RE capacity, way ahead of Barbados' 0.1 MW for the same year. Mauritius' overall RE adoption over the same 20-year period was also observed to be much more diversified in nature. By the year 2019, the country's RE adoption included up to five different types of technologies– hydropower, wind, solar, bioenergy and biogas (see figure 13 below). During the observed timeframe, bioenergy and hydropower represented the oldest existing RE at capacities of 52 MW and 59 MW respectively. Bioenergy was the country's largest contributor to RE capacity, steadily increasing at an average 3% per annum, in line with the overall RE adoption growth rate. This peaked in the year 2005 with the addition of 84 MW or an approximate 142% increase from the previous year. Although hydropower capacity was Mauritius' second largest RE contributor to RE, it remained relatively stable over the same timeframe, increasing only by around 2% overall.

Figure 14 Mauritius' RE Electricity Capacity (MW), 2000 to 2019



Source: (IRENA, 2019).

From the year 2009, solar, wind and biogas represented the 'newer' RE technologies introduced into Mauritius. Over the 20-year period, these three also depicted the biggest jumps in terms of overall growth. Solar was the third highest contributor to RE adoption. It saw its greatest increase in 2014, by around 6 times that of the previous year (from 2.5 MW to 18.2 MW). Since then, it has steadily grown to a total of 87 MW in 2019. Onshore wind showed the second highest growth spurt. Introduced in 2009, it remained stable at 0.7 MW until the year 2016 when it demonstrated a significant rise to around 10.6 MW and remained at this value up until 2019. Lastly, biogas showed the third highest overall increase in RE technology adoption, doubling from 2 MW in 2011 to a total 4 MW by the year 2019. Despite the recent growth of new REs in Mauritius, in 2019 solar, wind and biogas still formed less than 40% of all RE capacity (IRENA, 2019). Primary feedback implies that Mauritius' head start gained by more mature REs (bioenergy and hydropower) could be stymied or eroded in coming years if certain GET barriers and context conditions are not addressed. Specifically, case discrepancies concerning 'inhibiting veto actors of transition' especially stood out in our interview feedback as it related to energy supply and consumption culture.

5.4.4.4. *Changes Required in Energy Supply and Consumption Culture*

The presence of inhibiting veto actors of transition was an identified theme much more prevalent to Mauritian than Barbadian stakeholders interviewed. In Mauritius, the actions and characteristics of two main actors were viewed as hindrances to greater RE progress- the state-owned utility and the government. Interviewees identified the issue of a utility driven by a need to maintain power over the market (MS6, 2019) and hence the need for a paradigm shift in energy supply culture (MS12, 2019). "Utilities are generally not innovative, decisions are based on relationships and special interests", for example, "to maintain control and power versus ensuring power quality, new technologies and innovations" (MS6; MS12, 2019). Other actions have included unambitious targets set (MS7, 2019), the biased and limited award of tenders of power purchase agreements (PPAs) to IPPs (MS3; MS8, 2019), a not attractive enough price set on RE generated electricity to incentivise an entire switch from coal (MS16, 2019), and the promotion of self interest in the selection of RE projects (MS16, 2019). However, stakeholders also acknowledged reasons for the hesitance in more aggressive RE uptake. The most cited was that of grid connection and stability concerns due to the variability of RE (MS4; MS11; MS14, 2019) and the need for a smart grid (MS11, 2019). Also highlighted was the high costs of battery storage systems and options (MS4, 2019), "only a handful of systems are commercially viable" (MS23, 2019), and the need to put safeguards, standards, and accreditation in place, were cited as reasons for the modest 30%- 35% RE target (MS4, 2019).

In terms of government, the main hindrance pinpointed has been a lack of leadership (MS1; MS7; MS21) and political will (MS3; MS4, 2019). "There has not been strong leadership and governance in the energy sector. At times they are running after coal, then fuel, then LNG," strong leadership is also lacking in local governments (MS1, 2019). This has resulted in a political culture incompatible to more aggressive RE uptake. Whereas Mauritius' RE has been growing continually over the years, so too has its consumption of non-renewables. In addition, the current culture of energy consumption is one where individuals are less conscious of how they consume energy (MS1; MS13; MS17, 2019). "For people to move in another direction they need to see their interest in the project" (MS3, 2019). This has proven to be incompatible with national RE ambitions. Collectively, the contribution of coal and oil to total primary energy supply grew by 60%

over the 2000 to 2017 period and represented an even greater percentage contribution to total energy supply by the end of the 20-year period from 75% to 84% (IEA, 2020).

The government continues to explore non-renewable options alongside the RE agenda (MS4; MS14). Several interview subjects raised concerns of a fossil fuel (MS4) and LNG energy framework lock in (MS1; MS3; MS4) until 2045 that would significantly reduce the maximum possibilities of RE uptake (MS4). The Mauritian government has no RE vision beyond 2025 (MS9). Several interviewees indicated a need for more ambitious RE targets. While some stakeholders believed that RE alone could not meet all energy needs, a prevalent consensus also agreed that current RE targets set were "extremely low!" (MS7), "well below the country's potential" (MS1; MS3) and should have objectives beyond the 2025 timeframe (MS1; MS9). In this regard, there is a need for change of mindset in political culture, enhanced policy ambition and decisions (MS3; MS7). Barriers faced include "short-term thinking by policy makers" (MS8) and politicians who value money over the greater good of the country (MS3). While Mauritius has "very good institutions created by government", they lack teeth. A question remains whether these institutions are sufficiently independent to take strong decisions (MS7).

5.5. Conclusions

Both diffusion and sustainability transitions writers acknowledge that the successful adoption of a new technology does not solely rely on the nature of the technology itself, it also depends on the innovation's suitability to the new environment that it enters. However, additional characteristics distinctive to developing countries, especially within and across varying SIDS, have been overlooked. In this regard, our study provides novel empirical evidence. Despite their similar socio-economic conditions, we inferred that four key nuances across the cases of Barbados and Mauritius helped to account for their noticeably different in GET outcomes. Specifically, distinctions between the two countries': capacity to transition, level of reliance on external resources, effective learning and reform, and transition quality versus quantity: historical and influential context conditions.

We found that the first two areas of the capacity to transition and the level of reliance on external resources were closely connected. Barbados and Mauritius when compared demonstrated that having access to finances alone was not sufficient to significantly drive large-scale GET adoption. Rather, large-scale RE uptake occurred where there was sufficient presence in all three areas of what we view as the crucial capacity areas to transitioning. These were (whether internally or externally sourced) the combined presence of: ready and diversified access to financial resources, presence of the knowledge and information on how to effectively utilise resources available, and the appropriate allocation of available resources. In Barbados, where it failed to sufficiently meet all three capacity areas, no large-scale RE had taken place. Whereas in Mauritius, national stakeholders highlighted the important role that all three crucial capacity areas to transition played in their achieved RE uptake. Both countries' GET experiences were also dependent on the extent to which they had to rely on external resources to fulfil their crucial capacity areas to transition.

Our findings indicated that while external resources such as donor funding positively impacted GET, where external resources outweighed internal capacity available, this resulted in an overall negative impact on GET. Differences in the two countries' availability of indigenous capacity (i.e. human and financial resources) was a main factor that influenced their different GET experiences and hence outcomes. This was due to countries having less control in the design and allocation of external resources. Hence, where external resources composed the majority of the crucial capacity to transition (or GET investment activity), this equated to a very limited ability to steer the overall GET process. Consequently, where limited internal capacity to transition exists, it is important for countries to seek out resource options and partners that allow them sufficient influence over how resources (both human and financial) are allocated.

Lastly, our main conclusions on the area of effective learning and reform transferred into those relating to transition quality vs quantity: the significant role of historical and influential context conditions. Stakeholder feedback raised the question of transition quality versus quantity. That is, to what extent were national stakeholders satisfied overall with their observed transition outcome?

We found that the ability to engage in effective learning and reform has had a key influence on the observed quality of GET outcomes. Stakeholders interviewed across both cases emphasised that a need still existed for learning and reform. Namely, learning and reform that effectively responded to historical and influential context conditions which were incompatible with national RE ambitions. This was necessary for RE uptake to achieve not just a high quantity but also quality. Based on our data, a high quality meant that large-scale RE uptake was ambitious in its target, was inclusive in who could participate in its supply and demand and would be sustained within the long-term energy mix of the country. For example, Mauritius' RE achievements could be stymied or eroded in coming years if certain GET barriers and context conditions are not addressed. Although Mauritius' RE uptake was comparatively higher compared to Barbados in 2017, this value represented a decreasing proportion of Mauritius' total energy mix due to a higher national consumption of non-renewables (coal and oil) over the observed period.

In addition, unlike Barbados, a significant number of Mauritian stakeholders highlighted RE barriers relating to conflicting actor interests (linked to a colonial history and political interests) and the missed opportunity for energy sector democratisation. On the other hand, once Barbados is able to overcome its barriers which mainly relate to transition capacity (e.g. securing majority control over transition resources, introduction of an appropriate tariff, information deficits etc.), the Caribbean country is likely to achieve higher total and proportional RE levels due to much higher RE targets, and its less exclusive policy design and planning landscape. That is, based on current trends and contextual factors observed across both countries, in the long term Barbados' RE uptake would likely be of both higher quality and quantity.

Hence, although the theme was only substantially identified by Barbadian stakeholders, the overall need for continuous learning and reform can be viewed as critical to both countries' GET. As demonstrated by Mauritius, even when one is ahead, in an ever changing GET landscape such progress can be eroded by those elements that continually plague developing country contexts. Future research on multiple topics where information is lacking can help support SIDS policymakers in this learning and reform process. For instance, on topics that more deeply explore transition actors or 'influencers' and research that helps quantify the relationships between GET outcomes with main transition drivers, barriers and influential context conditions.

5.6. Notes

1. The term small island developing states (SIDS) in this paper refers to a group of 58 countries that are spread over three geographical regions; namely the Caribbean, the Pacific, and the Atlantic, Indian Ocean, Mediterranean and South China Sea (AIMS), as listed by The United Nations Department of Economic and Social Affairs (UNDESA, 2019).

2. We focus on innovation as the adoption and implementation (or uptake) of renewable energy (RE) technologies.

3. Mauritius' national RE target set is to achieve 35% renewable energy share of electricity production by 2025.

4. Calculated based on Barbados' initial national RE target to achieve 65% renewable energy share of electricity production by 2030. Following a change in government administration in 2018, this target was updated to 100% by 2030 (Ministry of Energy & Water Resources, 2019).

5. The IRENA and United Nations (UN) energy statistical databases, national and international legal texts, policies, briefs and reports which helped to outline countries green energy transition priorities and consequent systems in place.

6. Based on expert interview feedback (semi-structured and open-ended questions) from 20 Barbadian and 26 Mauritian subjects that was thematically analysed guided by King's (2004) template analysis technique. Responses were used to generate a list of codes ordered according to the frequency by which they were identified, using a hierarchical structure. A minimum of two independent interview sources were required for any thematic area to be considered of real significance, or to qualify as what we termed as 'low level consensus' (Davies, 2001).

7. Measured by the number of interviewees per case country that identified the thematic area as critical to national GET progress: (i) very high consensus ≥ 80% of interviewees (ii) high consensus 60% to 79% (iii) reasonable consensus 40% to 59% of interviewees (iv) low consensus 20% to 39% (v) very low consensus 8% to 19% of interviewees (vi) not applicable to case < 8%.

8. In the past, bagasse has at times been used to generate energy in Barbados' sugar cane industry. According to the Ministry of Energy & Water Resources (2019), in recent years some farmers are considering switching to high fibre canes to produce biomass rather than sugar.

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Chapter 6 (Paper 3): The Significant Impact of Actors on Renewable Energy Outcomes in SIDS: Stakeholder Perceptions in Barbados and Mauritius Compared

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Abstract

According to existing literature, a participatory green transition actor landscape can be more efficient than one which is state dominated. Within the SIDS context, the applicability of this notion remains unclear. Little attention has been paid to energy transition in SIDS, and by extension, we know little about the actors who mainly drive or inhibit green energy transitions (GET) within these cases.

Application of my own adapted indicators classifying actor participation across 8 main sub-category areas , highlighted the importance of 5 sub-categories on Barbados' and Mauritius' GET outcomes. Namely, it showed that a participatory landscape was indeed important for GET success, but only under 3 key sub-category areas- rule enforcement, distribution of opportunities, and information access. Furthermore, given certain conditions, a participatory framework was not necessary under the two other areas of decision making and rule formation, to achieve national RE targets.

My results prove relevant to key implementing actors responsible for GET learning and reform within SIDS. Findings also note that even where RE progress was achieved, both benefits and drawbacks were experienced whether the GET landscape was participatory or non-participatory in nature.

6.1. Introduction

The dynamics influencing energy transition have often been explored from a technical and technological perspective (Dodman & Mitlin, 2015). Less attention has been paid to the actors which actually drive and influence the diffusion process of innovations or technologies within societies (Wejnert, 2002). Consequently, transition-related research such as sustainability transition literature offer limited guidance on understanding national actors and the roles that influence transition success over time (Wittmayer, et al., 2016; Aligica & Tarko, 2012; Markard, et al., 2012; Flannagan, et al., 2011). This tendency is even more noticeable with respect to small island developing states' (SIDS) [1] green energy transition (GET) contexts.

The small size of SIDS' isolated geography and unique social and economic structures, make them ideal for understanding the green energy transition process within a well-defined geographic boundary. I comparatively explore the green energy transition actor landscapes of Barbados and Mauritius, guided by thematic analysis of stakeholder perceptions from across five main actor groups – public sector, private sector, civil society, regional organisations, and international organisations. I do so, guided by the main research question: how have key actors been able to influence green energy transition (GET) via the uptake of renewable energy (RE)? GET within this article is defined as "the outcome of the interactions between actors on one level and interactions between levels" (Kemp, et al., 2005, p. 12) within the context of a changing societal landscape (Loorbach & van Raak, 2006).

GET is ultimately realised by the everyday actors who experience it and support its implementation. Multiple actor types and roles can influence the general transition process (IPCC, 2015; Geoghegan, et al., 2014; SELA, 2012). In developed countries the societal shift towards green energies has been brought about by factors such as enabling actor participation, the building of new actor networks (Berkhout, et al., 2010), network dynamics (Kemp, et al., 2010; Loorbach, 2010; Loorbach, 2007), learning processes (Schot & Geels, 2008), competing (IPCC, 2014) as well as contesting values and expectations (Kohler, et al., 2019).

Unlike in developed contexts, actor engagement in developing countries occurs amidst the conditions of weaker state apparatus, less efficient bureaucracies, higher levels of political instability, less transparency and enforcement of legal frameworks, relatively high levels of economic and social inequality, a reliance on foreign resources, less advanced industrial processes, and a dominance of low-tech sectors (Hansen, et al., 2018). In addition, small market size can enhance the effect actors have on the energy landscape due to the distribution of power or their ability to participate in the transition landscape (The World Bank, 2019).

The overall aim of this article is to understand the actor landscape shaping GET across SIDS contexts. To do so, I comparatively investigate the islands Barbados (Caribbean region), and Mauritius (African region). Barbados and Mauritius are classified as what Briguglio (2014) refers to as 'self made' small state countries. The two SIDS possess a high degree of inherent economic vulnerability and have introduced both policies to help them cope with their vulnerabilities (Briguglio, 2014). This has included sustainable energy policy through the uptake of renewable energy electricity generation (MARENA, 2018; Government of Barbados Division of Energy, 2017). While both cases have undertaken RE ambitions, they do so from noticeable different RE actor landscapes, which in turn have shaped their RE outcomes, e.g., concerning vision setting, decision making, rule formation, rule enforcement, access to and distribution of opportunities, etc. Despite their similar political, socio-economic, and environmental conditions, the renewable energy (RE) implementation trends of Barbados and Mauritius notably differ.

As of the year 2018, Barbados' RE share of electricity production was observed to be a modest 3.5% of total electricity production. That is, 9.5 percentage points (p.p.) behind its calculated benchmark target [2] of 13% for that year [3]. On the other hand, Mauritius was 10 p.p. ahead of its 2018 benchmarked target at 21% RE share of total electricity production [4] (IRENA, 2019; Ministry of Energy & Public Utilities, 2019; MARENA, 2018; United Nations, 2018; Government of Barbados, 2015). Through the perspectives of GET actors themselves, I seek to explore how nuances between the countries' actor landscapes help explain their different RE outcomes.

In the rest of this article, I go on to outline the theoretical framework used to examine the GET actor landscape, I then comparatively identify the main GET actors in both countries, their level of participation in the GET process, and how they have influenced GET outcomes. I then present conclusions I infer from my comparative case study analysis.

6.2. Investigating the GET Actor Landscape

6.2.1. Theoretical Overview

According to Rothaermel (2001), sustainability transitions tend to be required in domains such as transport, energy, and agri-food, that are characterised by large firms like car manufacturers, electric utilities, and oil companies. Such firms possess complementary assets, such as access to distribution channels, service networks and complementary technologies (Geels, 2011). These assets give incumbent firms strong positions to develop first environmental innovations. Despite this, large incumbent firms tend not to be the initial leaders of sustainability transitions, but their involvement may accelerate their breakthrough where they support innovations through their complementary assets and resources (Geels, 2011). However, this requires a strategic reorientation of incumbents. These entities would otherwise defend existing systems and regimes which are stabilised through lock in mechanisms such as scale economies, sunk investment costs in machines, infrastructures, and competencies (Geels, 2011). From the lens of behavioural economics, Frederiks et al. (2015) and Adger, et al. (2013) add that at the consumer and household level, actors may not make rational choices, instead tending to retain the ‘status quo’ or cultural values. Hence, public authorities and civil society are crucial towards changing economic frame conditions (e.g., taxes, subsidies, regulatory frameworks) in the support of green niches (Geels, 2011). Without such changes in economic frame conditions, environmental innovations are unlikely to replace existing systems (Geels, 2011).

Private actors have limited incentive to pursue sustainability related transitions where the goal is related to the collective good (Geels, 2011). Hence, public authorities and civil society are crucial towards changing economic frame conditions (e.g., taxes, subsidies, regulatory frameworks) in the support of green niches (Geels, 2011). Without such changes in economic frame conditions, environmental innovations are unlikely to replace existing systems (Geels, 2011). The government plays a main coordinating role in transitions, albeit they may be but one amongst many types of actor (Voss & Kemp, 2005). In developed regions like the EU, the central government's power to develop and implement policies in a top down manner has decreased, to become one which is interactive, involving a diversity of societal actors (Loorbach, 2007).

Strategic niche management writers such as Anand & Kedia, 2015 and Geels & Schot (2010), view actor diversity as productive for niche development due to enhanced learning and network development. However, it also acknowledges that too much diversity can hamper developments (Geels & Schot, 2010). Although existing literature provides no convergence on how multi-level governance should be ideally organised, two main typologies have emerged, namely: (i) power sharing dispersed to a limited number of levels and (ii) a vast number of intersecting, flexible jurisdictions that are functionally specific (Hooghe & Marks, 2001). Hooghe and Marks (2001), highlight that often a combination of both could arise within a given context. Heritier (1999) also outlined that in order to increase the effectiveness of existing forms of government and planning towards long term societal change, a new balance between state, market and society is necessary (as cited in Loorbach, 2010, p. 162).

Studies on societal change, have come to an increasing consensus that traditional forms of steering are not suitable for societal challenges such as climate change which possess a high degree of complexity (Loorbach, 2007). From the participatory economist's perspective (Hanhel, 2015, p. 37; Hooghe & Marks, 2001), a more participatory [5] green transition landscape or 'polycentric' styled governance can potentially be more efficient than a central state monopoly. This is because increased participation is assumed to result in reduced inequality between actors in decision-making, and the distribution of the burdens and benefits of economic activity (Hanhel, 2015, p. 37).

A participatory landscape is also expected to promote transparency, cooperation, diversity of choice, efficiency [6], and environmental sustainability [7] (Hanhel, 2015, p. 37). However, sustainability transitions (Hooghe & Marks, 2004) and polycentricity (Thiel, 2016) researchers highlight that the need still exists to direct complex societal dynamics. Consequently, the role of government is still an important one. Nonetheless, according to sustainability transitions scholarship, top-down planning, and market dynamics only account for part of societal change (Loorbach, 2007, p. 71). Also important are network dynamics (where parties may have mutual influence), and reflexive behaviour (continued learning and adaptivity) (Loorbach, 2007; Voss & Kemp, 2005).

6.2.2. Mapping the GET Actor Landscape

The Transition Management (TM) approach (Loorbach, 2010), provides a useful means for mapping an actor landscape across multiple levels of governance. Specifically, under the 'strategic sphere' where wider goals and visions are set, the 'tactical sphere' where rules and regulations are introduced, the 'operational sphere' where new behaviours and technologies are deployed and reflexive sphere involving the monitoring and evaluation of policies and societal change (Loorbach, 2010). Across these spheres, varying institutional and societal structures define the pathways available to governments for coordinating the transition outcomes that they produce (Frolich & Knieling, 2013). For example, a state-driven versus a more participatory approach (Hooghe & Marks, 2004).

Rules put forth under polycentricity theory help one to understand the regularised behaviour of interdependent actors and to gauge the level of actor participation within a system (Aligica & Tarko, 2012). Polycentricity can be described as "a social system of many decision centres having limited and autonomous prerogatives and operating under an overarching set of rules" (Aligica & Tarko, 2012, p. 252). The Bloomington School approach outlines three defining features of polycentricity: (i) the existence of many decision-making centres, (ii) existence of a single system of rules and (iii) existence of a spontaneous social order (Aligica & Tarko, 2012).

In their work, Aligica and Tarko (2012, pp. 253-254), present eight indicators as a means by which polycentric features could be measured. According to theorists, an ideal polycentric or participatory system is spontaneous (Polyani, 1951). Within such a system, organisation patterns will be self-generating and self-organising, individuals will be incentivised into appropriate patterns of ordered relationships (Ostrom, 1972) and will have the ability to change rules "in an orderly way" (Aligica & Tarko, 2012, p. 247).

6.3. Methods

In this article I employ the most-similar comparative case study methodology (Seawright, 2008; Yin, 2015) to the cases of Barbados, and Mauritius. Broadly guided by Loorbach's (2010) transition management approach, I specifically explore the actors influencing GET across the strategic and tactical spheres of Barbados and Mauritius renewable energy sectors. Unlike traditional sustainability transitions studies, I instead chose a phenomenological approach (Creswell, 2014) based on feedback pertaining to the lived experiences of in-country green energy transition actors. Specifically, using a small N sample, I employ thematic analysis to assess responses from green energy transition actors concerning their perceptions related to this study's main research question: how have key actors been able to influence green energy transition (GET) via the uptake of renewable energy (RE)?

Compared to existing scholarship, this approach allowed me to explore the everyday GET landscape in greater detail from the stakeholder, rather than technical or technological, perspective. My findings provide useful insight into the Barbadian and Mauritian cases. However, given my chosen research design, further research with more extensive data collection would be required to determine external validity on other SIDS cases.

Data for this study was sourced from primary data collected under a wider research project examining GET experiences in SIDS via expert interviews (Creswell, 2014; Bogner, et al., 2009; Lilleker, 2003; Davies, 2001). This included interviews with a total of 20 and 26 relevant national stakeholders in Barbados, and Mauritius respectively. Semi-structured, open-ended questions (Leech, 2002) were used to collect detailed interview feedback (see appendix 3 for interview questions). Interview subjects represented individuals from the public sector, private sector, civil society, regional, and international organisations (see appendix 5 for interviewee overview). Eftimiades (1994), guided my approach to primary data analysis- a minimum of two independent interview sources were required for any thematic area to be considered of real significance (Davies, 2001). Feedback from Barbadian interviewees was represented by the codes $BB_{1\ldots20}$ and Mauritian interviewees were represented by the codes $MS_{1\ldots26}$.

I applied integrated use of principles from sustainability transitions (Loorbach, 2010) and polycentricity theory (Aligica & Tarko, 2012) to thematically investigate the main research question. Firstly, based on primary feedback, I identified the national stakeholders perceived to be most influential to RE uptake across both cases. Secondly, based on primary feedback and supplemented by secondary data where necessary (document analysis) [8], I used polycentricity theory (Aligica & Tarko, 2012) to identify the extent of actor participation allowed within the respective national RE landscapes. This was done using proxy indicators I adapted for this research which better suited data availability of the SIDS cases (see table below).

Table 11 Indicators Used for Classifying the GET Participation Landscape

No	Core Polycentric Condition	Proxy Indicator Employed	Participation Rating & Award Criteria Used		
			Participatory (P)	Partially Participatory (PP)	Non-Participatory (NP)
1	**Existence of many decision-making centres**	1.1. **Decision making-** A diversity of autonomous actors active in the landscape i.e. presence of 5 main actor groups (public, private, civil society, regional and international).	1.1 all 5 actor groups present.	1.1 At least 3 actor groups present.	1.1 < 3 actor groups present.
		1.2. **Vision setting-** Existence of a set of common or shared goals (presence of a clearly articulated National Policy and or Action Plan with contributions from across 5 main actor groups).	1.2 Present with contributions from all 5 actor groups.	1.2 Present at least to some extent with contributions from at least 3 actor groups.	1.2 Present to some extent with contributions from < 3 actor groups, or None in place.
2	**Existence of a single set of rules that are enforced**	2.1. **Rule formation-** Involvement of decision centres on drafting overarching rules with 3 main actor groups (public, private, civil society). Where input is regularly considered and where applicable adopted e.g. presence of an active consultative Committee including non-government stakeholders.	2.1. All 3 actor groups involved.	2.1. at least 2 actor groups involved.	2.1 < 2 actor groups involved.
		2.2. **Rule enforcement**- The alignment between rules and incentives (policy is accompanied by enforced legislation and regulations that act as drivers to the decision-centres) i.e. in place is: a) An attractive feed in tariff b) Net Metering/ Billing c) Interconnection Standards d) Tax Credits/ Reductions/ Exemptions e) Public Loans/ Grants f) IPPs Permitted g) Green public procurement	2.2. At least areas a) to f) are satisfied.	2.2. at least minimum requirements in place- a), c), and either b) or f) are satisfied.	2.2 Less than minimum requirements in place, or none satisfied
		2.3. Access to opportunity- Based on Sen and Nussbaum’s concept of *access to advantage*	2.3. all resource areas are	2.3. At least some resource areas	2.3 At least some resource areas are

		and *opportunity* under the 'Capabilities Approach': (a) access to financial, human, natural and infrastructural resources to 3 main actor groups- public, private sector and civil society.	readily accessible for all 3 actor groups.	are readily accessible to at least 2 actor groups.	readily accessible to < 2 actor groups, or No resources are available.
		2.4. Distribution of opportunities- across 3 main actor groups outside of the state- households, private sector (grid access must be inclusive of IPPs) and, civil society (e.g. social enterprises).	2.4. All 3 actor groups permitted grid access or off-grid energy activities.	2.4. at least 2 actor groups permitted some form of grid access or off-grid energy activities.	2.4. < 2 actor groups permitted some form of grid access or off-grid energy activities.
3	**Existence of a spontaneous social order**	**3.1. Information access**- Relevant information for decision-making is sufficiently and publicly available (to decision centres equally across 3 main actor groups- public, private sector and civil society).	3.1 sufficiently and publicly available to all 3 actor groups.	3.1. sufficiently and publicly available to at least 2 actor groups.	3.1 sufficiently and publicly available to < 2 actor groups.
		3.2. System entry- The nature of entry into the system satisfies any of the following conditions across 3 main actor groups- public, private sector and civil society: • *Free*- a decision centre can decide to enter the system and existing decision centres cannot prevent this • *Meritocratic*- based on ability or set criteria rather than on class privilege or wealth. • *Spontaneous*- no decision is involved.	3.2 At least one condition is fully satisfied for all 3 actor groups.	3.2. At least one condition is fully satisfied for at least 2 actor groups.	3.2 At least one condition is fully satisfied for < 2 actor groups, or No condition is fully satisfied.

Developed guided by: (Aligica & Tarko, 2012, pp. 253-254; Loorbach, 2010; Nussbaum, 2003; Sen, 1999).

Based on the above indicators, case countries' overall GET landscapes were classified according to three main categories:

(i) polycentric or participatory (P)- at least 5 indicator areas were rated as participatory (i.e., as P).

(ii) partially participatory (PP)- at least 5 indicator areas were rated as either a combination of participatory (P) and partially participatory, or as solely partially participatory (PP).

(iii) state dominated or non-participatory (NP)- at least 5 areas were rated as non-participatory (i.e., NP), or as non-participatory.

6.4. Transition Actors: The Most Important Driver of GET

Transition influencers were highlighted as the most significant driver of GET in both Barbados and Mauritius (see appendix 6). Although the two countries shared most of the actors identified as key to their national GET process, notable variances between the two cases also existed. Namely: (i) the level of interviewee consensus on those actors recognised as the most important to determining GET outcomes and (ii) how they have influenced national renewable energy uptake. Transition influencers such as the government, the utility, civil society, private sector, international organisations and regional groupings were commonly identified as key actors who helped to drive GET in both islands. Whereas the importance of actors such as the regulator and lending agencies was highlighted only by Barbadian interview subjects.

Table 12 Breakdown of Roles Played by Actors Identified as Influential to GET in Barbados and Mauritius

Rank	Actor	Prevalence of Theme [12] (Barbados)	Prevalence of Theme (Mauritius)	Roles Played		
					Distinctive to a case	
				Common to both Cases	Barbados	Mauritius
1	The Government	high	high	1. legislative and regulatory framework reform alongside the introduction of new policies 2. financing for RE projects 3. government-driven projects or investment in RE, 4. RE installations and generation, 5. introduction of a national policy plan 6. research on renewable energy options and opportunities		1. political leadership
2	Private Sector	high	reasonable	1. research, 2. RE installations and generation, 3. financing of RE projects 4. innovative introduction of RE e.g. hybrid systems 5. participation in public-private dialogue	1. advisory input 2. lobbying government for energy sector reform 3. green energy advocates in strategic positions 4. new financing models 5. introduction of combined systems with complementary RE technology	1. investment in RE 2. a corporate desire to be labelled as green
3	The Utility	high	low	1. new policies in favour of RE integration and generation 2. RE installation and generation	1. a proactive attitude to REs 2. pilot projects and innovative RE introduction	1. social programmes e.g. for the most vulnerable and small-scale industries

				3. research e.g. on battery storage 4. investing in RE	3. a majority private owned utility company	2. opening up to IPP structures under a good procurement regime 3. a state owned utility company
4	Civil Society	reasonable	low	1. lobbying and advocacy	1. stakeholder coordination, awareness building, consultation, and engagement	1. checks to power
5	International Organisations/ Donors	reasonable	low	1. project financing 2. research		1. fund human and institutional capacity building 2. awareness building initiatives 3. technical support
6	Regional Groupings	low	very low	1. financing and investment in RE		
7	Lending Agencies	low	Insignificant		1. green loans for households and commercial entities 2. development banks to governments	
8	The Regulator	very low	none		1. approval of renewable energy rider introduced by the Utility	
	Overall Rated Importance of Actors in GET	**very high**	**high**			

Data sources: (stakeholder interviews, Mauritius, 2019; stakeholder interviews, Barbados 2018).

Although critical to both countries, the number of main players identified in Barbados' GET landscape (5 actors) was noticeably greater than those identified in Mauritius' (2 actors). Details on the GET landscape or the 'system of rules' within which actors operated, aided in understanding why actors played or did not play certain roles. Despite Mauritius' slightly less diverse actor landscape, both countries' GET landscapes were classified overall as 'partially participatory'. Upon closer examination, several nuanced roles played by the Mauritian government, private sector, and utility, help account for its relatively more advanced GET outcome. Specifically, 5 notable differences stood out between the two cases' GET actor participation landscapes. That is, (i) decision making, (ii) rule formation, (iii) rule enforcement, (iv) distribution of opportunities, and (v) information access.

Table 13 Classification Breakdown of Barbados' and Mauritius' GET Actor Participation Landscapes

No	Polycentric Indicator Sub-Categories	Barbados	Mauritius
1	Decision making	P	NP
2	Vision Setting	PP	PP
3	Rule Formation	P	NP
4	Rule Enforcement	NP	P
5	Access to Opportunity	PP	PP
6	Distribution of Opportunities	NP	PP
7	Information Access	NP	PP
8	System Entry	PP	PP
	Actor Landscape Typology	**PP**	**PP**
	GET Status as of 2017	Behind Target	Ahead of Target

Key:

P	Polycentric or Participatory
PP	Partially Participatory
NP	Non-Participatory or State-Driven

Data Sources:

Barbados- (IRENA, 2019); (stakeholder interviews, Barbados 2018); (TAPSEC, 2018); (Government of Barbados Division of Energy, 2017); (CAPRI, 2014); (Moore, et al., 2014).

Mauritius- (PwC Mauritius, 2020); (stakeholder interviews, Mauritius, 2019); (PAGE, 2015); (Republic of Mauritius, 2009); (Republic of Mauritius, 2005).

Based on the classification of Barbados' and Mauritius' polycentric sub-category areas, three initial assumptions can be made. Firstly, that a participatory rating in the indicator areas of 'decision making' and 'rule formation' was not necessary for GET progress in Mauritius. Secondly, having at least a partially participatory rating in the indicator area of 'distribution of opportunities' and 'information access' has facilitated GET progress in Mauritius compared to Barbados. Thirdly, a participatory framework in the indicator area of 'rule enforcement' has facilitated GET progress in Mauritius compared to Barbados.

These assumptions are explored in further detail below through the perspectives of 46 RE sector stakeholders across Barbados and Mauritius. Any parts of discussion based on primary feedback from Barbadian interview subjects is referenced using the code BB, followed by assigned interviewee number, then year of interview. Likewise, any parts of discussion based on primary feedback from Mauritian interview subjects is referenced using the code MS followed by assigned interviewee number, then year of interview. The following information presented stems from the everyday experiences of 5 main actor groups – public sector, private sector, civil society, regional and international organisations. At times, secondary sources are also referenced (in separate brackets) to either validate and or build upon primary findings.

6.5. Key Differences in the GET Actor Landscape that Distinguished RE Outcomes

6.5.1. Decision Making & Rule Formation

Key distinctions were observed in the roles allowed to be played by private sector and civil society actors across Barbados' and Mauritius' decision making and rule formation landscapes. Barbados' RE sector involved contributions from at least 3 main actor groups. Regular input from public sector, private sector, and civil society helped to shape overarching rules facilitated through ad hoc and formalised inter stakeholder consultations. The interdisciplinary Electric Light and Power Advisory Committee, for example, allowed the advisory input of private sector towards energy sector reform (BB7, 2018). However, according to interview subjects, lengthy inefficient processes e.g., discussions being held within silos and limited capacity to implement necessary changes, may have hampered their effective translation into increased RE uptake (BB1; BB3; BB6; BB7, 2018). As of early 2017, even with input from private sector and civil society, the majority of Barbadian interviewees still identified the need for a clearly articulated vision, policies, and plan.

On the other hand, Mauritius' RE sector was described as one that could benefit from loosened government controls and increased (but managed) private sector influence (MS6, 2019). Within its less diverse decision making and rule formation context, almost a decade before Barbados, the government had introduced its Long-Term Energy Strategy 2009-2025 which helped to guide implementation efforts (MS1; MS4; MS11, 2019); (Ministry of Energy & Public Utilities, 2019). Important elements highlighted by interview subjects included integrated sustainable development objectives (e.g., consideration of energy access needs and gender equality issues), resource planning (MS1; MS4; MS5; MS11; MS13, 2019) and an Energy Policy which presented RE integrated scenarios and long-term planning (MS1; MS5, 2019). Furthermore, in 2014, the newly elected government administration introduced a more invigorated discourse concerning RE (MS1; MS2, 2019). Since then, government-signed contracts with the private sector must consider environmental, ecological, and social equity concerns within the energy sector (MS1, 2019).

Nonetheless, Mauritian interviewees pinpointed that a lack of stakeholder consultation acted as a barrier to RE uptake. Impediments identified included little to no ability to voice concerns on RE targets made (MS16, 2019), or that facilitated exchange between key stakeholders towards problem solving (MS1, 2019). Interview subjects indicated the need for overall transparency within government processes where "decisions are often made behind closed doors" (MS16, 2019), an issue not similarly raised by Barbadian interviewees. In Mauritius, this may be connected to other distinct concerns highlighted such as short-term thinking by policy makers focused on immediate political and economic interests (MS8, 2019), outdated RE targets set well below the country's potential (MS1; MS3; MS14, 2019) or the need for more ambitious targets, and for a new business model more heavily reliant on RE (MS1; MS16, 2019). Unlike Barbados, Mauritius' current and foreseen energy framework still includes significant use of fossil fuels such as coal and LNG (MS1, 2019); (Ministry of Energy & Public Utilities, 2019).

Civil society as "watchdogs" or a check to government power was uniquely recognised as an important role in the Mauritius case (MS7; MS10, 2019). NGOs have been successful in creating pressure towards pro-environmental change (MS3; MS10; MS11, 2019), as well as lobbying/ advocating for increased transparency (MS3, 2019) and against the increased uptake of unsustainable energy such as coal (MS3; MS11, 2019). On the other hand, in Barbados' more participatory decision making and rule formation energy landscape, such checks to power had yet to arise as necessary. Civil society's role instead entailed that of stakeholder coordination, awareness building, consultation, and engagement. For instance, lobbying for necessary reforms in favour of REs, like VAT removal (BB16, 2018), and filling implementation capacity gaps. Organisations such as the Barbados Renewable Energy Agency (BREA) have provided advisory input to government (BB9, 2018) and acted as key liaisons between critical national actors of influence (BB1, 2018). In a similar vein, Mauritius has the potential to build upon similar past public-private dialogue (PPD) such as the Maurice Ile Durable consultations (MS7, 2019) and that targeting energy efficiency (MS9, 2019).

6.5.2. Rule Enforcement

The Mauritian government was identified as an influential driver to national GET. Existing transition-related literature highlights the important role of government in enacting significant institutional reform (Foxon, et al., 2008, p. 10), coordinating actions, providing frameworks and support (IPCC, 2014) for a transition. A top-down or state-dominated approach drove Mauritius' RE vision, goals and their conversion into rules, regulations, legislation, and new institutions. Unlike Barbados, Mauritius had the presence of strong political will (i.e., commitments accompanied by action) by the ruling government no matter the political party affiliation (MS14, 2019). The government spearheaded necessary technical/ infrastructural upgrades (MS4, 2019), resource mobilisation efforts (MS13, 2019) and set a tariff rate that successfully raised investment interest (MS11, 2019). The Mauritian government also drove RE uptake through new policies that promoted small and large-scaled projects e.g., a long-standing presence of IPP policy (MS1; MS11; MS15, 2019), which included the tendering of big RE projects (MS6; MS15, 2019). In addition, new institutional structures such as the Mauritius Renewable Energy Agency (MARENA) which was introduced in January 2016, became operational.

According to Barbadian interviewees, real change happens when government provides an enabling environment (BB1; BB14, 2018), this is what really catapults people into action. However, these steps have only in recent years began to occur. Secondary sources show that the Caribbean country's initial long term RE roadmap (via its National Energy Policy) was only introduced recently in 2017 (Division of Energy and Telecommunications, 2017), and its targets increased after a change in government that brought with it an enhanced green economy push (Henry, 2018); (Knowledgewalk Institute, 2018). According to my interview subjects, further legislation and regulations that effectively enable large scale projects are still needed. Barbados has yet to introduce a viable economic model to attract IPPs. A major concern of interview subjects elaborated the lack of a reliable cost recovery approach (BB6; BB16, 2018) with a competitive return for investors (BB3; BB5; BB6; BB12, 2018). Stakeholders repeatedly pinpointed the need for an attractive feed in tariff (FiT), that is, one which is fixed (BB6, 2018), that provides payback predictability (BB1; BB3; BB4, 2018), and that allows enough cash flow to repay loans and interest rates (BB1; BB3; BB5; BB6; BB9; BB11; BB14; BB16; BB17, 2018).

In Mauritius, the legalised and incentivised involvement of IPPs contributed substantially to RE uptake. An existing country report indicates that in 2017, approximately 60% (1880 GWh) of total RE electricity generation came from IPPs (Republic of Mauritius, 2017). In addition, legal reform such as the 2005 Electricity Act set the rules for quality of services (Hadush & Bhagwat, 2019) and has allowed decentralisation in the supply of energy (Republic of Mauritius, 2005). Interviewees highlighted that reasons preventing such similar reform by a hesitant or more lethargic Barbadian government have included a need to find new forms of revenue generation due to lost tax revenue on oil-based products (BB15; BB19, 2018), and a need to consider the interest of varying actors (BB1, BB3; BB6, 2018). In some ways, the missing political drive to pursue RE ambitions was instead demonstrated by the utility in Barbados, who was identified significantly more within the Caribbean versus African island as an influential player to GET.

In Barbados, the utility had an especially proactive attitude towards REs (BB1; BB2; BB4; BB5; BB6, 2018). As a long-standing monopoly in the generation, transmission, and distribution of electricity on the island (Cumberbatch, 2020), the utility had the capacity to drive such change. Although there was some reluctance at first due to potential revenue loss, Barbados Light & Power (BL&P) eventually adopted a pro-RE stance (BB4, 2018). Secondary reports show that in 2016, the company's RE target of 100% by 2045 (Emera, 2016) was (in the longer term) higher compared to that of the Barbadian national government at 65% by 2030 (Ince, 2017) [9]. According to my subjects interviewed, the utility's private and foreign ownership had an influence. The Barbadian utility is wholly private owned (Barbados Light & Power Company Limited, 2019). RE was seen as an opportunity to be ahead of the pack, coupled with access to external parent company finances for funding projects (BB4, 2018). BL&P has allowed persons to sell electricity back into the grid and has financed large-scale RE investments (BB2; BB4, 2018).

6.5.3. Opportunity Distribution & Information Access

The distribution of opportunities within the RE sector can be linked back to the enabling framework in place under decision making and rule formation that enables participation. The differences thus far outlined between Mauritius and Barbados help account for variances observed between stakeholders' ability to seize RE opportunities across the two countries. In Mauritius, alongside the utility, the private sector was identified by my interview subjects as important investors in RE. The important role of the private sector is one already recognised by climate science and transition writers. For example, in the scaling up of actions in communities, households and civil society, and financing the transition (IPCC, 2014). Although the utility remains the driver of implementation (MS5, 2019), and Mauritius has seen less advanced growth of its medium scale RE systems [10], private sector entities have been able to engage in the large-scale introduction of RE. According to Mauritian interview subjects, a distinct role played by the private sector included investment in RE accompanied by a corporate desire to be labelled as green (MS1; MS11; MS16, 2019).

In Barbados, "utility scale expansion still needs to be better facilitated for other players" (BB8, 2018). Households and the private sector through the utility could adopt RE up to a limited scale, and only the utility has been able to engage in large scale RE projects. As of 2017, the role of Barbados' private sector was still at the stage of advisory input, advocating and lobbying government for energy sector reform, pilot, and demonstration projects, and small to medium-scale installation of residential and commercial systems (BB1; BB4; BB5; BB7; BB9; BB16; BB19, 2018). Barbados' exclusion of actors can be explained by shortcomings still existing in rule formation, enforcement and to some extent access to information. A very high consensus of Barbadian interviewees highlighted that legislative, regulatory and policy reforms were still needed for RE activities to further expand. “Independent Power Producer (IPP) frameworks need to be better developed” (BB8, 2018). Also needed is a revised licensing methodology and modalities for power purchase agreements (PPAs) between independent power producers (IPPs) with the utility company (BB1; BB12, 2018). For example, one subject elaborated that “to be an IPP you need a license, but the utility does not have to negotiate a PPA with you unless you have a license. Current legislation is not clear enough on the order of procedure” (BB1, 2018).

According to most Barbadian interviewees, the lack of an enabling framework can also be attributed to information deficiencies, and inefficient processes. Although many incentives are in place, the majority remain underexploited (BB2; BB20, 2018). Both primary and secondary sources raise the concern that RE policy implementation between government agencies has been poorly coordinated (BB6, 2018) which in turn has negatively impacted access to information by the private sector (Moore, et al., 2014). For example, interview subjects detailed that not enough communication exists on incentives relevant for lending institutions like commercial banks (BB2; BB19, 2018). Grid connection transparency was another information gap identified, i.e. public reporting by the utility on RE saturation levels per district (BB1, 2018). A key actor, the regulator, has also lacked the necessary capacity to effectively support RE sector advancement . A main issue identified by interview subjects concerned the regulator and its lack of information and expertise to understand what is bankable (BB3, 2018). This has led to inefficient or ineffective policies such as the existing tariff structure (BB16, 2018).

Despite the limitations faced, within the existing energy framework, a high number of my interviewees agreed that the Barbadian private sector has contributed to small and medium scale RE uptake at the household and commercial levels. This has included innovative introduction of combined systems using complementary technologies such as electric vehicles (EVs) and solar EV charging ports (BB2; BB13, 2018); (Moore & Howard, 2015). The private sector has also financed RE pilot projects (BB12, 2018) and introduced new financing models, for example, the Williams Caribbean Capital Green Energy Bond (BB3, 2018).

Within a less enabling energy framework, Barbados' utility the Barbados Light & Power Company (BL&P), was identified as an important facilitator of GET opportunities, to a much greater extent than the Central Electricity Board (CEB) in Mauritius. Markedly, BL&P's proactive attitude to REs reflected in a "100/100 Vision" [11] (Smith, 2017) is far more ambitious than that set of its African island counterpart. Barbados' national targets set by government have echoed this ambition, with a minimum goal set of 65% by 2030 and a long-term goal to reach 100% RE (Division of Energy and telecommunications, 2017). Towards this goal, BL&P has pursued research into battery storage solutions with generators, pilot projects, large-scale RE introduction and granted conditional grid access to other players (BB7; BB9, 2018). In 2010, the BL&P introduced the Renewable Energy Rider (RER) programme which allowed distributed solar PV capacity to be supplied to the grid. According to an IDB report, thanks to its introduction, the prevalence of small grid connected distributed solar PV installation has increased significantly in Barbados (Espinasa, et al., 2016).

Several of my interviewees attributed the BL&P's private ownership status to its proactive attitude towards RE and push for cleaner energy. However, customers were still limited on the amount that they could feed into the grid at 1.5 times their average monthly consumption. Secondary sources further indicate that the FiT has yet to result in the participation of any IPPs or large-scale renewable power investments in Barbados (Espinasa, et al., 2016). On the other hand, despite Mauritius' more modest 35% RE target, the state-owned utility (CEB) has granted grid access to IPPs and introduced RE to the most vulnerable and small-scale industries via social programmes. These actions enabled energy participation on a wider scale compared to Barbados. One of my interview subjects stated that "one of the biggest advantages of ownership of the grid has been the opening up to IPP structures, especially if it is done under a good procurement regime. This allows attraction of nice competitive projects to the grid without indebting the national government" (MS6, 2019).

While the state's full control of the energy network allowed it to decide on projects and how to implement them (MS5, 2019), the complete absence of a regulatory body in Mauritius led to issues of bias concerning the way in which opportunities were distributed. At the operational level, several of my interview subjects mentioned the missed opportunity for democratisation within Mauritius' energy sector via RE (MS1;

MS3; MS8, 2019). RE opportunities have been mainly exploited by the utility, alongside large national and foreign companies. According to interviewees, this was due to several barriers faced by other socio-economic segments. Namely, asymmetric information dissemination e.g. within cooperatives with insider information who have invested in small PV farms (MS8, 2019), lack of transparency in government tenders for large projects (MS3; MS8, 2019) e.g. IPP tender conditions favouring the sugar oligarchy and international firms so no one else can bid (MS3, 2019), incentives lacking that facilitate a more inclusive or diverse group of players e.g. social enterprises, NGOs, SMEs, and that allow people to sell energy from one home to another (MS10; MS12; MS15, 2019). Furthermore, Mauritian interview subjects also highlighted that the lack of a regulatory authority was a main barrier to more advanced RE uptake. Within the current energy framework, it is still not very well defined who will be the enforcing body (MS4; MS12, 2019). However, even when plagued by the identified problems faced, as of 2017, Mauritius' RE uptake trends showed that they had managed to introduce a diverse range of RE at a rate ahead of its benchmarked nationally set target (IRENA, 2019).

Based on the comparative survey of Barbados' and Mauritius' actor landscapes, a number of key inferences can be made concerning GET across the two SIDS. These are seen graphically outlined below.

Figure 15 Summarised Main Assumptions Based on Factors Influencing GET Across Barbados and Mauritius

Main Driving Conditions of GET include:

a) clear vision, plan, and policies + political leadership → clear rules and regulations in place

b) state utility ownership + monopoly power on energy generation, transmission, and distribution → opening up of large scale RE generation to private sector as IPPs + intro of social programmes

c) participatory rule enforcement (i.e., an attractive FiT + interconnection standards + an IPP framework in place) → partially participatory large-scale RE uptake

Other Factors Driving Overall RE Advancement include:

d) participatory decision making and rule formation → little/ no transparency or corruption problems + non-state actors filling crucial

e) non-participatory decision making and rule formation → faster introduction of an enabling framework

f) a pro-RE attitude by the utility + monopoly power on energy generation, transmission, and distribution → more ambitious national RE targets

Main Conditions Hindering GET include:

a) non-participatory decision making and rule formation + no regulator → transparency issues + modest national targets + biased opportunity distribution

b) non-participatory rule enforcement + weak regulator → missing, inefficient and ineffective policies

c) inefficient stakeholder coordination/ consultation + limited implementation capacity → bottlenecks in RE uptake

d) inefficient and asymmetric information access → transparency issues, biased opportunity distribution and unused

e) private utility ownership → only the utility engaged in large scale RE generation

Existing studies on societal change have come to the increasing consensus that a more participatory [5] green transition landscape can potentially be more efficient (Anand & Kedia, 2015; Hanhel, 2015; Loorbach, 2010; Loorbach, 2007). However, my analysis of the Barbadian and Mauritian overall RE actor frameworks (see table 12), accompanied by feedback from the everyday experiences of national energy sector stakeholders, indicate that a participatory governance framework was not always required depending on the sub-indicator area. Within its overall partially participatory landscape, important emphasis was placed on the Mauritian government's introduction of participatory rule enforcement as crucial for success (specifically, an attractive FiT + interconnection standards + an IPP framework in place).

This was backed by my Barbadian interview feedback which highlighted non-participatory rule enforcement, and a weak regulator as major barriers for RE uptake. Based on this, my first inference made is that to be ahead of its RE target, a participatory actor framework is not required in the sub-indicator areas of decision-making, and rule formation. However, at least partial participation is required in the sub-indicator area of rule enforcement. Secondly, inefficient, and asymmetric information access had a negative influence on RE progress across both countries.

In terms of actor themselves, sustainability transitions theorists have highlighted the crucial role of public authorities and civil society towards changing economic frame conditions in support of GET (Geels, 2011; Voss & Kemp, 2005). Conversely existing scholarship also acknowledges that too much diversity can hamper transition developments (Geels & Schot, 2010). National stakeholders (based on my primary research findings) perceived, 3 main factors as conducive to driving GET progress in Mauritius – presence of a clear vision, plan and policies, political leadership, and participatory rule enforcement. Supplemented by a clear roadmap, political leadership, and an at least participatory rule enforcement landscape, they believed this allowed Mauritius to advance its RE ambitions, particularly when it came to large-scale RE uptake.

In Barbados, stakeholders highlighted the positive influence of participatory decision-making and rule formation on overall RE advancement. Meanwhile, Mauritius' non-participatory decision-making and rule formation landscape had a negative influence on access to opportunity, information, and distribution of RE opportunities. However, Barbados' more diverse actor landscape lengthened its decision-making and rule formation process. These findings largely confirm what we know from the existing literature concerning the nature of the transition actor landscape.

My primary research findings also go beyond existing literature to provide added insight on the exact entities and key roles driving GET across the two SIDS cases. Based on stakeholders' feedback, a third inference made is that in Barbados where the utility had a proactive attitude to REs, they possessed much more ambitious national RE targets. Fourthly, private utility ownership in Barbados equated to limited decentralisation within the RE sector, whereas in Mauritius, state utility ownership equated to overall wider participation in the RE sector. Fifth and lastly, a weak regulator (Barbados) or no regulator (Mauritius) had a negative influence on RE uptake in both countries.

6.6. Conclusions

My empirical findings identified transition actors as the most important drivers of GET in both Barbados and Mauritius. In both countries, the government followed by the private sector, the utility and civil society were similarly identified by stakeholders interviewed as the most important actors shaping GET outcomes. Nonetheless the two countries depicted quite different GET outcomes, with Barbados significantly behind its RE target and Mauritius ahead of its own. I found that key differences in the countries' GET actor participation landscapes helped explain their different GET outcomes. These differences were captured via adapted indicators I developed which specifically measured actor participation levels across 8 main sub-category areas (see tables 10 and 12). Four main nuances in the two countries' actor participation levels especially helped to explain their respective GET outcomes. These sub-categories depicted critical variances in the roles able and needed to be played by the main actors shaping GET. That is, the five areas of decision making, rule formation, rule enforcement, distribution of opportunities and information access were the most important for understanding GET outcomes.

According to existing literature an overall more participatory green transition landscape can potentially be more efficient than a state driven one. Comparative application of my adapted indicators confirmed that a participatory landscape was indeed important overall for GET success, if not crucial for successful RE uptake across the two cases. This however, a participatory actor landscape was only necessary for 3 of the 5 significant sub-category areas of actor participation. Namely: rule enforcement, distribution of opportunities and information access. Furthermore, under the two remaining areas of decision making and rule formation, a participatory framework was not necessary at all to achieve national RE targets in the short to medium term and given a modest national target, as was demonstrated by the Mauritius case. Rule enforcement was the only sub-indicator area categorised as fully participatory in Mauritius, a status which compared to Barbados where it was non-participatory, indeed allowed the African country's RE agenda to advance.

Collectively, the two cases demonstrated that innovative actions by the private sector could not have a significant impact on RE uptake unless participatory rule enforcement was also in place. That is, a framework that effectively incentivised and enabled large-scale RE uptake via an attractive feed in tariff, interconnection standards, and a clear PPA and IPP framework. Based on my findings the below revisions are proposed to the future use of the indicators initially proposed in this study (see table 10) for examining GET outcomes via the actor participation landscape.

I propose the following updated criteria for classifying the overall GET participation landscape according to three main categories:

(i) Polycentric or participatory (P)- rule enforcement, access to, and distribution of opportunities, must be at least partially participatory (PP), and at least 2 other indicator areas rated as participatory (i.e., as P).

(ii) Partially participatory (PP)- rule enforcement, and distribution of opportunities must be at least PP, and at least 3 other indicator areas rated as either a combination of participatory (P) and partially participatory (PP).

(iii) State dominated or non-participatory (NP)- if rule enforcement or distribution of opportunities is NP, automatically classified as NP overall. And, or if 5 areas were rated as non-participatory.

Overall findings further showed that despite any RE progress achieved, both benefits and drawbacks could be experienced whether core areas of the GET landscape were participatory or non-participatory in nature. For instance, non-participatory decision making, and rule formation allowed for the much faster introduction of an enabling framework for RE in Mauritius (led to higher quantity), but it also led to problems with transparency, outdated RE targets and stakeholder exclusion (led to lower quality). In contrast, greater actor diversity was found to have both facilitated (led to higher quality) and delayed RE advancement (led to lower quantity) in Barbados. Hence, in the design or reform of the actor landscape, it is important to recognise that the benefits and drawbacks of either a more participatory or non-participatory landscape will have implications on overall GET quality and quantity.

An important component of supporting the GET learning and reform process within SIDS, entails continued research on the areas where data is lacking. Follow-up research is suggested on a wider research sample, as well as that which builds upon this article's approach to explore in greater detail actors' ability to effect change. Additionally needed, is research that helps determine the overall weighting of actor influence on GET outcomes.

6.7. Notes

1. The term small island developing states (SIDS) in this paper refers to a group of 58 countries that are spread over three geographical regions; namely the Caribbean, the Pacific, and the Atlantic, Indian Ocean, Mediterranean and South China Sea (AIMS), as listed by The United Nations Department of Economic and Social Affairs (UNDESA, 2019).

2. Calculated using the base year of 2015, determined by the year countries submitted their Nationally Determined Contributions (NDCs) to the United Nations Framework Convention on Climate Change (UNFCCC).

3. Barbados' initial national RE target set was to achieve 65% renewable energy share of electricity production by 2030. Following a change in government administration in 2018, this target was updated to 100% by 2030 (Ministry of Energy & Water Resources, 2019).

4. Mauritius' national RE target set is to achieve 35% renewable energy share of electricity production by 2025.

5. Viewed in terms of economic democracy. That is, decision-making power in proportion to the degree one is affected (Hanhel, 2015, p. 37).

6. Meeting economic goals, with as little waste of resources, time, labour, and energy as possible.

7. Seeks to meet economic needs without diminishing the ability of future generations.

8. Available country reports, and legal documents.

9. All other things being held constant – i.e., assuming no changes in BL&P's and the Barbadian government's implementation timeframe, nor in the set targets.

10. Where a lack of a regulatory framework exists for private sector investment e.g. no predictability in the application process although there is demand (MS12, 2019).

11. One hundred (100) percent renewable energy and 100 percent electrification by 2045.

12. Based on total interviewee consensus where: Very high is >79%; High is 60 – 79%; Reasonable is 40% - 59%; Low is 20% - 39%; Vey Low is 8% - 19%; Insignificant to case <8%.

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Chapter 7 (Paper 4): Quantitative Analysis of the Factors Most Impacting Green Energy Transition in SIDS

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Abstract

The effectiveness of green energy policies is reliant upon a greater understanding of the factors impacting green energy transition (GET). Small Island Development States (SIDS) offer an important opportunity to investigate such factors in conditions of relative systemic isolation. We quantitatively investigate a shortlist of main factors impacting renewable energy (RE) transition in SIDS through a comparative study based on a time-series cross-sectional dataset of 3 countries (Barbados, Jamaica, and Mauritius) between the 2000 to 2018 timeframe.

Our findings shed new light on the leading factors impacting SIDS' GET and provides a premise for/outlines notable areas for further study beyond the SIDS context. Results suggest that the thematic factors most impacting RE uptake trends were specific to the islands' developing country contexts- overcoming poverty and resource allocation. Lower corruption levels, real debt, higher stakeholder participation, and sugar production, showed a positive statistical relationship with RE uptake. Conversely, external aid, oil prices, domestic credit, the presence of a majority state-owned utility and especially surprising national RE roadmaps showed a negative relationship with RE uptake.

We propose that factors under our identified themes could benefit from future research across a wider sample of SIDS and or other small developing countries. Especial areas of future focus should include the roles of official national RE roadmaps, domestic financing and historical context on GET.

7.1. Introduction

Small island developing states (SIDS) [1] are a diverse group of countries that share common overarching vulnerabilities that provides scope for mutual learning (Herbert, 2019; OECD, 2018; IMF, 2016; Lisowska, 2016). They also provide an excellent opportunity to investigate green energy transition in developing social and economic systems with a relatively well-defined system boundary. While a certain level of homogeneity exists across the SIDS grouping, nuances within their commonalities can lead to critical differences in their overall adaptive capacity (Herbert, 2019; de Coninck, et al., 2018; Nurse, et al., 2014), and thus by extension their respective green energy transition (GET) experiences. Although existing diffusion of green innovation and sustainability transitions research provide a general basis for exploring SIDS' GET experiences, this is largely derived from developed and large developing country contexts (Ramos-Mejia, et al., 2018; Wieczorek, 2018). Consequently, conditions more or less unique to small developing countries, have been overlooked by scholars, with the main focus instead on factors related to environmental sustainability or production-consumption systems (Ramos-Mejia, et al., 2018).

Unlike their developed country counterparts, SIDS exhibit distinctive characteristics due to their shared isolated geographies, socio-economic, political, and environmental vulnerabilities (Briguglio, 2016). For instance, market imperfections, social exclusion (Ramos-Mejia, et al., 2018), high exposure to external economic shocks, insularity and geographic remoteness, high proneness to natural disasters, a high degree of trade openness, among others, are commonly cited factors (Briguglio, 2014). Consequently, such countries would particularly benefit from greater focus on factors linked to the economy, politics, institutions, ideology, and foreign policy (Kern & Rogge, 2016; Foxon, 2011; Kern, 2011; Meadowcroft, 2011; Meadowcroft, 2009).

Approximately 90 percent of SIDS' energy used comes from oil imports (UNEP, 2014). Energy-mix diversification and the proliferation of renewable energy resources are included in the sustainable development agenda of almost all SIDS, both individually and collectively via global networks such as AOSIS (IRENA, 2018b; Ourbak & Magnan, 2018; Surroop, et al., 2018). Even those SIDS which are considered more closely related in terms of socio-economic and demographic indicators such as Barbados and Mauritius

(The World Bank Group, 2018; Briguglio, 2014), depict notable differences in their green energy transition (GET) outcomes. However, limited evidence-based knowledge exists that helps to explain for such variations in GET outcomes across varying SIDS contexts (Nurse, et al., 2014). GET in this article refers to the adoption (or uptake) of renewable energy (RE) technologies, gauged via the proxy RE electricity generation (Gwh). In this study we specifically explore the research question: to what extent have identified GET factors impacted the uptake of renewable energy electricity generation across SIDS?

We build upon diffusion (e.g. Wejnert, 2002) and sustainability transitions scholarship (e.g. Ramos-Mejia, et al., 2018; Geels & Schot, 2007; Kemp, et al., 2005), focusing on the three relatively similar SIDS countries of Barbados, Jamaica, and Mauritius (Briguglio, 2014). These countries have explicitly expressed GET ambitions at both the international and national levels, as part of their sustainable development agenda (UNFCCC, 2015). We empirically investigate the impact of their salient GET factors on RE uptake over time. To do so, we conduct a twofold analysis of a time-series cross-sectional (TSCS) aggregate panel dataset. The dataset tested is based upon a shortlist of GET factors identified from existing diffusion and sustainability transitions literature, and our own previous research conducted. This approach allowed us to test the effects of identified GET factors at two levels: within countries over time, and between countries.

The rest of this article begins with our conceptual framework. This reviews existing academic assumptions alongside relevant findings previously reported, and our own primary data collected on SIDS GET experiences. From this we form several main hypotheses which we test empirically (of which 4 were accepted and 5 rejected based on our main TSCS results). We go on to outline our findings and assumptions from exploratory descriptive statistics. This is followed by our main results from analysis conducted on our TSCS panel dataset, that includes information from all 3 countries between 2000 and 2018. Lastly, we briefly discuss longitudinal evidence presented, from which we make brief conclusions explaining major renewable energy electricity generation trends observed across the three case countries examined.

7.2. Conceptual Framework and Hypotheses

7.2.1. Main Assumptions on the Factors Impacting GET Success

Diffusion of innovation scholars have identified a broad array of contextual variables that can significantly influence the probability of whether or not an innovation will be adopted (Rogers, 2016; Wejnert, 2002; Rogers, 1962). For instance, geographic settings, societal culture, political conditions, globalisation, and uniformity (Wejnert, 2002) are factors typically cited. In addition, it is understood that the "relative weight of each variable may change according to the circumstances characterising the innovation and its context" (Wejnert, 2002, p. 318).

Through the lenses of existing sustainability transitions and diffusion of innovation scholarship, progress towards green energy transition (GET) is understood as resulting from "alignment between technological and socio-economic elements such as user preferences, practices, prices, rules and regulations" (Berkhout, et al., 2010, p. 267), as well as with ecological and cultural context (Wejnert, 2002). Furthermore, transition trajectories appear to be mainly determined by shared problems, long term goals, visions, and learning-process, rather than the trajectory of technologies or technological systems (Loorbach & van Raak, 2006).

Findings from available country assessments, reports, and our own primary data[56] collected, cite the influence of up to 42 factors (see annex 1) that fell under three main themes relevant to understanding GET outcomes within SIDS contexts. Two of these overarching themes were similarly observed across the wider literature as also relevant to developed and large developing countries. Namely, (i) climate governance i.e. the extent to which rules and regulations allow stakeholders to participate, including civil society participation, and ii) transition context i.e. effective planning and coordination (e.g. a renewable energy roadmap), and changes in global oil prices.

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[56] Interview feedback from Barbadian respondents was represented by the code $BB_{1\ldots n}$ and Mauritian respondents were represented by the code $MS_{1\ldots n}$.

However, the sub-theme of ‘national capacities’ (or lack thereof) was distinct to the SIDS cases examined or was less prevalent within the wider literature. Under this theme arose factors related to (i) overcoming poverty- i.e. access to external resources (e.g. development assistance), and (ii) resource allocation- i.e., corruption levels. Guided by the three identified overarching themes and primary research conducted, we investigate up to 9 hypotheses. Our propositions seek to empirically test the relationship of up to 10 exogenous variables on our endogenous variable of interest- RE electricity generation (Gwh) in Barbados, Jamaica, and Mauritius.

7.2.1.1. Climate Governance

Actor Participation

As part of the response to climate change (IRENA, 2018b; UNFCCC, 2015), green energy transition (GET) within SIDS will inevitably entail complex inter-relationships between stakeholders and forms of societal coordination (i.e. climate governance). According to Hanhel (2015, p. 37) and Hooghe & Marks (2001), a more participatory [8] green transition governance landscape can potentially be more efficient than a more centralised one. This is because increased participation is assumed to result in reduced inequality between actors in decision-making, and the distribution of the burdens and benefits of economic activity (Hanhel, 2015, p. 37). Such participation will include respective roles for a range of different institutions and actors from the public sector, private sector, and civil society (Frohlich & Knieling, 2013; UNEP, UNDESA and FAO, 2012). For instance, in the form of political action and regulatory reform (Kohler, et al., 2019; Yang, et al., 2019; Edmondson, et al., 2018; IMF, 2016), as well as key adaptation leaders and advocates (IPPC, 2014; Spash, 2012; Unmussig, et al., 2012). Through hypotheses 1 and 2 we explore if stakeholder participation in the energy sector affects RE uptake. Specifically, via the exogenous variable rule enforcement (i.e. the extent to which existing rules and regulation enable stakeholder participation), hypothesis 1 tests the dependency on RE electricity generation (Gwh) for controlling overall participation within the RE sector measured as either partially participatory or non-participatory [2].

Hypothesis 1. A partially participatory rule enforcement landscape leads to higher renewable energy uptake in Barbados, Jamaica, and Mauritius.

Through hypothesis 2 we test whether changes in civil society participation leads to significant changes in RE electricity generation (Gwh).

Hypothesis 2. Higher civil society participation leads to higher renewable energy uptake.

Resource Allocation

The roles played by the government within SIDS' energy sector have been emphasised as especially crucial to RE advancement (Francis, 2018; Konold, et al., 2015; Barrett, et al., 2013). Synthesised results from our own previous research conducted [3] support these findings. Interview subjects identified the government as the most important actor driving green energy advancement (stakeholder interviews, Mauritius 2019; stakeholder interviews, Barbados 2018). Good governance can influence a country's GET progress (Tita, 2014; Boto & Biasca, 2012). Specifically, public management can be an important area in societal transformation via the presence of relevant and quality public services (Boto & Biasca, 2012; UNEP, UNDESA and FAO, 2012).

However, the development of SIDS' renewable energy resources have been hindered by weak institutional mechanisms (UNEP, UNDESA and FAO, 2012). The effective coordination of climate-related finances, such as towards green energy transition goals, requires adequate administrative capacity (IMF, 2017). Furthermore, SIDS' small market sizes enhance the effect actors can have on the transition landscape (The World Bank, 2019). This may be due to the existing distribution of power, or actors' ability to participate in the transition (The World Bank, 2019). A lack of transparency in the form of "shady deals, weak enforcement of rules and other illicit practices" (Transparency International, 2018) can potentially undermine GET efforts.

Conversely, Li and Jun Wu (2010) argue that in countries with a relatively high level of trust, corruption tends to be more "efficiency enhancing" than corruption in countries with a relatively low level of trust, which tends to be more predatory and thus, inefficient (Li & Jun Wu, 2010). In small countries such as SIDS, where institutional capacity is often a key constraint (Ourbak & Magnan, 2018; United Nations, 2015), corruption in the form of bribes, nepotism etc., can similarly aid to speed up deals and overcome lengthy or excessive bureaucratic procedures.

“Theoretical studies suggest that corruption may counteract government failure and promote economic growth in the short run [4], given exogenously determined suboptimal bureaucratic rules and regulations” (Eatzaz, et al., 2012, p. 278). The impartial administration attribute measures fair and predictable public administration. It does so via 5 sub-indicators indicating corruption levels (see annex 2) (International IDEA, 2019a). These collectively measure the extent to which the executive, and public administration more broadly, do not abuse office for personal gain (International IDEA, 2019a). Scoring runs from 0 to 1, impartial administration scores closer to 1 represent less corruption and vice versa (International IDEA, 2019b). Through hypothesis 3 we test the extent to which corruption levels have had an impact on RE electricity generation (Gwh).

Hypothesis 3. A higher impartial administration score leads to higher renewable energy uptake

7.2.1.2. National Capacities: Overcoming Poverty

It is especially crucial to consider concepts of poverty and poverty alleviation when examining sustainability transitions within developing country contexts (Ramos-Mejia, et al., 2018). Small states such as SIDS often have limited capacity to harness growth opportunities (Commonwealth Secretariat, 2018; World Bank, 2016) such as those pertaining to renewable energy. Systemic and structural socio-economic challenges faced by small states limit their ability to effectively respond to climate change related ambitions (IMF, 2017); (stakeholder interviews, Mauritius 2019; stakeholder interviews, Barbados 2018 [4]). Ramos-Mejia et al. (2018) emphasise the importance of acknowledging these countries’ ability to counteract processes of poverty reproduction and capability deprivation in the process of social transformation (Ramos-Mejia, et al., 2018). In this regard, varying country reports have highlighted national debt as a main obstacle to SIDS’ GET progress (IMF, 2017; Espinasa, et al., 2015; Ochs, Alexander, et. al., 2015). In 2014, several SIDS’ debt to GDP ratio was approximately 57% compared to 44% in other middle and low-income countries (Chen, 2017). SIDS’ heavy reliance on fossil fuels has worsened trading deficits and debt problems. For example, in the

Caribbean region island states hold outstanding loans to oil exporters, like Venezuela, valued at as much as 10% of GDP (Chen, 2017). Through hypothesis 4, we test whether changes in national debt leads to changes in RE electricity generation (Gwh).

Hypothesis 4. Lower debt per capita (US$) leads to higher renewable energy uptake.

Resources supporting the response to climate change are often fragmented in nature (IMF, 2017). Finances can come from multiple sources like international financial institutions, bilateral and multilateral mechanisms, climate funds utilised alongside national development assistance agencies (i.e. official development assistance or ODA), or other regional, and national funds (IMF, 2016). For example, in our preliminary research Mauritian interviewees highlighted the importance of domestic resources in supporting national GET efforts (MS3; MS6; MS11, 2019). Interview subjects also highlighted the supplemental role donor funding played (MS6; MS8; MS11; MS14, 2019). Due to limited national funds available, external or international financing and grants are often the main resources available to small states to address the scarcity of domestic capital (Government of Barbados, 2018; IMF, 2017; Espinasa, et al., 2015; UNFCCC, 2015; Nurse, et al., 2014); (stakeholder interviews, Mauritius 2019; stakeholder interviews, Barbados 2018). However, many SIDS also find that they increasingly do not fit into the standard development model, excluding them from much needed external support. Small vulnerable economies such as Barbados and Seychelles are considered ineligible for certain funding due to their status as “high-income threshold” countries (OECD, 2018). Consequently, the extent to which external sources such as ODA compared to other national resources impact on transition efforts, can be better understood. Hypothesis 5.1 and 5.2 tests the extent to which external finances have had a positive effect on RE electricity generation (Gwh) as compared to domestic financing sources.

Hypothesis 5.1. Higher Net ODA (US$) leads to higher RE uptake.

Hypothesis 5.2. Higher domestic credit provided to private sector (% of GDP) leads to higher RE uptake.

7.2.1.3. Transition Context

Synthesised findings from our own previous research conducted [3], suggest that over the 2000 to 2018 period, up to 4 other distinct thematic factors emerged as important when examining SIDS' GET experiences. The impact of these factors on GET have been less widely explored by researchers.

SIDS' developing country landscapes

Despite their similarities (Briguglio, 2016), Barbados, Jamaica and Mauritius depicted contrasting green energy transition outcomes. These differences could be attributed to shared but also nuanced case factors such as historical context, culture (Wejnert, 2002); (stakeholder interviews, Mauritius 2019), existing social values and norms (Rogers, 1962), circumstances and characteristics of the existing energy system in place, behaviour (IPCC, 2015) and external economic factors (Clausen & Fichter, 2019; Yang, et al., 2019; Loorbach, 2010; Kemp, et al., 2010; Loorbach, 2007; Rogers, 1962).

The socio-economic shift out of colonisation is an experience shared by all three case countries examined. This shift bore different implications on each countries' sugar industry, which historically has been an important sector in terms of both employment and exports (Ministry of Energy & Water Resources, 2019; Government of Mauritius, 2017; Bandy, 2016). For many SIDS, commercial biomass has become an important source of renewable energy, mostly in the form of bagasse from the production of sugarcane (UNEP, UNDESA and FAO, 2012, p. 17); (stakeholder interviews, Mauritius 2019).

Hypothesis 6. Higher sugar production (tonnes) leads to higher renewable energy uptake.

External and national market conditions

For many SIDS, the pursuit of renewable energy is driven by a desire to reduce their dependence on imported fossil fuels (Government of Barbados, 2018; IRENA, 2016a; IRENA, 2016b; UNFCCC, 2015); (stakeholder interviews, Mauritius 2019; stakeholder interviews, Barbados 2018). These countries "are highly dependent on imported oil and other fossil fuels for transport and electricity generation" leaving them highly exposed to exogenous shocks from oil-price and supply volatility (Briguglio, 2014; AOSIS, 2012, pp. 1-2; Briguglio, 1995). Hypothesis 7 tests the extent to which dependence on imported fossil fuels, via changes in the global oil price (average US$/barrel), has had an impact on RE electricity generation (Gwh).

Hypothesis 7. A higher global oil price (average US$/barrel) leads to higher renewable energy uptake

For all three case countries the utility was identified as one of the most important actors shaping RE uptake (stakeholder interviews, Mauritius 2019; stakeholder interviews, Barbados 2018); (Doris, et al., 2015; Barrett, et al., 2013) alongside the government, private sector, and civil society. For instance, through its overall attitude towards REs (BB4; BB5; BB6, 2018; MS8, 2019), policies impacting RE integration (BB1; BB2; BB6; MS4), as well as on wider participation via access to the electricity grid (BB2; BB6, 2018; MS9; MS11, 2019). According to Rothaermel (2001), sustainability transitions tend to be required in domains characterised by large firms such as electric utilities which possess complementary assets such as access to distribution channels, service networks and complementary technologies (Geels, 2011). These assets give incumbent firms strong positions and these firms are often first to develop environmental innovations.

Despite this, large incumbent firms tend not to be the initial leaders of sustainability transitions, but their involvement may accelerate their breakthrough where they support innovations through their complementary assets and resources. However, this requires a strategic reorientation of incumbents (Geels, 2011). For instance, in Barbados, the utility has been a recognised leader in promoting renewable energy technologies (Espinasa, et al., 2016). However preliminary findings also suggested that the utility’s impact on RE uptake could vary according to its ownership status. Our previous research demonstrated that for Mauritius, state ownership of the utility led to wider participation in large-scale RE generation activities, albeit under modest national RE ambitions. On the other hand, private utility ownership in Barbados equated to much more ambitious RE targets set but limited decentralisation within the RE sector. Hypothesis 8 tests the dependency on RE electricity generation (Gwh) for controlling utility ownership status as either majority state- or private-owned.

Hypothesis 8. Majority state utility ownership leads to higher renewable energy uptake.

To achieve both environmental and economic goals, it is widely acknowledged that a roadmap for the development and diffusion of environmentally friendly technologies combined with a coherent and effective governance framework is required (Crespi, 2016). This principle proves especially relevant for SIDS like Barbados, Jamaica, and Mauritius who have been in pursuit of green energy transition ambitions strongly centred on the uptake of RE technologies (Ministry of Energy & Public Utilities, 2019; Government of Barbados, 2018; Planning Institute of Jamaica, 2018). Both Barbadian and Mauritian national stakeholders identified the presence of an RE roadmap as beneficial to the GET process (BB2, 2018; MS4; MS5; MS11; MS13, 2019). Hypothesis 9 tests the dependency on RE electricity generation (Gwh) for controlling presence of a renewable energy roadmap as either in place or not in place.

Hypothesis 9. Presence of a renewable energy roadmap leads to higher renewable energy uptake

7.3. Research Design

Our study is a comparative one which examines cross-sectional variation. We also look at longitudinal data within countries over time. Analysis of cross-sectional variation tends to be done according to two types: between individuals (type 1), and between countries (type 2). Where longitudinal sources are also examined, this can be done for individuals over time (type 3), and within countries over time (type 4) (Christmann, 2018). At the contextual or country level, we analyse a time-series cross-sectional (TSCS) panel dataset of 3 SIDS between 2000 and 2018 (type 2 and 4). This allows us to assess which changes in the GET factors shortlisted, led to changes in RE electricity generation at the national level.

This article is based on existing academic assumptions of the main factors that impact green energy transition (GET) outcomes in developed and large developing countries. It is also based on our own previous research conducted exploring this topic specifically within SIDS (document analysis and primary data collection). We identified 10 main factors commonly important to GET outcomes across the three SIDS cases. Ceteris paribus, we explore the empirical impact of these factors on renewable energy (RE) electricity generation in gigawatt hours (our proxy indicator for GET outcome). Ramos-Mejia et al. (2018), highlight that distinctive characteristics of developing countries such as “ill-functioning institutions” and “market imperfections”, shape their transition experience. In our analysis, we similarly assume that SIDS’ contextual characteristics help account for RE generation trends observed. Specifically, we control for 3 variables over time: rule enforcement, utility ownership status, and RE roadmap.

Data availability determined our small N sample size (i=3=country) chosen to be examined. Small island developing countries generally lack data for comprehensive climate change and socio-economic projections (Scobie, 2016). To ensure robustness of our conclusions, we adopted a similar approach to section 3.2 of Isensee, et al.’s (2020, p. 4) data extraction and analysis. In our study we employ a dual method of conducting thematic analysis both manually (via template analysis (King, 2004)- see results in appendix 6) and automatically via n-gram analysis using the tm package 0.7-8 (Feinerer

& Horni, 2020; Fenierer et al., 2008) in R 3.6.3 (R Core Team, 2020) statistical software, see results in appendix 7.

Secondary data alongside empirical research (field work) entailing primary data collection and document analysis, informed our choice of thematic category factors to quantitatively explore. Barbados, Jamaica, and Mauritius proved to be suitable case countries due to their more readily accessible data availability compared to other SIDS. They also shared relatively similar political, socio-economic, and environmental conditions (Briguglio, 2014). Despite some missing data, our dataset is strongly balanced, given most of the values were available for each exogenous variable, for the timeframe examined. Hence, we considered the compiled dataset sufficient to begin an empirical exploratory analysis to test our research question and corresponding hypotheses.

The indicators analysed in this paper are:

Y = Renewable Energy Electricity Generation (Gwh)

X_i = set of *i* exogenous variables, which include:

control variables for national conditions	
Rule Enforcement	*X_8(hypothesis 1)*
Utility Ownership Status	*X_9(hypothesis 8)*
Renewable Energy Roadmap	*X_4(hypothesis 9)*
variables measuring national capacities	
Real Debt in 2015 terms (US$)	*X_1(hypothesis 4)*
Real Net Official Development Assistance in 2015 terms (US$)	*X_2(hypothesis 5.1)*
Domestic Credit Provided to Private Sector (% of GDP)	*X_5(hypothesis 5.2)*
variable measuring transition context	
Sugar Production (tonnes)	*X_3(hypothesis 6)*
variables measuring other national and external conditions	
Civil Society Participation	*X_6(hypothesis 2)*
Impartial Administration	*X_7(hypothesis 3)*
Real Global Oil Price in 2015 terms (average US$/barrel)	*x_{10}(hypothesis 7)*

The hypotheses were tested through fixed and random effects panel regressions. The Ordinary Least Square (OLS) regression model (please see appendix 9 for regression code details) was specified as follows:

Equation 1 Ordinary Least Square (OLS) regression model

$$y_{it} = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \dots \beta_k x_k + u_{it}$$

Where y_{it} (i=country and t=2000-2018) is Renewable Energy Electricity Generation and $x_{1\dots k}$ is the exogenous variable with $\beta_{1\dots k}$ being the coefficient for that variable. The model disturbance is u_{it}.

With the equation for the fixed effects model becoming:

Equation 2 Equation for the fixed effects model

$$y_{it} = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \dots \beta_k x_k + \alpha_i + u_{it}$$

Where α_i (i=1…n) is the n entity specific intercept.

and the random effects model being:

Equation 3 Equation for the random effects model

$$y_{it} = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \dots \beta_k x_k + \alpha + u_{it} + \varepsilon_{it}$$

Where ε_{it} is the within-entity error, and u_{it} is the between-entity error.

Our investigative approach allowed us to comparatively gauge the extent to which the specified exogenous variables were correlated to the 3 countries' GET outcomes (RE electricity generation over time in Gwh). This was done over a timeline for which data was most readily available for all variables – the 19-year period of 2000 to 2018.

7.4. Data and Measurement

The endogenous (or dependent) variable, RE electricity generation (Gwh), is measured using 2000 to 2018 data sourced from the International Renewable Energy Agency's (IRENA) 'Trends in Renewable Energy' online database. These records provide electricity generation (Gwh) at the country level, cumulatively broken down by up to 12 renewable energy technology types (e.g., marine, geothermal, offshore wind, mixed plants, etc.). Data can be further disaggregated by grid connection: on-grid, and off-grid. The data we used reflects both on-grid and off-grid RE uptake for up to 5 RE technology types (biogas, solid biofuels, solar photovoltaic, onshore wind, and renewable hydropower).

In total, we retrieved data for the three countries of Barbados, Jamaica, and Mauritius, compiled in a time-series cross-sectional (TSCS) panel dataset. This includes information for 57 country-years, with 19 observations per country. This represented a regional coverage of two Caribbean, and one African SIDS. For our exogenous (or independent) variables we sourced data from up to 6 different databases. Due to SIDS' limited data availability, it was necessary to utilise a number of different datasets. Data sources referenced included: countryeconomy.com, World Bank Open Data, knoema.com, idea.int, reeep.org and statista.com [5].

Where necessary, thematically synthesised findings of primary (feedback from 46 interview subjects) [3], and secondary data (via document analysis of country reports, and policy documents) were also referenced. This provided source data for the categorical exogenous variables of rule enforcement, utility ownership status, and renewable energy roadmap. Each observation in our model represents the recorded total RE electricity generation (Gwh) per year, given changes in 10 key exogenous variables (see appendix 8 for dataset details), recognised by national stakeholders as important influencers on RE uptake over time (2000 to 2018).

7.4.1. An Overview of National RE Uptake Trends

As of the year 2018, Barbados was approximately 9.5 percentage points (p.p.) behind its estimated benchmark renewable energy (RE) generation target, compared to Jamaica and Mauritius who were both approximately 8 p.p. and 10 p.p. ahead of their own targets respectively (see table below) [6].

Table 14 Overview of Renewable Energy Uptake in Barbados, Jamaica, and Mauritius, as of the year 2018

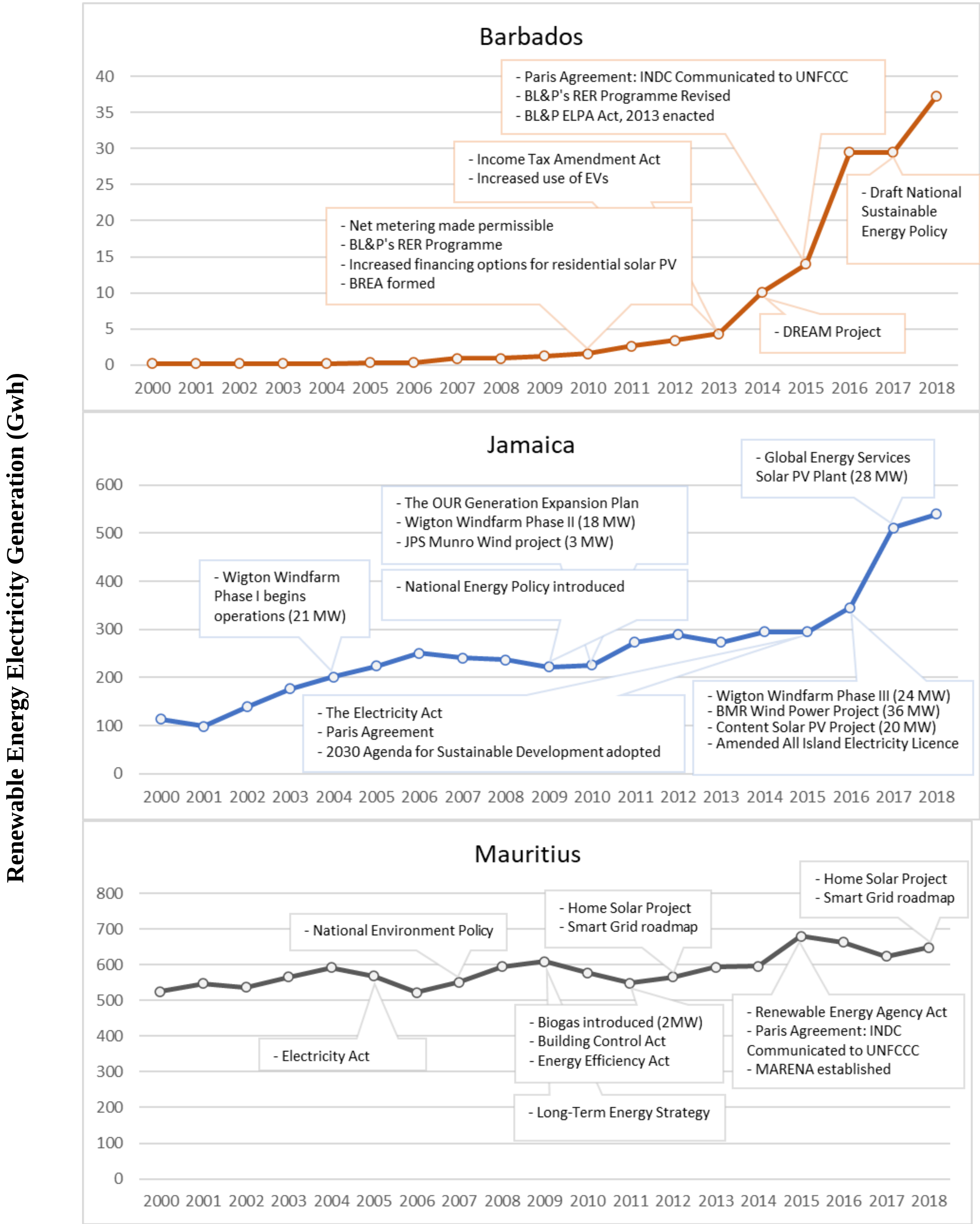
Country	2018 Gross Electricity Production (Gwh)	Renewable Power Generation (Gwh)	2018 Renewable Energy Share of Electricity Production (%)	National RE Electricity Target (Base year 2015)	Indicative RE Target Progress (as at 2018)	2018 Progress Benchmark*
Barbados	1071	37.3	3.5%	65% by 2030	-9.5%	13%
Mauritius	3132	648.7	20.7%	35% by 2025	10%	11%
Jamaica	4355	540	12.4%	20% by 2030	8%	4%

Note*: The base year of 2015 was used to calculate 2018 progress benchmark, determined by the year countries submitted their Nationally Determined Contributions (NDCs) to the United Nations Framework Convention on Climate Change (UNFCCC).

Data Sources: (IRENA, 2019; Ministry of Energy & Public Utilities, 2019; CCREEE, 2018; MARENA, 2018; United Nations, 2017; Government of Barbados, 2015).

In Fig. 14, the three case countries are all seen to depict distinctive RE uptake trends over time.

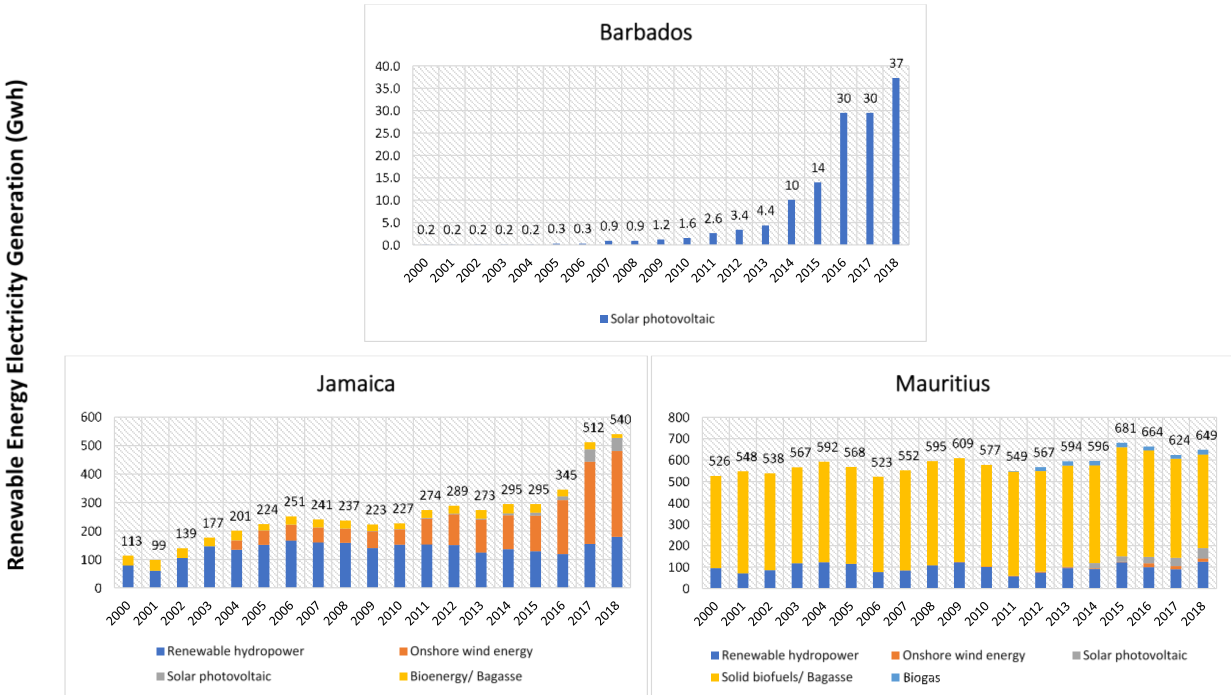
Figure 16 Timeline Trends of RE Electricity Generation (Gwh), Outlining Country Policy Setting, 2000 to 2018



Data Sources: (IRENA, 2019; MARENA, 2018; TAPSEC, 2018a; TAPSEC, 2018c; PAGE, 2015; Republic of Mauritius, 2009; Republic of Mauritius, 2005).

Barbados' RE electricity generation, which was solely sourced from solar PV (see figure 16), remained practically stagnant until it more than doubled in the years 2014, and then again in 2016. The country's 2014 RE value was preceded by the introduction of the Income Tax (Amendment) Act, and increased use of electric vehicles (EVs) in 2013. In 2014, the Disaster Risk and Energy Access Management (DREAM) Project promoting decentralized solar photo-voltaic electricity generation then commenced (UNDP, 2021). In 2015, several notable developments similarly preceded Barbados' 2016 RE value. This included enactment of the Barbados Light & Power (BL&P), Electric Light and Power Act (ELPA), 2013, and revision of BL&P's renewable energy rider (RER) Programme (see figure 15).

Figure 17 Timeline Trends of RE Electricity Generation (Gwh) by Renewable Energy Source, 2000 to 2018



Source: (IRENA, 2019)

Jamaica's RE uptake was seen to steadily increase over the observed 19-year period. Introduced in 2004 via the Wigton Windfarms government project, by the year 2018 onshore wind represented the majority share (56%) of the country's RE electricity generation (see figure 16). In 2017, it showed its biggest increase by around 48% from the previous year. In 2016, the government amended the All-Island Electric Licence allowing for the wider private sector participation in utility-scale RE projects (see figure 15). New independent power producers (IPPs) who emerged included the Content Solar PV Project (20 MW of installed capacity) in 2016, and the Global Energy Services Solar PV Plant (28 MW) in 2017.

Until the year 2015, Mauritius' RE electricity generation steadily ranged between 520 Gwh to 610 Gwh. Dips observed in RE uptake during those 15 years were largely associated with declines in either, or both RE electricity generation from renewable hydropower, and bioenergy (i.e., in the years 2002, 2006, and 2011- see figure 16). In 2015, Mauritius' total RE generation demonstrated a notable rise by 14%. That year, both bioenergy and renewable hydropower significantly increased by approximately 11%, and 34% respectively. In 2015, several relevant developments took place which included introduction of the Renewable Energy Agency Act (see figure 15).

Figures 15 and 16 show us that despite their similarities, SIDS countries can experience very different national trajectories in RE electricity generation. However, all three countries also give indication of notable increases in their RE generation (i.e., by > 25 %) around the years when changes in their enabling framework, and or market conditions took place. Overall, trends allude that changes in enabling framework, and market conditions can help account for case discrepancies between countries' GET outcomes.

7.5. The Measured Effect of SIDS-related GET Factors on Their RE Uptake

7.5.1. Descriptive Statistics

Summary statistics (seen in table 14) depict a high standard deviation for RE Uptake between the three countries of 248.46. This indicates that the data is dispersed over a wide range of values. For instance, the minimum RE uptake of 0.16 observed in Barbados is much lower when compared to the min values observed in Jamaica (98.6 Gwh), and Mauritius (522.7 Gwh). Similarly, the maximum value of RE uptake also varies largely between Barbados and the other two countries, from 37.3 in Barbados, to 540 in Jamaica, and 680.7 in Mauritius. Large standard deviations are also observed for the exogenous variables of real debt (6,759.12), real NDA (46,000,000), sugar production (1,800,000), and domestic credit (27.51). This confirms that, despite being considered countries of similar vulnerabilities and socio-economic settings (Briguglio, 2016), SIDS can depict drastically different GET landscapes and RE outcomes.

Table 15 Descriptive statistics and pairwise correlations (considering all three countries)

	Mean	S.D.	Min	Max	RE Uptake	Real Debt	Real NDA	Sugar production	Domestic credit	Civil Society Part.	Impartial Admin.	Real GOP
RE Uptake	284.27	248.46	0.16	680.70	1							
Real Debt	8,262.63	6,759.12	1,849.32	28,543.42	-0.5750*	1						
Real NDA	46,900,000.00	46,000,000.00	-11,400,000.00	174,000,000.00	0.4551*	-0.2476	1					
Sugar production	2,110,000.00	1,800,000.00	83,369.00	5,790,000.00	0.8881*	-0.6310*	0.2963	1				
Domestic credit	59.98	27.51	13.00	106.30	0.2559	0.3689*		0.2442	1			
Civil Society Participation	0.66	0.06	0.56	0.73	0.5547*			0.5343*	0.6651*	1		
Impartial Admin.	0.61	0.05	0.52	0.69	-0.9136*	0.5316*	-0.3122	-0.9603*	-0.4008*	-0.5730*	1	
Real GOP 2015	57.7	29.13	17.6	104.45		0.332	0.4887*		0.2625			1

Note: values are listed only if correlation coefficients are higher than 0.2, and we use * for all correlation coefficients significant at the 90% level. All variables have been log transformed.

The pattern of pairwise correlations is largely consistent with previous research, as well as our preliminary analysis. Firstly, they align with the assumption that overall, debt relates negatively to renewable energy uptake ($r = -0.5750$, $p < 0.1$). Secondly, external finances (real NDA) ($r = 0.4551$, $p < 0.1$) have a more significant impact on RE uptake as compared to domestic financing sources (domestic credit) (an r of no statistical significance). Thirdly, higher sugar production leads to higher RE uptake ($r = 0.8881$, $p < 0.1$). Fourthly, higher civil society participation leads to higher RE uptake ($r = 0.5547$, $p < 0.1$). Lastly, contrary to our initial expectations but in line with writers such as (Eatzaz, et al., 2012; Li & Jun Wu, 2010), that higher corruption (impartial administration) leads to higher renewable energy uptake ($r = -0.9136$, $p < 0.1$).

7.5.2. Aggregate time-series cross-sectional (TSCS) panel dataset

Initially, to test our hypothesis on the role of climate governance, national capacities and transition context we fit two models, one with fixed effects and another with random effects. All continuous variables underwent a natural logarithm transformation aiming to resolve heteroskedasticity problems. We employed the Hausman test to determine the most appropriate model. Our initial results rejected the random-effect assumption (Wang & Chen, 2014, p. 86; Wooldridge, 2002, p. 288), thus we used fixed-effect models. We present these results in Table 15, column 1 (model 1 or M1).

Largely in line with our initial correlational results, at least 6 exogenous variables from our dataset support the evidence of a variation in the regressand due to 1 unit change in the regressors we were interested in (other things being equal). However, under M1, results for 4 of these exogenous variables were unexpected compared to our initial hypotheses made. Moreover, concerns regarding an inflated adjusted R^2 motivated us to do additional transformations to our continuous variables to deal with across-time autocorrelation (Bell, et al., 2018; Gurka, et al., 2012).

In Table 15, column 2 (i.e. M2), we report results using a baseline year with respect to 2000 levels, and in columns 3 and 4 (i.e. M3), a growth rate transformation was used. The Hausman test for model 2 (M2) rejected the random-effect assumption, thus we only present M2 fixed-effect model results. Conversely, for model 3 (M3) the random-effect assumption was accepted. Both results from the M3 model appeared to depict the least inflated adjusted R^2 results. In addition, the results for most of our variables under M3 were consistent, that is, regardless of being random or fixed we had the same direction of relation for the variates and covariate. We present both fixed and random effect results for model 3.

Table 16 The effect of SIDS-related [7] GET Factors on RE uptake in Barbados, Jamaica, and Mauritius - country level baseline regression results.

	Fixed Effects			*Random Effects*
	M 1	**M 2**	**M 3**	**M 3**
Variables				
Real Debt 2015	0.705*	12.066	0.022	0.325
	(0.3)	(9.4)	(0.7)	(0.7)
Real NDA 2015	-0.021	-1.577*	-0.055***	-0.052***

	(0.1)	(0.7)	(0.0)	(0.0)
Sugar production	-1.339***	-53.440	0.140	0.113
	(0.3)	(48.4)	(0.3)	(0.3)
Domestic credit	0.000+	-7.413	-0.056	-0.143
	(0.0)	(33.7)	(0.4)	(0.4)
Real GOP 2015	-0.003	-10.467*	-0.045	-0.158
	(0.0)	(4.1)	(0.2)	(0.2)
RE roadmap	-0.567***	12.646	-0.203+	-0.225+
	(0.2)	(14.3)	(0.1)	(0.1)
Rule enforcement	-0.503**	-17.758	0.186	0.156
	(0.2)	(14.9)	(0.2)	(0.2)
Utility Ownership	-0.648*	-74.923**	-0.352+	-0.080
	(0.3)	(24.6)	(0.2)	(0.1)
Civil Society Participation	0.084***	0.492	-0.002	0.015
	(0.0)	(1.2)	(0.0)	(0.0)
Impartial Administration	0.005	8.854	0.051	0.038**
	(0.1)	(5.3)	(0.1)	(0.0)
Constant	11.796+	-519.911	-2.532	-3.053*
	(6.8)	(312.6)	(3.4)	(1.2)
Observations	50	52	50	50
R-squared	0.93	0.73	0.48	0.43
Hausman	32.49	10.55	4.14	
Number of i	3	3	3	3

Standard errors in parentheses
**** p<0.001, ** p<0.01, * p<0.05, + p<0.1*

Note: See appendix 8 for dataset details.

Based on our final R^2 value and Hausman test results, we examine our M3 random effects outputs. Somewhat in line with our initial assumptions, correlational results suggested that factors related to 2 main thematic areas were most significantly correlated to RE uptake in Barbados, Jamaica, and Mauritius. These were: overcoming poverty (Real NDA), followed by resource allocation (impartial administration). The results for both variables were in line with our initial hypotheses.

Although not statistically significant, results for another 3 exogenous variables suggested a relationship with RE uptake in line with our initial hypotheses made. These variables were associated to the thematic areas of climate governance (rule enforcement and civil society participation), and SIDS' developing country landscape (sugar production). Conversely, outputs for up to 5 exogenous variables were unexpected compared to our initial hypotheses made. These were the variables associated to the themes of overcoming poverty (domestic credit and national debt), and SIDS' national and external market conditions (Real GOP 2015, utility ownership and RE roadmap).

Below, our M3 random effect results (based on growth rate transformation) are thematically reviewed in order of highest to lowest impact on the regressand. In our discussion, our statistical results are supplemented with previous relevant primary data findings from document analysis and the thematic coding of expert interviews conducted (see chapter 3, sections 3.3.2. and 3.3.3.). Interview feedback from Barbadian respondents was represented by the code $BB_{1...n}$ and Mauritian respondents were represented by the code $MS_{1...n}$.

7.5.2.1. National Capacities: overcoming poverty

A Higher Reliance on Donor Funding Negatively Impacted RE Uptake

Real NDA was one of three exogenous variables used to gauge national capacity to transition. Model results support the evidence of a variation in the regressand RE uptake due to 1 unit change in the regressor Real NDA. Real Net Official Development Assistance was one of only two exogenous variables that indicated a statistically significant covariance with RE uptake. This supported our assumption that external or international financing and grants impacted the SIDS' RE uptake over the 2000 to 2018 period (hypothesis 5.1). However, the suggested direction of the relationship between Real NDA and the regressand was unexpected. Namely, that higher Real NDA negatively affects RE uptake. Whilst our results are surprising, our findings can be explained by primary feedback gathered directly from RE stakeholders interviewed as well as related to existing literature.

Access to external resources such as international platforms and financiers was identified as an important driver to GET in both countries by national stakeholders (BB4; BB8; BB9, 2018; MS6; MS8; MS11; MS14, 2019). However, Briguglio (2014) highlights that development support at times can do more damage than good. Our interview subjects indicated that in the case of Barbados and Mauritius, when external resources composed the majority of the crucial capacity to transition (or GET investment activity), this equated to a very limited ability to steer the overall GET process. Hence, while external resources such as donor funding can positively impact GET, where external resources outweighed internal capacity available, this resulted in an overall negative impact on GET. This could be explained by countries having less control in the design and allocation of external resources (BB5, BB7, BB15, BB16; MS2, MS7; MS10, MS16, 2019). Given the empirical significance of Real NDA on RE uptake, we propose that the variable's role in GET merits future exploration beyond this study.

Higher Domestic Credit Levels Negatively Impacted RE Uptake

Domestic credit, the second variable used to gauge national capacity to transition, showed no statistical significance on RE uptake. Furthermore, results unexpectedly suggested that higher domestic credit provided to the private sector (% of GDP) negatively affects RE uptake. This did not provide any support for our previously stated hypothesis 5.2, which was based on our primary data analysed (see appendix 6). Specifically, initial primary empirical data analysed under document analysis (Jamaica) and from interview subjects (Barbados and Mauritius) emphasised the importance of having sufficient indigenous resources available to drive the transition. For example, government finances (MS3, 2019; Myers, 2015; Chin Lenn, 2012) and financing options readily available from local commercial banks (MS11, 2019) for large and small-scale RE systems (MS6, MS11, 2019). Although unexpected, our statistical results shed light on the possibility that other variables relevant to national capacity not incorporated into our model may have had an effect on RE uptake. Our results also allude to potentially unfavourable terms under existing domestic models when it comes to GET. We suggest our covariate alongside others measuring domestic resources warrant further exploration using a wider sample of country cases.

Higher Debt Levels Positively Impacted RE Uptake

Thirdly, despite no indication of statistical significance, results suggested that the variable relating to national debt (Real Debt 2015), had a positive relationship with RE uptake. This contrasted our hypothesis 4 assumption, that lower debt led to higher renewable energy uptake. Our primary case data[57] highlighted that barriers to RE adoption included

[57] Sourced from document analysis (Jamaica) and interview subjects (Barbados and Mauritius).

high government debt levels (BB1; BB4, 2018); (Myers, 2015; Chin Lenn, 2012), high levels of household debt (BB4; BB6; BB7; BB16; BB19, 2018) and many overindebted small and medium-sized enterprises (SMEs) (BB4; BB9, 2018). Case data provided some level of insight into the unexpected positive statistical relationship we observed between national debt and RE uptake. In Jamaica, where the majority of GET investment activity was state-dominated, high government debt stimulated innovation in how the transition was financed. Here, high debt led to the government using blended financing models which helped to increase RE uptake (see chapter 4, section 4.5.3.2.). Whereas in the cases of Barbados and Mauritius where the private sector was expected to make or had made major investments into financing GET, issues of debt were more important at the micro (households and SMEs) rather than macro level (government).

From our combined primary and statistical results, we infer that when GET is state dominated, higher debt led to innovation in financing the transition and hence a positive statistical relationship between debt and RE uptake. Our data further suggests that when the private sector plays a significant role in financing GET, debt at the micro level may have a more significant impact on RE uptake than debt at the macro level. That is, the impact of debt on RE uptake may be determined by the ratio of whether the transition is majority public or private sector financed or driven. Given the greater role of the private sector in two of our case countries' GET, this may explain why national debt (public) in our model results was statistically insignificant. Much of capacity building support in SIDS focuses on supporting government with little or ineffective support directly provided to private sector and other actors. Consequently, our findings have major potential implications on the manner in which debt related support is provided in order for it to be effective on GET outcomes. It should be noted that our qualitative and quantitative empirical data only began to reveal the relationship between debt and RE uptake. Furthermore, our regression model (due to limited time and data availability) only examined debt at the macro level. In light of its statistical significance, we propose that the role of varying forms of debt on RE uptake is a crucial area that warrants future exploration beyond this study.

7.5.2.2. Climate Governance: resource allocation

Lower Corruption Levels Positively Impacted RE Uptake

Corruption (via the impartial administration index) was the second of only two variables demonstrating to exert an effect on RE uptake with statistical significance. Less corruption (i.e. a higher impartial administration score) suggested a positive impact on RE uptake within our model. This was in line with our initial assumption under hypothesis 3, as well as with our primary case data collected and analysed on the significance of this variable on observed GET outcomes. This also aligned with existing literature by writers such as Transparency International (2018) and Tita (2014), who found that transparency and public management can be an important area in societal transformation.

Specifically, across our three cases a common barrier highlighted by our primary data was access to information on and opportunities in RE (MS3; MS8, 2019); (BB2; BB19, 2018); (OUR, 2016). For example, in Jamaica, increased RE uptake was attributed to enhanced transparency amongst electricity sector participants and an empowered regulator. On the other hand, in Barbados stakeholders interviewed complained that RE opportunities were not effectively communicated to key target groups such as the private sector (BB2, 2018) and lending institutions like commercial banks (BB19, 2018). This led to private sector entities being unaware and hence unable to access financial and other opportunities to engage in GET. In Mauritius, a major barrier to RE uptake stemmed from decisions often being "made behind closed doors" (MS16, 2019) and an energy framework which lacked a well-defined enforcing body (MS4; MS12, 2019). This resulted in government policies and procurement procedures that excluded some actors from RE sector participation (MS10; MS12; MS15, 2019). The statistical significance of corruption on our three case countries' RE uptake demonstrates the importance of further research on this area. Specifically, we suggest future research that helps to further reveal how corruption impacts on RE outcomes and the strategies that could be employed to overcome barriers faced using a wider sample of case countries.

7.5.2.3. SIDS' national and external market conditions

Higher Global Oil Prices Negatively Impacted RE Uptake

To capture the impact of case countries' national and external market conditions on RE uptake one of the variables we controlled for was changes in global oil prices (Real GOP 2015). This variable showed no statistical significance on RE uptake. However, it is still interesting to note that the direction of its relationship with RE uptake did not support our assumptions under hypothesis 7. That is, that a higher global oil price (average US$/barrel) leads to higher RE uptake. Existing literature (e.g., IRENA, 2016a) has repeatedly emphasised the dependence on high-priced fossil fuels as a key motivator for the uptake of renewable energy in SIDS. Our initial primary data from stakeholders interviewed also suggested that potential government, commercial and household financial savings due to high oil prices was a driver of GET (BB4; BB9; BB12; BB15; BB16, 2018); (MS4; MS10; MS15, 2019). However, our model results indicated that higher global oil prices negatively impacted RE uptake trends across the three cases. It is worth noting here that over the studied period global oil prices behaved quite erratically. Whilst, overall from 2000 to 2012 a steep increasing trend was observed (despite a major decrease in 2006); from then up to 2016, prices plummeted close to 2000 levels. These volatile trends increase the complexity of estimating an effect on RE uptake. We propose future research seek to further explore the empirical impact of fossil fuels on RE uptake via alternative proxy indicators e.g., fossil fuel imports or consumption, in a wider sample of cases.

A Majority State-Owned Utility Negatively Impacted RE Uptake

Secondly, the variable utility ownership was also used as a control variable of the three SIDS' national market conditions. Similarly to global oil prices, the effect of utility ownership on RE uptake depicted no statistical significance. The negative relationship between utility ownership on RE uptake rejected our assumption under hypothesis 8. That is, that a majority state-owned utility leads to higher renewable energy uptake. Wider existing scholarship and our own preliminary primary data potentially help to explain this observed relationship. Sustainability transitions literature suggests that the utility's involvement in transition can accelerate RE uptake, however this first requires a strategic reorientation of incumbents (Geels, 2011).

These results corroborate preliminary qualitative research results within this thesis compared across chapters 4 to 6 (i.e. sections 4.5.1.2., 5.4.4.4., 6.5.2. and 6.5.3.) which showed that much higher RE targets were set when the utility was majority private-owned. This behaviour aligns with existing theory under the dynamic capabilities approach. Namely, that incumbent firms are strategic actors that develop and adopt innovations based on their interests, resources, dynamic capabilities, and in relation to observed signals from the surrounding environment (Stalmokaitė & Hassler, 2020). The extent to which this holds true for the majority state- versus private- owned utilities examined, warrants further research beyond the scope of this study.

According to our study's initial primary qualitative findings, grid modernisation is another important area relating to national and external market conditions that could benefit from further research. Grid modernisation costs was a major factor identified especially in Mauritius followed by Jamaica case data as a barrier to setting higher national RE targets (see chapters 4 section 4.5.1.1. and chapter 5 section 5.4.4.4.). Specifically, grid upgrades were identified as a requirement in order to effectively integrate variable RE into the existing power infrastructure. However, our attempt to include this variable within our model (via relevant electricity grid investment costs per annum) were hampered by limited data availability. Hence, the impact of this variable on RE uptake could also benefit from future research, especially since many SIDS suffer from issues relating to outdated electricity grid infrastructure.

Roadmaps or Roadblocks? Official National RE Roadmaps Surprising Negative Impact on RE Uptake

Thirdly, we controlled for the presence of national RE roadmaps in our model as one of SIDS' national market conditions. Unexpectedly the effect of RE roadmap on RE uptake was insignificant. Our model results also surprisingly indicated a negative relationship between RE roadmaps with RE uptake. This contrasts with hypothesis 9 which was based on feedback from primary stakeholders we interviewed across Barbados and Mauritius who identified the presence of a clearly articulated vision and plan as an important driver of RE uptake (BB2, 2018; MS4; MS5; MS11; MS13, 2019). Based on our preliminary primary empirical data gathered and analysed, we can only make a limited deduction on what could explain our RE roadmap statistical results. Nonetheless, our available findings sufficiently bring into question the currently accepted assumption that a national roadmap is required for effective green transition to occur (Crespi, 2016). This assumption forms the foundation of the current and foremost global norm of designing and implementing green transition policy in a top-down manner. For example, largely conceptualised and driven via frameworks such as Nationally Determined Contributions (NDCs), Nationally Appropriate Mitigation Action (NAMAs), via arrangements such as the Barbados Declaration and SAMOA Pathway etc. The two countries in our sample where RE roadmaps were present, both adopted top-down government driven investment in early RE adoption and for most of the observed research timeline.

One explanation for our model's findings could be that a single country in our sample skewed our results. Another explanation could be that bottom-up approaches may be more effective or suitable for introducing new RE technology within SIDS' small developing country context, versus the sole or major utilisation of the top-down approach often adopted in official national RE roadmaps. We suggest that this relationship is worth further investigation in future, using a larger sample size of SIDS and with wider statistical comparisons made to other countries.

7.5.2.4. *Climate Governance: actor participation*

Wider Stakeholder Participation Positively Impacted RE Uptake

Rule enforcement (i.e. the extent to which existing rules and regulation enabled overall stakeholder participation) [2] and civil society participation were included in our model to capture how participation in the energy sector affected RE uptake. Although there was no indication of statistical significance, outputs for the two variables supported our assumptions under hypotheses 1 and 2, that wider stakeholder participation is positively related with higher RE uptake. Out statistical results generally support the initial qualitative findings within this thesis. Namely, that the GET actor landscape must have an at least partially participatory rule enforcement framework for positive large-scale RE uptake to occur (see chapter 6, section 6.6.). Partially participatory being where stakeholder participation in the renewable energy sector at minimum includes an attractive feed in tariff, interconnection standards, and either net metering/ billing, or IPPs permitted. Furthermore, higher civil society participation also positively affected RE uptake. This confirmed initial results analysed from primary stakeholder feedback under chapter 6 of this thesis (see table 12 and section 6.5.1.). Overall, our model results measuring actor participation align with existing scholarship where previous researchers have found that a more participatory [8] green transition governance landscape can potentially be more efficient than one which is state-dominated (Hanhel, 2015; Hooghe & Marks, 2001).

7.5.2.5. SIDS' developing country landscape

Sugar Production Positively Impacted RE Uptake

Sugar production (tonnes) was a variable used to gauge the effect of the three SIDS' transition context. Specifically, it served as a proxy indicator for the shared experience of a socio-economic shift out of colonisation. Despite showing no statistical significance, results did suggest a positive relationship with RE uptake. This supported our assumption under hypothesis 6 that higher sugar production leads to higher RE uptake. Existing literature (UNEP, UNDESA and FAO, 2012, p. 17) highlights the important role that commercial biomass via the sugarcane industry has played in SIDS' RE sector. Primary findings from the qualitative stage of this thesis emphasised the important contribution of Mauritius' strong sugarcane industry to its present RE advancement (MS1; MS4; MS5; MS12; MS14; MS16, 2019)[58]. Government actions to enhance competitiveness of the sugarcane sector associated to Mauritius' historical transition out of colonisation, bore a strong influence on their early RE advancements. Hence, in light of the colonial history of many SIDS, we suggest that this relationship is worth further exploration using a larger sample size of case countries.

[58] See chapter 5, section 5.4.4.

7.6. Conclusions

Combining existing scholarship with our own primary qualitative data, this article sought to empirically explore the relationship between 10 select exogenous variables related to three SIDS' contexts on their RE electricity uptake over time (RE uptake). Specifically, we used a time-series cross-sectional panel dataset that covered the countries of Barbados, Jamaica, and Mauritius during the time period 2000 to 2018. Results of this study build upon main findings from previous qualitative research conducted, which were represented under 9 central hypotheses. Our study further provides important new insights based upon our statistical results. Across the three cases, our results generally suggested that an overall partially participatory actor landscape, less corruption, the presence of a majority private-owned utility, and absence of a RE roadmap, provided conducive conditions to RE uptake during the 2000 to 2018 period.

We found that the factors most statistically significant to explaining RE outcomes in Barbados, Jamaica, and Mauritius related to 2 main thematic areas. These were: national capacities (overcoming poverty) and climate governance (resource allocation). Specifically, the variables most impacting RE uptake over the years 2000 to 2018 were external aid (or Real NDA 2015) followed by corruption (or impartial administration). Surprisingly, our statistical results suggested that higher aid flows overall negatively affected RE uptake. We found that when external resources outweighed internal GET investment capacity available, countries possessed less control of their GET design and implementation processes. This in turn, resulted in an overall negative impact on GET. We thus infer that when countries heavily rely on external resources such as foreign aid for their GET, it is important to seek out partnerships that allow them sufficient influence over how resources (both human and financial) are allocated. For our second most statistically significant variable corruption (impartial administration), in line with our primary case data, we found that lower corruption levels positively affected RE uptake. We recommend that the statistical significance of corruption reinforces the importance of further research on this area towards better understanding and shaping GET outcomes in SIDS.

Our model results for up to 3 other variables supported our initial hypotheses made based upon previous initial qualitative research conducted. In order of most statistical significance, these were the variables of rule enforcement, sugar production and civil society participation. In addition, 5 other variables rejected our initial hypotheses that were made. In order of most to least statistical significance these were Real debt 2015, RE roadmap, global oil prices (Real GOP 2015), domestic credit and utility ownership. Despite demonstrating no statistical significance, 2 of the 8 remaining variables we examined especially stood out. This was due to their higher statistical relationship with RE uptake and the contrast of these statistical results when compared to previous qualitative findings. These were the variables of RE roadmap and national debt (Real debt 2015). When a RE was present results indicated a negative statistical relationship with RE uptake. This finding rejected the existing assumption that a national roadmap is required for effective green transition to occur (Crespi, 2016). Our RE roadmap results pose significant potential implications on the manner in which GET is approached within SIDS' contexts. Specifically, it raises the question of whether bottom-up approaches versus the widely accepted top-down approach of RE roadmaps may be more effective for supporting large-scale RE uptake within SIDS' contexts?

Furthermore, our findings relating to the variable national debt (real debt 2015) pose significant implications to the manner in which GET resources are allocated within SIDS. Our primary and statistical data suggest that when the private sector is expected to, or plays a significant role in financing GET, debt at the micro level may have a more significant impact on RE uptake than debt at the macro level. Our findings have major implications on the manner in which debt related and general capacity building support is provided for it to be effective on GET outcomes. Our primary data indicates that much of capacity building support provided in our SIDS cases currently focuses on supporting government, with little or ineffective support directly provided to private sector and other actors. In light of its statistical significance, we propose that the role of varying forms of debt on RE uptake is a crucial area that warrants future exploration beyond this study.

A main limitation of our study was its small dataset due to time and resource constraints in collecting the necessary data inputs. Given that little to no research currently exists on the specific topic, it was important to run empirical tests using the data that was available, through primary data collection and literature review, to identify the trends and factors that require further investigation. We recommend that future research utilises an expanded dataset to comparatively include other SIDS and non-SIDS countries, and where data availability allows a longer investigative timeline.

Overall, our results give insightful novel statistical indication concerning the behaviour of the 10 examined exogenous variables on the three case countries' RE electricity generation (RE uptake). However, we also acknowledge that to increase the robustness of the conclusions and to translate the results to other SIDS as well as other developing country cases, further and more extensive research is needed. Our findings hence provide a premise upon which future research can build and outlines multiple areas that can benefit from further study.

7.7. Notes

1. The term small island developing states (SIDS) in this research refers to a group of 58 countries that are spread over three geographical regions; namely the Caribbean, the Pacific, and the Atlantic, Indian Ocean, Mediterranean and South China Sea (AIMS), as listed by The United Nations Department of Economic and Social Affairs (UNDESA, 2019).

2. The minimum level of active actor participation allowed within the energy sector measured according to two sub-categories:

    a) Partially participatory if there is an attractive feed in tariff, interconnection standards, and either net metering/ billing, or IPPs permitted.

    b) Non-participatory if any of the partial participation conditions are not in place.

3. Based on primary data collected via expert interviews (Bogner, et al., 2009) from a total of 20 and 26 relevant national stakeholders in Barbados, and Mauritius respectively. Feedback represented five main stakeholder groups- public sector, private sector, civil society, regional organisations, and international organisations.

4. In their analysis Eatzaz, et al. (2012) consider a long run period to be 25 years (1984-2009) within their empirical model. Within their national policy planning documents, Barbados, Jamaica, and Mauritius outline planning and implementation periods of 11 years (2019-2030), 21 years (2009-2030), and 16 years (2009-2025) respectively for their renewable energy sectors (Government of Barbados, 2018; PAGE, 2015; Ministry of Energy and Mining Jamaica, 2009). Hence, we determined anything less than 10 years to be a short-term period. In our analysis we examine a 19-year period (2000 to 2018).

5. Details on data sources:

    a) Countryeconomy.com – data is collected from up to 19 sources which include: the Ministry of Finance, Central Bank, National Statistics Offices, World Bank, the International Monetary Fund, etc.

b) World Bank Open Data (data.worldbank.org) - an analysis and visualisation tool that contains collections of time series data on a variety of topics. Sources include the International Monetary Fund, Government Finance Statistics Yearbook and data files, and World Bank and OECD GDP estimates.
c) Knoema.com - an Eldridge business, public and open data platform, with the most comprehensive source of global decision-making data in the world.
d) Idea.int – the International Institute for Democracy and Electoral Assistance (International IDEA) is an intergovernmental organization that supports sustainable democracy worldwide. They capture and provide access to data related to diverse experiences of democracy from the around globe. Topic areas covered include electoral processes, constitution-building, political participation and representation.
e) Reeep.org – the Renewable Energy and Energy Efficiency Partnership (REEEP) designs and implements programmes that advance market readiness for clean energy, energy efficiency and energy access, for the benefit of the most vulnerable populations. REEEP monitors, evaluates, and learns from its programmes. Via its reports, REEEP shares the insights and knowledge gained with government and private sector stakeholders.
f) Statista.com – a provider of market and consumer data, statistics, studies, and reports from over 22,500 sources. Primary and secondary sources from businesses, government departments, associations (e.g., London Waste and Recycling Board) etc. Statista works with several partners from different market research institutes, and publishes relevant results on its platform e.g. The Gesellschaft für Konsumforschung (GfK) is Germany's largest market research institute.

6. Calculated per country in terms of electricity generation in gigawatt hours (Gwh) based on respective national RE targets of Barbados 65% by 2030, Jamaica 20% by 2030 and Mauritius 35% by 2025.

7. Factors related to SIDS' small developing country contexts as outlined according to primary and secondary data sources.

8. Viewed in terms of economic democracy- decision-making power in proportion to the degree one is affected (Hanhel, 2015, p. 37).

7.8. Annexes

Annex 1

Table 17 Rated Influence of GET factors identified as key to renewable energy (RE) uptake across Jamaica, Barbados, and Mauritius

No.	GET Factor of Influence	Country Rating			Overall Rating
		Barbados	Jamaica	Mauritius	
1	political action and regulatory framework	1	1	1	1
2	role of government	1	1	1	1
3	presence of a clearly articulated vision and plan	1	1	1	1
4	transition influencers	1	1	1	1
5	legislative, regulatory and policy gaps/ loopholes	1	2	1	1
6	lack of resources and capacity/ limitations	1	1	2	1
7	costs of adoption	1	2	2	2
8	national market characteristics	1	2	2	2
9	resource endowments	1	2	2	2
10	financial savings	1	1	3	2
11	ownership of the grid	2	1	2	2
12	government driven investments	2	1	2	2
13	grid modernisation	2	1	2	2
14	inefficient processes	2	2	2	2
15	information deficit	1	2	3	2
16	access to external resources	2	1	3	2
17	a proactive utility	2	1	3	2
18	the need for overall transparency	1	4	1	2
19	inappropriate allocation of resources	1	4	1	2
20	technology improvements and adaptation	3	1	3	2
21	need for continuous learning and reform	1	4	2	2
22	oil price and supply volatility	3	1	3	2
23	compatibility issues with national conditions/ facilities	3	2	2	2

24	incentives and enabling framework	3	2	3	3
25	changing international trends	3	2	3	3
26	culture	3	4	1	3
27	lack of interest or hesitance in RE uptake	2	4	2	3
28	information and coordination	2	4	2	3
29	national incentives	3	2	3	3
30	energy security	3	2	3	3
31	blended financing	4	1	3	3
32	Inhibiting veto actors of Transition	3	4	2	3
33	an accepting population	2	4	3	3
34	response to climate change	3	3	3	3
35	historical context	4	4	1	3
36	global discourse and emphasis on environmental issues	3	3	3	3
37	changes in political agenda	3	4	3	3
38	lack of trust	3	4	3	3
39	presence of a holistic sustainable development agenda	3	4	3	3
40	new business opportunities	3	4	3	3
41	energy framework lock in	4	4	3	4
42	still a role for non-renewables in the foreseen energy mix	4	4	3	4

Key:

Factors aligned with findings under existing scholarship	
Factors unique to the SIDS countries or less prevalent within the wider literature	

Rating System	Assigned Rating
Very Significant	1
Significant	2
Somewhat Significant	3
Not significant	4

Note: The above factors were identified via thematic coding[59] conducted under my literature review as well as on all three cases across chapters 4 to 6 (see details in chapter 3, sections 3.3. and 3.4.). Ratings were assigned based on primary stakeholder consensus[60] and document analysis of secondary sources.

[59] Open coding was guided by Strauss and Corbin (1990) as cited in Emmel (2013, p. 21-23); Selective coding was guided by Flick (2014, p. 319), Gibbs (2012, p. 9) and (King, 2004) .

[60] Very Significant (>66% of consensus), Significant (>33%, <66%), Somewhat Significant (>4%, <33%), and Not significant (<4%).

Sources:

See appendix 4 for literature review sources.

Document analysis (Bowen, 2009) was done for the Jamaican case- (BMR Energy Limited, 2019; IRENA, 2019; Francis, 2018; Planning Institute of Jamaica, 2018; Clover, 2017; The World Bank Group, 2017; OUR, 2016; WRB Enterprises, 2016; Doris, et al., 2015; The Government of Jamaica, 2015; Patterson, 2015; Briguglio, 2014; CAPRI, 2014; Barrett, et al., 2013; Makhijani, et al., 2013; OUR, 2010; Briguglio, 1995)

Expert interviews (Bogner, et al., 2009) were conducted for the Barbadian and Mauritian cases- (stakeholder interviews, Mauritius 2019; stakeholder interviews, Barbados 2018).

Annex 2

Table 18 Data Sources for the Impartial Administration Indicator

No.	Indicator	Description/question	Data set
4.1.1	Public sector corrupt exchanges (v2excrptps)	ES: How routinely do public sector employees grant favours in exchange for bribes, kickbacks or other material inducements?	V-Dem
4.1.2	Public sector theft (v2exthftps)	ES: How often do public sector employees steal, embezzle or misappropriate public funds or other state resources for personal or family use?	V-Dem
4.1.3	Executive embezzlement and theft (v2exembez)	ES: How often do members of the executive (the head of state, the head of government and cabinet ministers) or their agents steal, embezzle or misappropriate public funds or other state resources for personal or family use?	V-Dem
4.1.4	Executive bribery and corrupt exchanges (v2exbribe)	ES: How routinely do members of the executive (the head of state, the head of government and cabinet ministers) or their agents grant favours in exchange for bribes, kickbacks or other material inducements?	V-Dem
4.1.5	Corruption (F)	ES: How widespread is actual or potential corruption in the form of excessive patronage, nepotism, job reservations, 'favour-for-favours', secret party funding or suspiciously close ties between politics and business?	ICRG

Notes: ES = expert surveys.

Source: (International IDEA, 2019b, p. 8)

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Chapter 8: Conclusions & Recommendations

This thesis provides two main original contributions. The first is a tailored and original investigative approach for conducting green energy transition (GET) research on small island developing states (SIDS) despite research obstacles faced. Secondly, I provide new empirical evidence and make knowledge contributions to GET-related research on SIDS via the cases of Jamaica, Barbados, and Mauritius. Specifically, I considered elements often overlooked or less frequently examined by diffusion of innovation and sustainability transitions scholars- i.e. economic, social and environmental drivers and barriers (Foxon, 2011). I also added to sustainability transitions' limited analysis of agency and actor roles (Wittmayer, et al., 2016; Flannagan, et al., 2011; Smith, et al., 2005) via the application of polycentricity theory (Aligica & Tarko, 2012). I further considered the issue of 'pro-innovation bias' (Nguyen, 2019; Karch, et al., 2016; Rogers, 1962)[61] by focusing on three developing countries still in progress and at varying stages of their green energy transition journeys.

Across four academic papers I directed the focus of leading GET literature (i.e. sustainability transitions and diffusion of innovation studies) and up to 5 other bodies of associated literature[62] to the circumstances of SIDS. To do so, I designed and applied an original investigative approach more suited to examining GET in the small developing country contexts of SIDS. This entailed a tailored mixed methods research design (see chapter 3) which included an integrated methodological schema (see chapter 2, figures 4 & 5). My original investigative approach allowed me to make several novel insights pertaining to my main research question: how can variances in green energy transition (GET) processes and outcomes across small island developing states (SIDS) be accounted for?

[62] sustainable development, the green economy, climate governance, small states, SIDS and climate change, and polycentricity theory.

8.1. Novel Insights Derived from Application of My Tailored Approach to Exploring GET in SIDS

A main contribution of this thesis was its tailored mixed method research design which included the use of an original methodological schema. My approach helped me to overcome four main obstacles when I attempted to carry out investigative work on SIDS cases: theoretical knowledge gaps relating to small developing country contexts within leading GET-related frameworks, overall limited case data availability, a small number of actors or primary data samples sizes, and small datasets. Specifically, my research design allowed me to extended application of existing theory to my SIDS cases through:

- synthesised use of existing theory via an originally developed methodological schema (see chapter 2, section 2.5),
- triangulated use of multiple data sources to compensate for SIDS' data gaps- document analysis, secondary databases, and primary data collection via expert interviews (see chapter 3, section 3.5.2.), and
- a quantitative model especially designed to work with a small data set and based around the data availability of the cases examined (see chapter 7, section 7.3).

My original, synthesised and interdisciplinary approach (see figure 4) provides a useful example and means by which future researchers can similarly explore GET in SIDS or in similar settings (see chapter 3) despite the typical research problems faced. A significant insight I derived from the design and application of my tailored approach was that leading GET-related frameworks as they currently exist largely excluded important themes relevant to understanding GET within SIDS' contexts. Hence, (without adjustments) leading theory has limited relevance or insight for explaining GET outcomes within these countries.

My wider conceptual reference to 5 other bodies of literature (see figure 4), revealed that up to twenty-five (25) themes/ factors relevant to GET in SIDS were currently underexplored or overlooked by the leading existing theoretical frameworks (sustainability transitions and diffusion of innovation). The most significant of these neglected SIDS-related themes were those of 'a clearly articulated vision and plan', 'transition influencers', and 'lack of resources and capacity/ limitations' (see chapter 7, annex 1). Based on the problems that I experienced, which tend to be faced when conducting research on SIDS[63], and the noted gaps in leading theory, I recommend that tailored approaches should be considered and applied by researchers interested in investigating GET outcomes in SIDS.

8.2. New Empirical Evidence: Existing Literature Expanded on GET in SIDS

The second major contribution of my thesis was new empirical evidence and corresponding insights. Namely, on the central drivers, barriers and context conditions impacting GET outcomes within and across the three SIDS cases examined. This included clarification on those thematic factors which were common, nuanced, and unique across the countries. I also provided new findings pertaining to the actor participation landscape or public policy approaches (across the strategic and tactical transition spheres) which have shaped GET outcomes. My key findings and novel insights are surmised under 5 main thematic areas below (see sections 8.2.2. to 8.2.5.). My findings emphasise the importance of the overlooked themes in explaining SIDS' GET outcomes and hence their corresponding significance for GET policy design and implementation when compared to other countries.

8.2.1. The leading investor ultimately directs the transition

An important empirical finding was that the largest investor held the power to direct the manner in which overall GET took place. This was because they controlled the allocation of the crucial capacity areas needed to transition. Conversely, the more internal national resources available to finance the green energy transition, the greater control a country had over its GET experience (e.g. see chapter 5, section 5.4.2.). Even when access to opportunity in the transition actor landscape is at least partially participatory (see tables 11 and 13), the power to direct GET outcomes significantly lied with the stakeholder which was the largest transition investor. Depending on who this was, this impacted the rate of transition and its overall success. For example, in Barbados (contrary to Mauritius) where donor funding outweighed internal capacity available, this resulted in an overall negative impact on GET outcomes (see chapter 5, section 5.4.2.). Due to their many

[63] (Briguglio, 2018; Eckstein, 2018; Scobie, 2016; Nurse, et al., 2014).

capacity constraints (see Chapter 2, section 2.3.1.), most SIDS' often have to rely on external resources such as donor funding to drive their GET, thus retaining limited power to shape their overall GET experience.

Hence, I inferred from my findings that when countries heavily rely on external resources such as foreign aid for their GET, it is important to seek out partnerships that allow them to retain sufficient influence over how resources (both human and financial) are allocated. In this regard, my findings indicated that both the desire and scope existed for strategic and formalised South-South cooperation based on SIDS' capacity strengths and weaknesses. For example, the leveraging of existing diplomatic channels and the support of civil society (e.g. academic and not for profit agencies). This could include complementary exchanges where knowledge and expertise are shared on areas such as policy frameworks, public green procurement, IPP policy, effective stakeholder consultation and inclusion etc.

8.2.2. Transition quality is significantly determined by the transition actor landscape

Empirical evidence relating to the three themes learning and reform, transition influencers and inhibiting veto actors raised the question of what can be considered a desirable transition based on actor participation and inclusivity (i.e. quality over quantity within a transition)? Under chapter 6, my methodological schema's application of customised indicators explored the GET actor landscape[64]. This revealed new findings on how varying forms of actor participation impacted on SIDS' GET outcomes. My chapter 6 findings built upon those from chapter 5 which emphasised the importance of learning and reform for positive GET progress. Insights derived from the combined findings here were particularly important given the increased influence actors tend to have within small settings such as in SIDS (The World Bank, 2019). The first insight was that an overall higher quality of GET was likely to occur where learning and reform led to 'rule formation' that was participatory in nature. My second insight was that a higher quantity of transition progress was likely to occur where 'rule enforcement' was participatory in nature. Thirdly, any transition progress achieved was only likely to be sustained in the

[64] Developed lending from polycentricity theory and sustainable development literature (see Chapter 6, table 11).

long term when there was wider and unbiased access to and distribution of opportunities among transition actors.

For example, despite Mauritius having been ahead of Barbados in terms of RE uptake trends, case comparisons indicated that stakeholders were more satisfied with the overall quality of GET in Barbados despite the Caribbean country's significantly lower RE uptake values. Less corruption, more effective stakeholder inclusion in the policy framework design and continued inclusive dialogue suggested that in the long-term Barbados' RE uptake will be greater and more sustained due to its more participatory decision making and rule formation frameworks (see chapter 6, table 13) when compared to Mauritius. Therefore, when analysing and comparing GET trends, it is important to ask, are these desirable transitions? That is, are people happy with the approach taken towards social transformation? In the case of Barbados, the general consensus was yes. Conversely, due to transparency issues as well as exclusion in the access to and distribution of opportunities (see chapter 5, sections 5.4.4.2; 5.4.4.3.), in the case of Mauritius the overall answer was no.

8.2.3. Renewable Energy (RE) Roadmaps Have Thus Far Negatively Impacted GET Outcomes

Divergent to widely accepted existing academic assumptions (Crespi, 2016) and to feedback from my primary interviewees', my quantitative findings indicated that RE roadmaps had a negative statistical impact on RE uptake in the electricity sector (see chapter 7, section 7.5.2.3.). This rather unexpected finding suggests that while having a plan in place is important, the ways in which RE roadmaps have been translated into action have had a negative rather than positive impact on RE uptake. In both Jamaica and Mauritius where RE roadmaps were present for most of the observed research period, early RE investments were driven by the government.

Based on my empirical data gathered and analysed, I was only able to make a limited deduction on what could explain RE roadmap results. My empirical evidence available suggested that wider participation and bottom-up approaches could potentially be more effective or suitable for introducing new technology within small developing country contexts such as SIDS. That is, versus the sole or major utilisation of the top-down approach currently employed under official national RE roadmaps. However, in order to gain a more conclusive and deeper understanding between RE roadmaps and RE uptake, more data, a broader sample with more years and observations are needed. My findings on RE roadmaps flag the crucial need for more research in this area, the outputs of which have potential implications on the typical top-down manner in which RE roadmaps are designed and implemented within SIDS' contexts.

8.2.4. SIDS' Historical Contexts Have Shaped Their RE Outcomes

In the small contexts of SIDS, one cannot ignore the inherent interlinkages between wider sustainable development and cultural issues with their GET progress. Across my sample the theme of historical context, colonisation and the evolution out of the plantation economy particularly demonstrated this. My original findings showed that divergences in a shared historical context concerning the shift out of colonialism, impacted the timeline within which REs were substantially introduced into the case countries (e.g. see Chapter 5, section 5.4.4.). Many SIDS were once colonised and experienced a shift out of the plantation economy; with political, social and economic implications. Depending on how this post-colonial shift took place, the Mauritian case demonstrates that this can lead to issues of 'compatibility' or conflicting interests which must be considered and addressed in any business models and policy frameworks introduced to drive the transition. For example, within Mauritius, barriers which still needed to be addressed included the centralised ownership of RE assets by the descendants of former colonial rulers such as the sugar oligarchy (see Chapter 5, section 5.4.4.2.). To date, legal and regulatory gaps remain needed to enable wider participation to counteract asymmetries out of a colonial history (see chapter 6, section 6.5.3.). Hence, I recommend that the impact of historical context on GET is an important area that requires future research concerning its impact on SIDS' GET outcomes.

8.2.5. Complementary Development Strategies Should be Implemented Alongside GET Policies in SIDS

Compatibility issues with SIDS' national conditions such as infrastructure, geophysical challenges and energy consumption culture were among the main factors that helped to explain GET outcomes in my case countries. From my findings I inferred that an overall need existed for the better design and coordinated implementation of wider development strategies alongside GET policies. Such wider development strategies should address relevant context conditions in conflict with RE ambitions. For instance, in all three cases, countries had to first overcome (and continued to be faced with) the existing challenge of outdated and inefficient national electricity grids[65] in order to then be able to incorporate REs. This created added cost and time to RE development. Additionally, while my original findings only briefly begin to touch upon the topic, also essential to the achievement of RE ambitions was the compatibility of RE targets with the national energy consumption culture.

For example, Mauritius' RE consumption has been growing continually over the years, however, so too has its consumption of non-renewables (see Chapter 5, section 5.4.4.3.). This was due to upward economic growth trends and a national culture of energy consumption where individuals are less conscious of how they consume energy. As a result, observed incompatibilities between national conditions with RE ambitions emerged related to both energy supply and demand. Namely, the government had fallen back on the familiarity of non-sustainable energy options to keep up with national growth and energy demand needs. This therefore demonstrated that alongside RE supply investments, a need also existed to create a sustainable energy consumption culture that prevented backslide into traditional non-sustainable energy sources. I recommend that future research should explore how relevant national conditions such as infrastructure upgrades and energy consumption culture impact on achieving GET goals. Such research should also include assessment of what necessary complementary strategies (pertinent to energy supply and demand) can be deployed to ensure compatibility or harmonisation between national conditions with RE uptake goals.

[65] Which could not be avoided due to high levels of nationals already connected to the electricity grid for their energy supply needs.

8.2.6. Main Policy Insights Concerning GET in SIDS versus in Other Countries

My synthesised findings pinpointed up to 42 thematic factors (or determinants) that significantly influenced renewable energy (RE) uptake trends across the three countries examined. The majority (approximately 60% or 25) of the 42 identified transition determinants were unique to one or all three of the SIDS countries examined or were less prevalently mentioned within the wider existing literature. The remaining 17 transition determinants coincided to those already documented for large developing and developed countries (see chapter 7 annex 1). Wieczorek's (2018) review of the sustainability transitions literature, provides three main policy insights relevant to green transition in the large developing country context (see chapter 2, section 2.4.1.1.). Although similarities existed, my thesis findings indicated that the transferability of these insights to the three SIDS' contexts was limited due to their nuanced characteristics as small states.

Nonetheless, although quite distinguished, the themes of effectiveness of donor funding, the important role of government, and ensuring a balance between local competences with external forces, were ones broadly shared with large developing countries' GET experiences (Wieczorek, 2018). Specific to SIDS' GET experiences, the main policy insights I deduced from this thesis' overall findings are as follows:

1. Donor financing can provide useful resources to supplement green energy transition (GET) activities. However, where these resources outweigh internal capacity available, a country has less control over its GET experience (see chapter 5, section 5.4.2.). Hence, having sufficient availability of national capacity (human and financial) to transition plays a crucial role on GET outcomes. Where countries must rely on external resources, they should seek out partnerships that allow them to retain sufficient control on how these resources are allocated.

2. When the private sector played a significant role in financing GET, debt at the micro level was more important to explaining RE outcomes than debt at the macro level (see chapter 7, section 7.5.2.1.). Much of capacity building support in SIDS focuses on supporting government with little or ineffective support directly accessible to private sector and other actors. Consequently, a better understanding

of how varying forms of debt impact on GET outcomes in SIDS is an important area that should be further explored. Such research should also examine how policies enabling better access to green financing for private sector and other non-state actors can enhance GET policy outcomes in SIDS.

3. The role of government is important in steering conducive conditions for GET. However, higher levels of RE uptake are more likely to occur when a minimum level of wider actor participation is enabled (e.g. see chapter 6, sections 6.5.2. and 6.5.3.). Specifically, stakeholder participation in the renewable energy sector that at minimum includes an attractive feed in tariff, interconnection standards, and either net metering/ billing, or IPPs permitted. In addition, in order to achieve not just a high transition quantity but also quality, additional reform must also take place. Namely, learning and reform that: leads to an ambitious RE uptake target, is inclusive in who could participate in RE supply and demand and promotes sustained presence of RE within the long-term energy mix of the country (see chapter 5, section 5.5.).

4. The presence of certain combined context conditions is more likely to result in overall successful large-scale RE outcomes in SIDS. These were an at least partially participatory actor landscape, lower corruption levels, a majority private-owned utility company, and absence of a RE roadmap (see chapter 7, section 7.6.). These acted as conducive conditions to RE uptake (based on the 2000 to 2018 timeframe examined).

8.3. Final Remarks

Through application of an original methodological approach, I was able to generate novel findings that helped to answer the overarching research question of this thesis: how can variances in green energy transition (GET) processes and outcomes across small island developing states (SIDS) be accounted for?

My findings provide a valuable basis upon which future research concerning GET outcomes in SIDS can be expanded by other researchers. Other important areas that could benefit from future research include how RE uptake is impacted by: (i) a country's ratio of internal versus external transition capacity, (ii) the actor participation landscape (with indications on the extent to which transition quality and quantity are achieved), (iii) RE roadmaps, (iv) the historical context of SIDS (i.e. the shift out of colonialism and the plantation economy), (v) SIDS' national conditions (e.g. infrastructure, energy consumption culture etc.), and (vi) varying forms of debt.

Small states like SIDS could also benefit from the increased use of statistical approaches that are tailored to examine RE trends within and across these contexts. Such models should consider and or allow for comparisons with countries other than small states. Ultimately, my thesis findings, and the above proposed topics for future investigative work, could benefit researchers and key implementing actors interested in GET learning and reform within SIDS, with potential wider applicability to other small developing country settings. In addition, my original methodological approach presented and tested (see chapter 3), can benefit future researchers facing similar data availability issues, whether it be on SIDS or other underexplored contextual settings faced with similar research implementation challenges.

Appendices

Appendix 1 - Full World Bank Listing of Small States

AFR	EAP	LAC	MENA	ECA	SAR
Botswana	Brunei Darussalam	Antigua and Barbuda	Bahrain	Cyprus	Bhutan
Cabo Verde	Fiji	The Bahamas	Djibouti	Estonia	Maldives
Comoros	Kiribati	Barbados	Qatar	Iceland	
Equatorial Guinea	Marshall Islands	Belize		Malta	
Gabon	Federal States of Micronesia	Dominica		Montenegro	
The Gambia	Nauru	Grenada		San Marino	
Guinea-Bissau	Palau	Guyana			
Lesotho	Samoa	Jamaica			
Mauritius	Solomon Islands	St. Kitts and Nevis			
Namibia	Timor-Leste	St. Lucia			
São Tomé and Principe	Tonga	St. Vincent and the Grenadines			
Seychelles	Tuvalu	Suriname			
Swaziland	Vanuatu	Trinidad and Tobago			

Notes: AFR (African Region), EAP (East Asia Pacific), LAC (Latin America and the Caribbean), MENA (Middle East and North Africa), ECA (Eastern Europe and Central Asia), SAR (Special Administrative Region).

Source: (World Bank, 2016, p. 2).

Appendix 2 – Full List of 58 Small Island Developing States (SIDS)

No	Caribbean and Atlantic Sea	No	Pacific	No	Africa, Indian Ocean, Mediterranean and South China Sea (AIMS)
1	Anguilla	1	American Samoa	1	Bahrain
2	Antigua and Barbuda	2	Cook Islands	2	Cape Verde
3	Aruba	3	Commonwealth of the Northern Marianas	3	Comoros
4	The Bahamas	4	Federated States of Micronesia	4	Guinea-Bissau
5	Barbados	5	Fiji	5	Maldives
6	Belize	6	French Polynesia	6	Mauritius
7	Bermuda	7	Guam	7	São Tomé and Príncipe
8	British Virgin Islands	8	Kiribati	8	Seychelles
9	Cayman Islands	9	Marshall Islands	9	Singapore
10	Cuba	10	Nauru		
11	Curacao	11	New Caledonia		
12	Dominica	12	Niue		
13	Dominican Republic	13	Palau		
14	Grenada	14	Papua New Guinea		
15	Guadeloupe	15	Samoa		
16	Guyana	16	Solomon Islands		
17	Haiti	17	Timor-Leste		
18	Jamaica	18	Tonga		
19	Martinique	19	Tuvalu		
20	Montserrat	20	Vanuatu		
21	Puerto Rico				
22	Saint Kitts and Nevis				
23	Saint Lucia				
24	Saint Vincent and the Grenadines				
25	Sint Maarten				
26	Suriname				
27	Trinidad and Tobago				

28	Turks and Caicos Islands
29	United States Virgin Islands

Source: (UNDESA, 2019).

Appendix 3 – Interview Instrument

PhD Fieldwork Interview Questions

A Comparative Exploration of Green Energy Transition (GET) Outcomes Across Small Island Developing States (SIDS): Jamaica, Barbados, and Mauritius

What is this research about?

Green transition can be defined as the shift to "*an environmentally sustainable economy centred on the transformation of markets, behaviours, products and processes, technological deployment and new skills*".

Several small island developing states (SIDS) have set green transition ambitions in the renewable energy sector making particular reference to the 2015 sustainable development goals (SDGs), and highlighting a direct link to national socio-economic and environmental needs.

This research project aims to examine the cross-country variances in green energy transition outcomes across SIDS using the case study examples of Barbados, Jamaica, and Mauritius.

I General Questions (asked to all interviewees)

1. What main factors have driven advancements in the Renewable Energy sector over the last 30 years? (e.g., political, economic, and social/ behavioural factors)

2. Who are the most significant actors driving change in the Renewable Energy sector?

3. What have been the main obstacles faced in advancing the Renewable Energy sector over the last 30 years?

4. What innovative and successful approaches have emerged to combat challenges and constraints faced in the advancement of the Renewable Energy sector, and who have driven these advancements?

5. What is the single greatest reform currently needed to facilitate enhanced advancements in the Renewable Energy sector?

6. Any additional comments?

7. Any recommendations on of other key stakeholders that should be interviewed and their contact details (or can an introduction please be facilitated)?

II Public Sector Questions Only

1. To what extent has access to external resources and funds from aid flows filled critical resource gaps that have contributed to the advancement of the Renewable Energy sector? And how?

2. What monitoring, evaluation and reform mechanisms exist that track the success of policies implemented and that systematically engage in reform together with wider stakeholders to improve the overall process?

3. In what way has the ownership status of the national grid affected the advancements in the Renewable Energy sector?

III Private Sector Questions Only

1. To what extent have local traditions, perceptions and core values in any way affected the consumer demand for Renewable Energy products?

2. To what extent has access to varying consumer financing options played a role in the uptake of Renewable Energy technology?

IV Civil Society Questions Only

1. To what extent have local traditions, perceptions and core values in any way affected the consumer demand for Renewable Energy products?

2. To what extent has access to external resources and funds from aid flows contributed to the advancement of the Renewable Energy sector? And how?

V Regional Organisation Questions Only

1. Over the last 30 years how would you rate the government’s ability to be responsive to renewable energy and climate change issues in the policy-making and regulatory process?

2. To what extent has access to external resources and funds from aid flows contributed to the advancement of the Renewable Energy sector? And how?

3. What monitoring, evaluation and reform mechanisms exist that track the success of policies implemented and that systematically engage in reform together with wider stakeholders to improve the overall process?

VI International Organisation Questions Only

1. What have been some of the main contributions towards the advancement of the Renewable Energy sector made by development funded projects that otherwise would not have been possible?

2. What monitoring, evaluation and reform mechanisms exist that track the success of policies implemented and that systematically engage in reform together with wider stakeholders to improve the overall process?

Appendix 4 – Summary of GET Factors Identified Across the Literature

Table 19 Factors Recognised as Important to GET Across 4 Bodies of Literature

No	Green Economy (8 sources)	Diffusions Research (7 sources)	Policy Studies (10 sources)	Sustainability Transitions (13 sources)
1	institutions and implementation capacity (Bosselmann, et al., 2008; Puppim de Oliveira, 2012)	complexity (Rogers, 1962)	climate governance/ regulatory and non-regulatory instruments (Ostrom, 2010; Loorbach, 2010; Frolich & Knieling, 2013; SELA, 2012)	interactions between actors (Kemp, et al. 2005)
2	regulatory and legal framework (SELA, 2012)	trialability (Rogers, 1962)	human capacity and skills (Global Renewable Energy Islands Network, 2014)	capacity to respond to unexpected effects and developments (Voss & Kemp, 2005)
3	role of government (SELA, 2012)	observability (Rogers, 1962)	limited financial and human resources (IPCC, 2014)	political regulation (Voss & Kemp, 2005)
4	voluntary action (Unmussig, et al., 2012; Spash 2012)	information cascades (Geroski, 2000)	limited coordination of governance (IPCC, 2014)	government (Loorbach, 2007; Loorbach, 2010; Kemp, et al., 2010)
5	cooperation (Unmussig, et al., 2012; Spash 2012)	technology improvements and adaptation (Hall, 2004)	key adaptation leaders and advocates (IPCC, 2014)	network dynamics (Loorbach, 2007; Loorbach, 2010; Kemp, et al., 2010)
6	self-organisation (Unmussig, et al., 2012; Spash 2012)	communication (Hall, 2004)	well designed domestic policies (IMF, 2016)	reflexive behaviour (Loorbach, 2007; Loorbach, 2010; Kemp, et al., 2010)
7	climate governance (Frohlich & Knieling, 2013)	costs of adoption (Hall, 2004)	a roadmap for development and diffusion (Crespi, 2016)	decentralised decision-making (Loorbach, 2007; Loorbach, 2010; Kemp, et al., 2010)
8	public and private investments (UNEP, 2011; SELA, 2012)	benefits received (Hall, 2004)	effective governance framework (Crespi, 2016)	social networks (Schot and Geels, 2008)
9	enterprise (Unmussig, et al., 2012; Spash 2012)	uncertainty and information problems (Hall, 2004)	greater physical capital (IMF, 2017)	building of new actor networks (Berkhout et al., 2010)
10	level of consumption (Cato, 2009)	size of sunk costs (Hall, 2004)	democratic institutions (IMF, 2017)	actor participation (Berkhout et al., 2010)
11		technology characteristics (Wilson, 2012)	environmental feasibility (IPCC, 2018)	agency of actors (Flannagan, et al., 2011)
12		experimentation and learning (Wilson, 2012)	institutional feasibility (IPCC, 2018)	policy making and interactions (Flannagan, et al., 2011)
13		upscaling of energy technologies (Wilson, 2012)	geophysical feasibility (IPCC, 2018)	policy action (Markard, et al., 2015; Kern & Rogge, 2016;

			Edmondson, et al., 2018; Wieczorek, 2018)
14	entrepreneurial experimentation (Rogers, 2016)	is in line with country's vision (IPCC, 2014)	access to resources (Markard, et al., 2015; Kern & Rogge, 2016; Edmondson, et al., 2018; Wieczorek, 2018)
15	knowledge development and diffusion (Rogers, 2016)	small market size (Read, 2001)	public policy and political processes (Kohler, et al., 2019)
16	favourable cost-benefit ratio (Clausen & Fichter, 2019)	competing values (IPCC, 2014)	market forces (Loorbach, 2007; Loorbach, 2010; Kemp, et al., 2010)
17	high compatibility and confidence in innovation (Clausen & Fichter, 2019)	weak economic growth (Brito, 2015)	user preferences, cultures, perceptions and power relations (Markard, et al., 2015; Kern & Rogge, 2016; Edmondson, et al., 2018; Wieczorek, 2018)
18	relative advantage (Rogers, 1962)	high economic vulnerability (Brito, 2015)	contesting values (Kohler, et al., 2019)
19	compatibility (Rogers, 1962)	better regulated financial markets (IMF, 2017)	learning processes (Schot and Geels, 2008)
20	external or social conditions (Rogers, 1962)	low income inequality (IMF, 2017)	expectations in niche development (Schot and Geels, 2008)
21	legitimation (Geroski, 2000)	economic feasibility (IPCC, 2018)	broad inclusive learning (Berkhout et al., 2010)
22	differences in goals, needs and ability of individuals (Geroski, 2000)	social/cultural feasibility (IPCC, 2018)	adaptation of technology (Berkhout et al., 2010)
23	competition (Geroski, 2000)	uncertainties about projected impacts (IPCC, 2014)	innovation processes (Kohler, et al., 2019)
24	market structure, industry of social environment (Hall, 2004)	different perceptions of risks (IPCC, 2014)	overcoming poverty (Ramos-Mejia et al., 2018)
25	market characteristics/ system integration (Wilson, 2012)	insufficient research, monitoring and observation (IPCC, 2014)	
26	development of positive externalities (Rogers, 2016)	technological feasibility (IPCC, 2018; Zhang, 2018)	
27	market formation (Rogers, 2016)		
28	incentives (Rogers, 2016)		
29	market push (Clausen & Fichter, 2019)		

30		social structure (Rogers, 1962)
31		resource mobilisation (Rogers, 2016)
32		legitimacy (Rogers, 2016)

Colour Key:

Climate Governance	
Social, market and external conditions	
Technology characteristics, experimentation and learning	
National Capacities	

Appendix 5 – Overview of Renewable Energy Sector Stakeholders Interviewed

Stakeholder Category	Number of Interview Subjects	
	Barbados	**Mauritius**
Public sector	15%	23%
Private sector	35%	35%
Civil society	20%	27%
Regional organisation	10%	8%
International organisation	20%	8%
Total Interviewees	**20**	**26**

Appendix 6 – Template Analysis of Expert Interview Feedback

Table 20 Top Thematic Factors Identified as Influential to National GET According to Barbadian and Mauritian Energy Stakeholders

Level 1 Codes	Level 2 Codes	Level 2 Weighting		Level 3 Codes	Level 3 Weighting	
		BB	MS		BB	MS
1.0 GET Drivers	**1.1. Transition Influencers**	**90%**	**62%**			
				1.1.1. The Government	75%	62%
				1.1.2. Private Sector	65%	46%
				1.1.3. International Organisations/ Donors	45%	35%
				1.1.4. The Regulator	20%	0%
				1.1.5. Lending Agencies	20%	4%
				1.1.6. Regional Groupings	10%	8%
				1.1.7. Households	5%	0%
	1.2. Financial savings (at the household, commercial and government levels)	**80%**	**23%**			
	1.3. Information and Coordination	**45%**	**42%**			
				1.3.1. Stakeholder awareness building	50%	23%
				1.3.2. Research matched to stakeholders' needs	25%	12%
				1.3.3 Inter Stakeholder consultations and collaboration	10%	12%
				1.3.4. Education and Training	5%	4%
	1.4. Access to external resources	**45%**	**27%**			
				1.4.1. International platforms and financiers	45%	27%
				1.4.2. Technology and human resources	10%	4%
	1.5. Incentives and Enabling Framework	**30%**	**27%**			
				1.5.1. Ability to sell back to the grid	25%	0%
				1.5.2. Appropriate legislation, regulation and standards in place	10%	19%
				1.5.3. Easy/ Enabling market entry	5%	8%
	1.6. Resource Endowments	**10%**	**35%**			

				1.6.1. Financing Options/ Financial resources	5%	19%
				1.6.2. Natural resources	5%	19%
				1.6.3. Knowledge and Information	0%	8%
	1.7. Historical Context	**0%**	**35%**			
				1.7.1. A strong sugarcane industry	0%	23%
				1.7.2. Transition out of a colonial economy	0%	15%
				1.7.3. Early adoption of REs	0%	12%
	1.8. Changing International Trends	**20%**	**27%**			
				1.8.1. In Technology	20%	15%
				1.8.2. In Environmental Awareness	0%	15%
	1.9. New Business opportunities	**25%**	**8%**			
				1.9.1. Access to new/cheaper technologies	25%	0%
				1.9.2. Attractive ease of doing business	0%	8%
				1.9.3. Utility revenue diversification	5%	4%
				1.9.4. Off-grid sector	0%	4%
	1.10. Ownership of the grid	**25%**	**8%**			
				1.10.1. Private ownership	25%	0%
				1.10.2. State ownership	0%	8%
	1.11. Response to Climate Change	**5%**	**19%**			
				1.11.1. International Agreements Signed	0%	19%
				1.11.2. Natural disasters	5%	4%
	1.12. Adoption of a holistic sustainable development agenda	**5%**	**19%**			
				1.12.1. Ensuring the right energy mix - all REs, EE, battery storage EVs, and hybrid systems are considered	5%	19%
				1.12.2. An integrated sustainable development agenda	5%	15%
	1.13. Energy Security	**15%**	**8%**			
				1.13.1. Energy consumption needs	10%	4%
				1.13.2. Vulnerability to external forces	5%	4%
	1.14. A Clearly Articulated Vision and Plan	**5%**	**15%**			
				1.14.1. Guide to implementation efforts	5%	8%
				1.14.2. Setting the right tariff	0%	4%

				1.14.3. An integrated sustainable development agenda	0%	4%
				1.14.4. Integrated Resource Planning	0%	4%
	1.15. Manner in which technologies are deployed	**5%**	**0%**			
	1.16. Ability to Incentivise Investment	**5%**	**0%**			
2.0 GET Barriers	**2.1. Legislative, regulatory and policy gaps/ loopholes**	**90%**	**73%**			
				2.1.1. The need for a holistic sustainable development agenda	75%	54%
				2.1.2. The need for clearly articulated policies, vision and plan	70%	46%
				2.1.3. The enabling framework	65%	46%
				2.1.4. Exclusion of stakeholders	10%	23%
				2.1.5. The need for more ambitious targets	0%	27%
				2.1.6. The need to understand the varying interests of stakeholders	10%	19%
				2.1.7. The need for a regulatory authority	0%	19%
	2.2. Lack of resources and capacity/ limitations	**90%**	**54%**			
				2.2.1. Financing Options/ Financial resources	85%	35%
				2.2.2. Human and Institutional	50%	19%
				2.2.3. Environmental or geographical limitations	0%	35%
				2.2.4. Infrastructural	10%	15%
	2.3. Information deficit	**75%**	**19%**			
				2.4.2. Education of consumers and other key stakeholders	55%	8%
				2.4.1. Macro and microeconomic levels	50%	15%
	2.4. Inefficient processes (institutional and administrative) can lead to bottlenecks in uptake	**65%**	**54%**			
				2.4.1. Manner in which technologies are introduced	5%	42%
				2.4.2. Need for streamlining	35%	12%
				2.4.3. A regulatory authority lacking capacity	20%	4%

				2.4.4. Lack of stakeholder coordination or consultation	15%	19%
				2.4.5. Private sector not aggressive enough	10%	0%
				2.4.6. Existing Financing Instruments	10%	0%
	2.5. Lack of interest or hesitance in RE uptake	**50%**	**58%**			
				2.5.1. An unwilling utility	25%	31%
				2.5.2. A hesitant or lethargic government	25%	27%
				2.5.3. Grid connection and stability concerns (smart grid)	15%	23%
				2.5.4. Not enough incentive	15%	8%
				2.5.5. Conflicting interests	0%	8%
	2.6. Inappropriate allocation of resources	**30%**	**19%**			
				2.6.1. Manner in which technologies are introduced	0%	8%
				2.6.2. By Donors	15%	8%
				2.6.3. Overloaded staff	10%	0%
				2.6.4. By Government	0%	8%
	2.7. Lack of trust	**10%**	**8%**			
				2.7.1. Between key stakeholders	10%	4%
				2.7.2. Framework for Foreign Investors	0%	4%
	2.8. Energy framework lock in (Fossil Fuel and LNG)	**0%**	**12%**			
3.0 Influential Context Conditions	**3.1. An accepting population**	**35%**	**15%**			
				3.1.1. Experience with previous RE technologies (e.g. solar water heaters, demo projects)	35%	8%
				3.1.2. Highly educated	0%	8%
				3.1.3. Culturally open to new ideas	0%	8%
				3.1.4. Increased access to information	5%	0%
	3.2. Need for continuous Learning and Reform	**25%**	**4%**			
	3.3. Changes in Political Agenda	**20%**	**31%**			
				3.3.1. Changing priorities with changes in administrations	5%	31%
				3.3.2. Government is allowed to take cautionary steps	20%	19%

	3.4. The need for overall transparency	**15%**	**15%**			
				3.4.1. An independent body and coordinating voice	15%	0%
				3.4.2. Within government processes	0%	15%
	3.5. Inhibiting veto actors of Transition	**10%**	**42%**			
				3.5.1. The Utility	0%	31%
				3.5.2. The Government	5%	27%
				3.5.3. The Regulator	10%	4%
				3.5.4. Civil Society	0%	8%
	3.6. Culture	**5%**	**27%**			
				3.6.1. Energy Consumption	0%	15%
				3.6.2. Business market	5%	8%
				3.6.3. Ethnic and Socio-economic factors	0%	4%
				3.6.4. Short term thinkers or cash flow driven persons	5%	0%
	3.7. Still a role for non-renewables in the foreseen energy mix (LNG)	**0%**	**12%**			
	3.8. A highly engaged civil society	**0%**	**4%**			

Note: Weighting was determined according to stakeholder consensus, that is, the number of interviewees who identified the thematic factor as important to national GET.

Source: Primary expert interview feedback from 20 Barbadian and 26 Mauritian interview subjects (see chapter 3, section 3.3.3.).

Definition of Codes

The below outlines the respective definitions for the three main overarching higher order codes under which all other levels 2 to 3 codes were categorised. These definitions helped to create consistency in the carrying out of analytic coding[66] (Gibbs, 2012, pp. 4-6) on my interview transcripts and the assignment of reviewed text under relevant thematic categories.

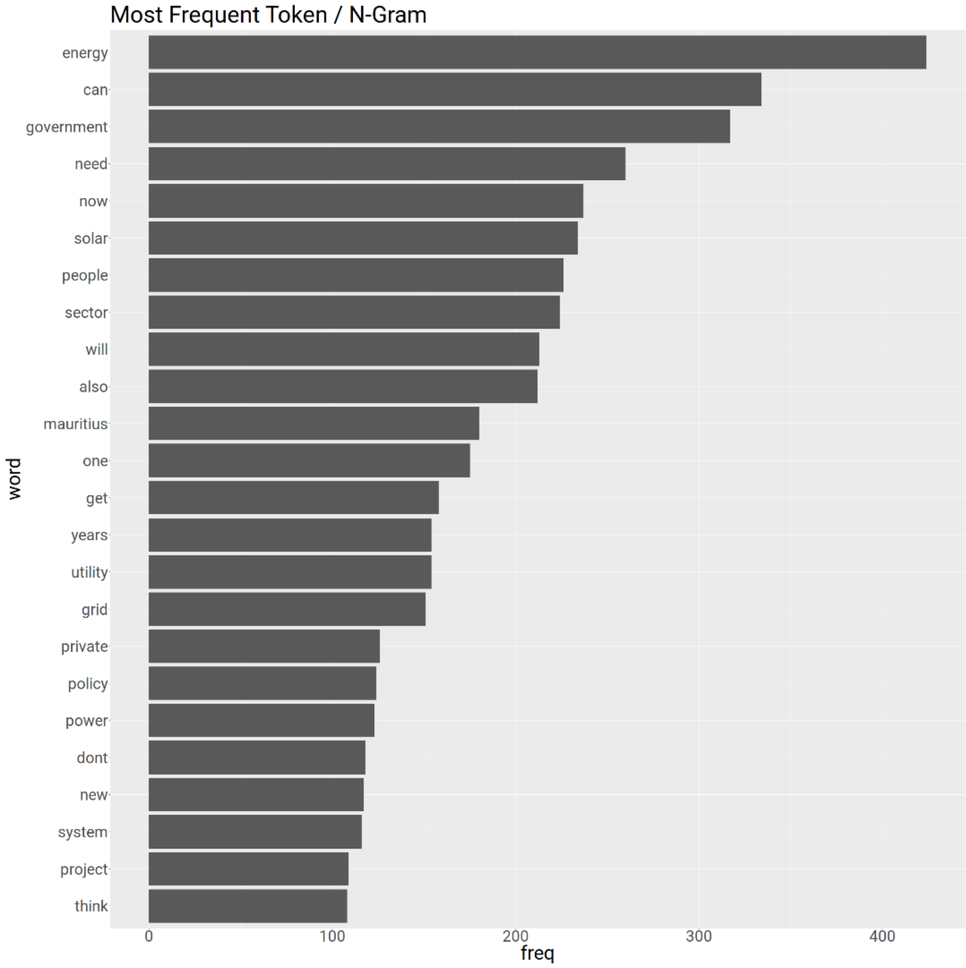
[66] Text was coded based not only on exactly what the interview subject said but from what was implied by their feedback (Gibbs, 2012).

Code #	Code Name	Code Definition
1.0	Drivers	That which positively impacts the uptake of renewable energy in the electricity sector.
2.0	Barriers	That which hinders or negatively impacts the uptake of renewable energy in the electricity sector.
3.0	Influential Context Conditions	A characteristic of the case country setting which must be considered due to its past, existing or potential impact on renewable energy advancement in the electricity sector.

Appendix 7 – N-gram Analysis Results from 1-gram to 3-grams

The below depicts the n-gram analysis results (aggregated up to 3-grams and per country up to 2-grams) for expert interview transcripts from 20 Barbadian (2018) and 26 Mauritian (2019) interview subjects. Semi-structured, open-ended questions (Leech, 2002) were used to collect interview feedback (see appendix 3 for interview questions). Aggregated results for Barbados and Mauritius are first presented, followed by the individual country results.

Figure 18 Aggregated N-gram Analysis Results from 1-gram, Barbados and Mauritius

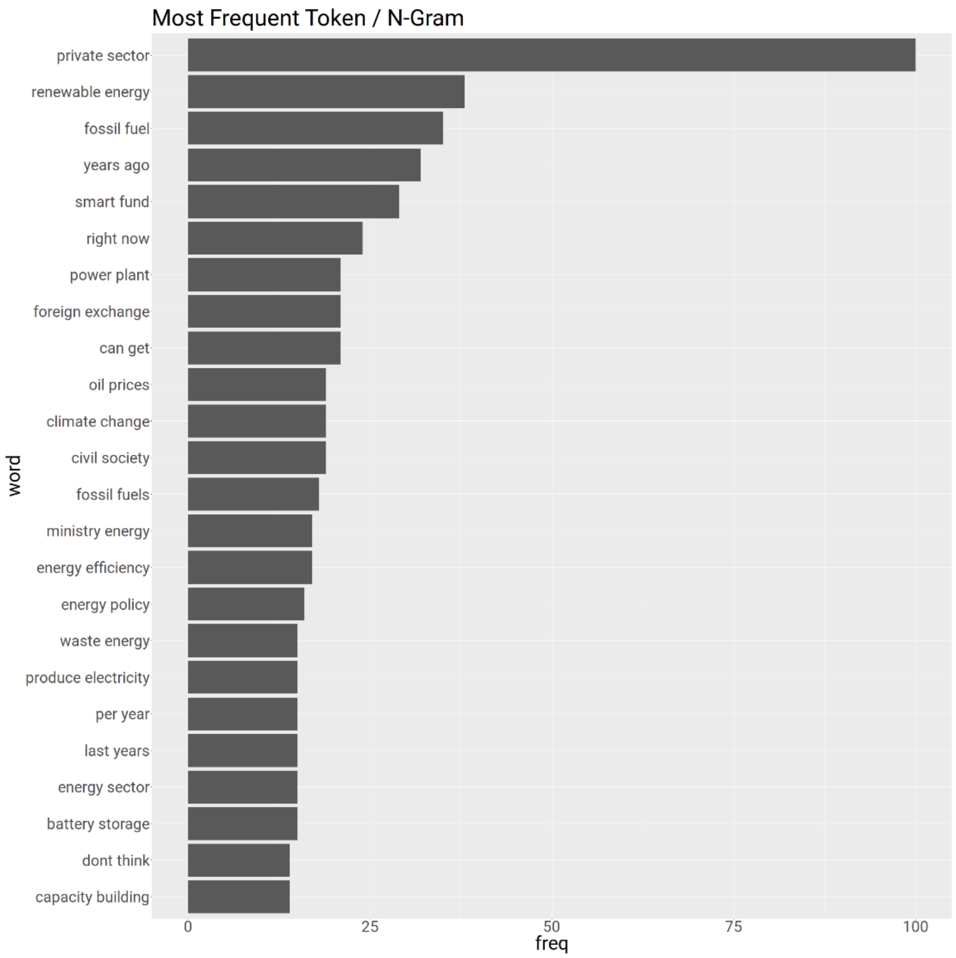


Sources: (stakeholder interviews, Mauritius, 2019; stakeholder interviews, Barbados 2018).

Figure 19 Aggregated Wordcloud N-gram Analysis Results from 1-gram, Barbados and Mauritius

Sources: (stakeholder interviews, Mauritius, 2019; stakeholder interviews, Barbados 2018).

Figure 20 Aggregated N-gram Analysis Results from 2-grams, Barbados and Mauritius

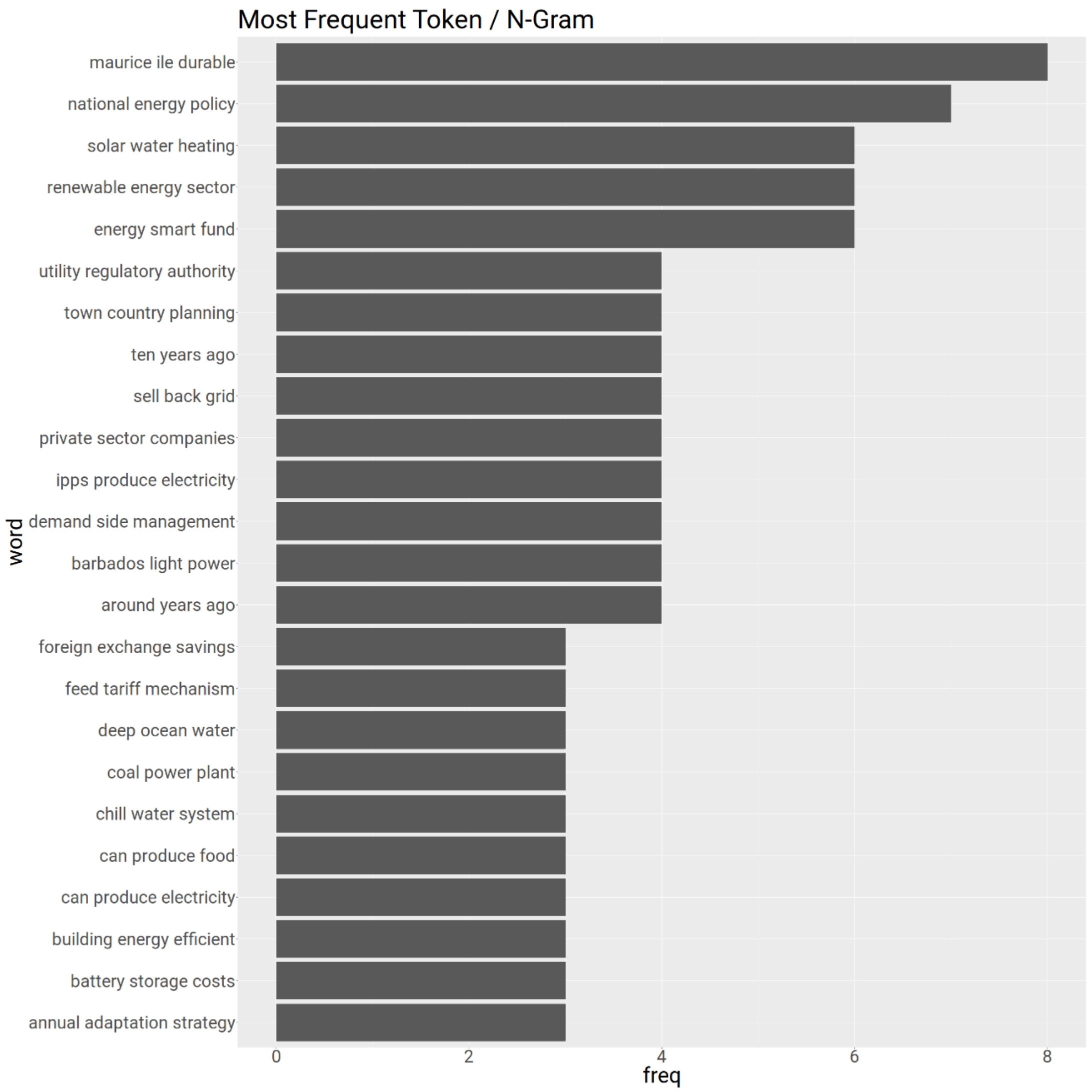


Sources: (stakeholder interviews, Mauritius, 2019; stakeholder interviews, Barbados 2018).

Figure 21 Aggregated Wordcloud N-gram Analysis Results from 2-grams, Barbados and Mauritius

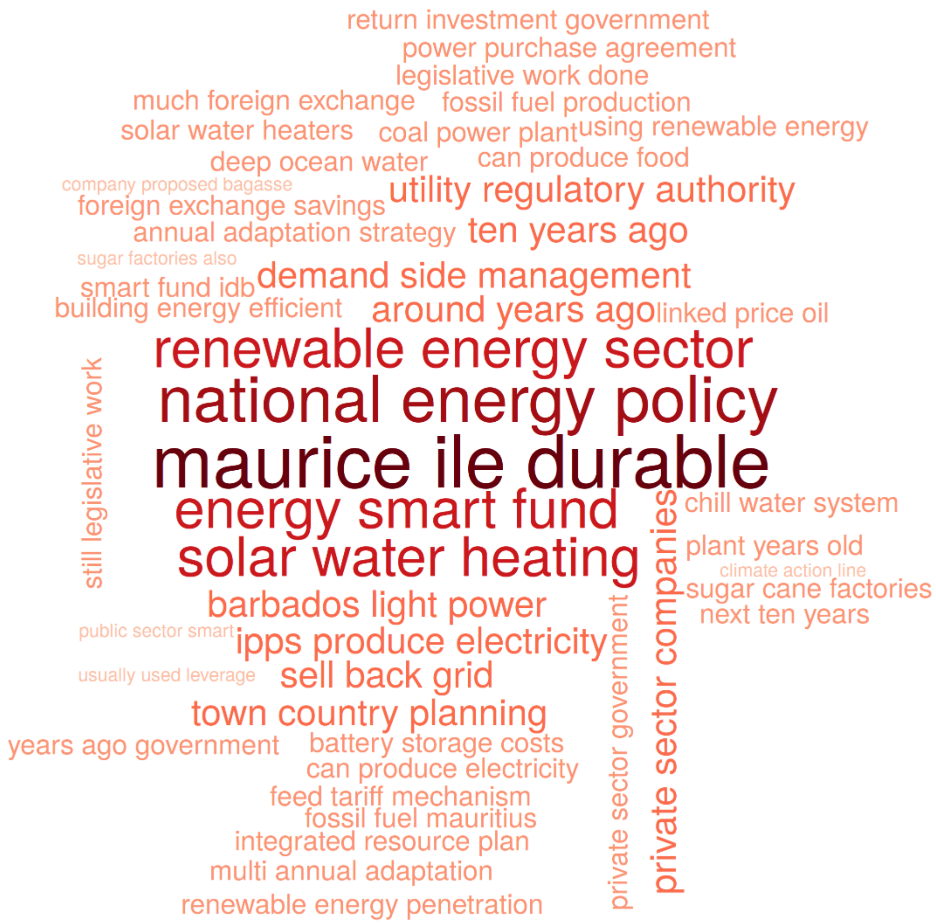
Sources: (stakeholder interviews, Mauritius, 2019; stakeholder interviews, Barbados 2018).

Figure 22 Aggregated N-gram Analysis Results from 3-grams, Barbados and Mauritius



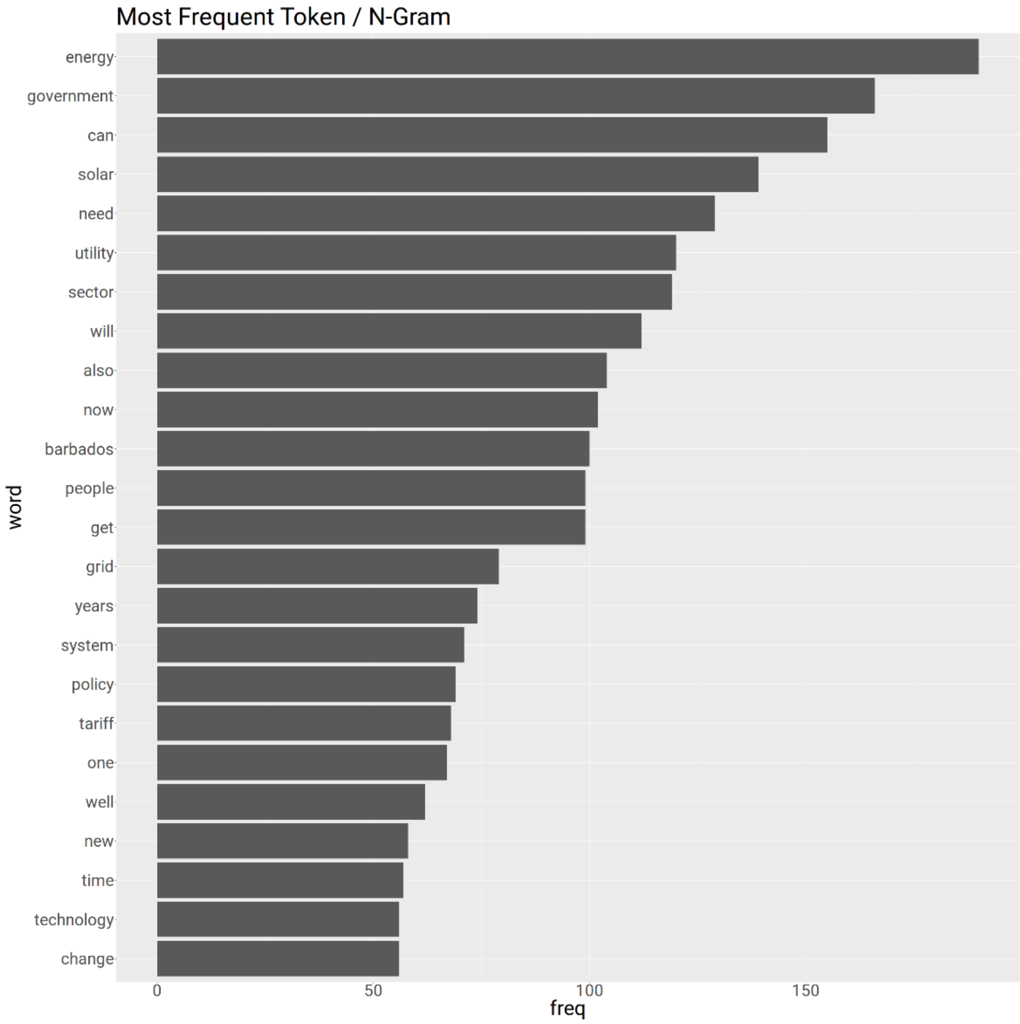
Sources: (stakeholder interviews, Mauritius, 2019; stakeholder interviews, Barbados 2018).

Figure 23 Aggregated Wordcloud N-gram Analysis Results from 3-grams, Barbados and Mauritius



Sources: (stakeholder interviews, Mauritius, 2019; stakeholder interviews, Barbados 2018).

Figure 24 N-gram Analysis Results from 1-gram, Barbados

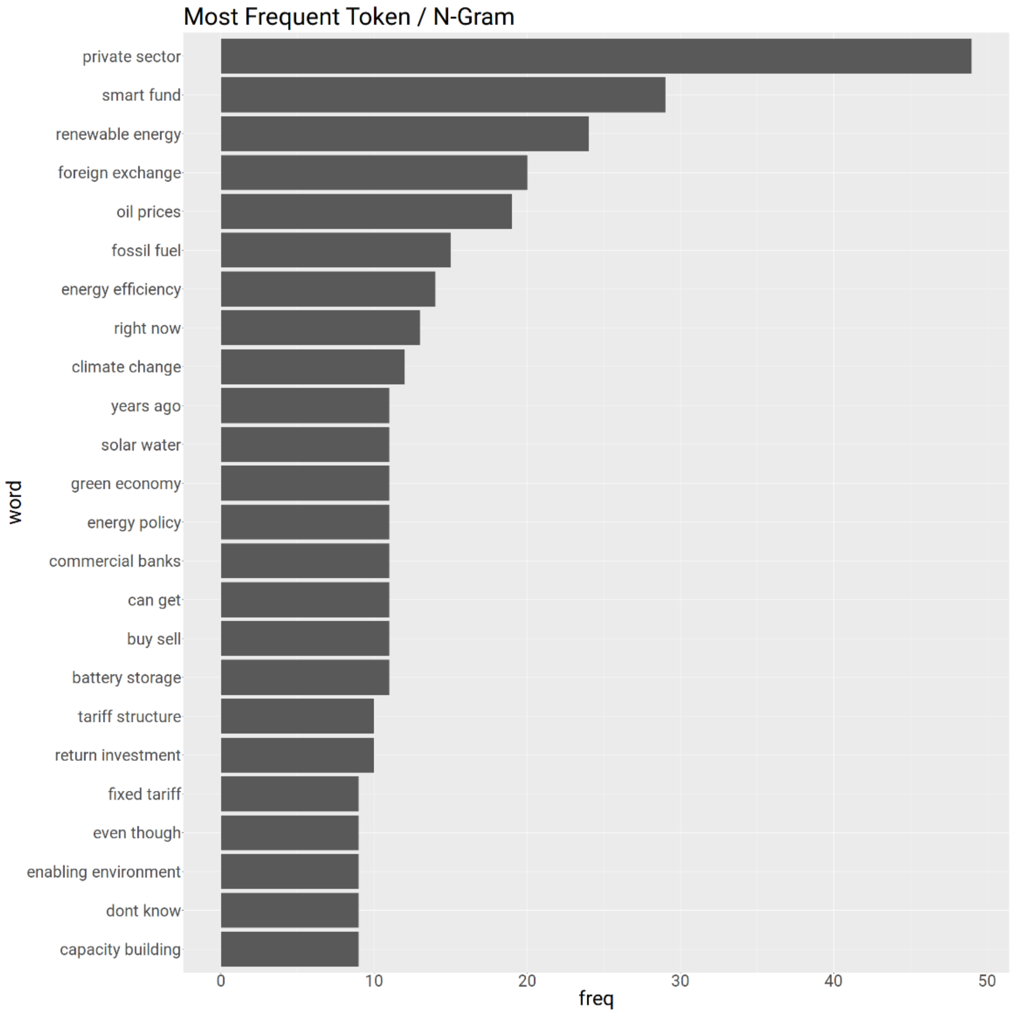


Source: (stakeholder interviews, Barbados 2018).

Figure 25 Wordcloud N-gram Analysis Results from 1-gram, Barbados

Source: (stakeholder interviews, Barbados 2018).

Figure 26 N-gram Analysis Results from 2-grams, Barbados

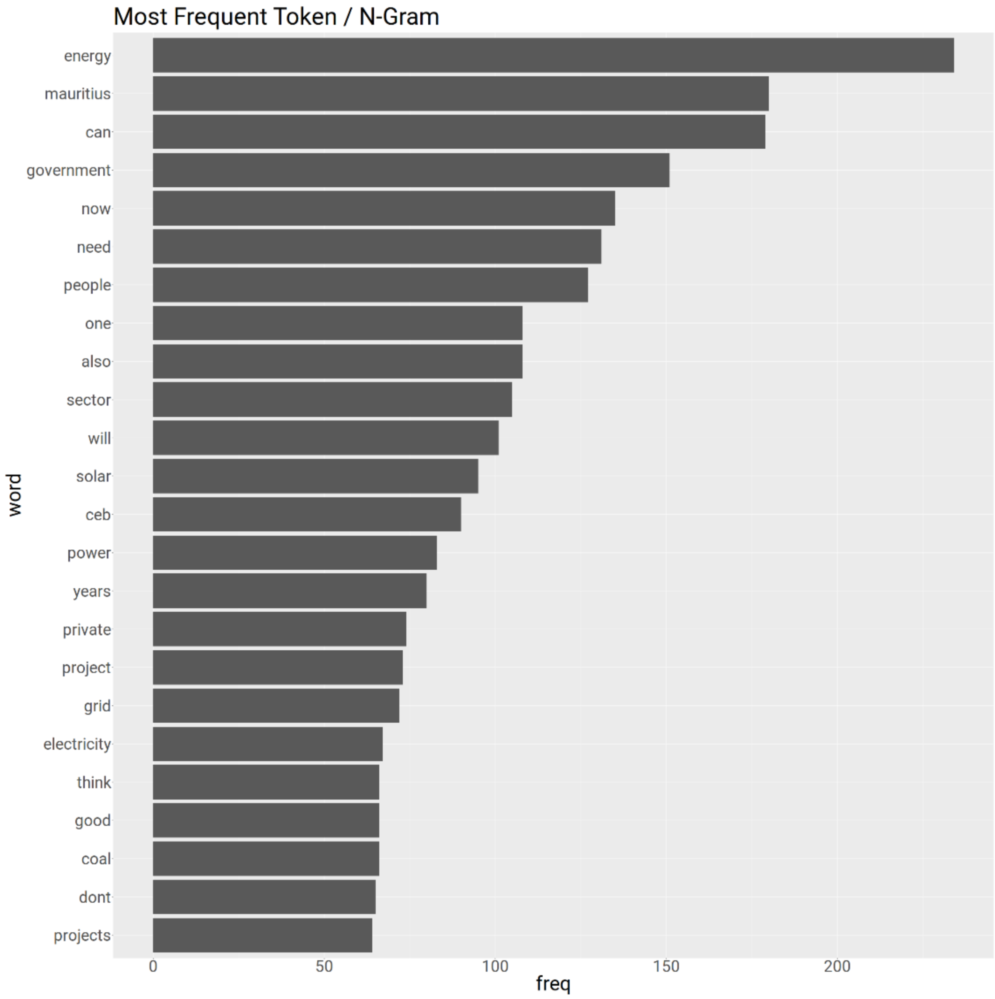


Source: (stakeholder interviews, Barbados 2018).

Figure 27 Wordcloud N-gram Analysis Results from 2-grams, Barbados

Source: (stakeholder interviews, Barbados 2018).

Figure 28 N-gram Analysis Results from 1-gram, Mauritius

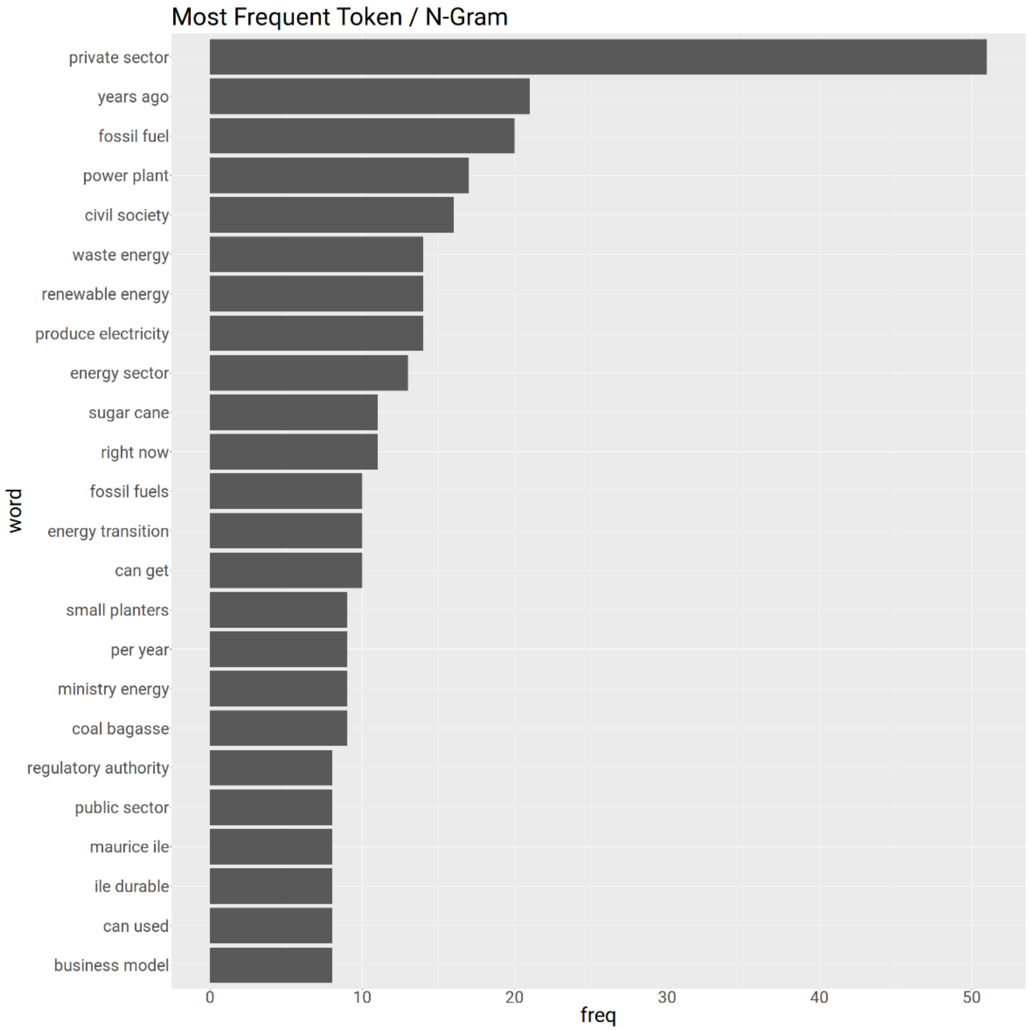


Source: (stakeholder interviews, Mauritius, 2019).

Figure 29 Wordcloud N-gram Analysis Results from 1-gram, Mauritius

Source: (stakeholder interviews, Mauritius, 2019).

Figure 30 N-gram Analysis Results from 2-grams, Mauritius



Source: (stakeholder interviews, Mauritius, 2019).

Figure 31 Wordcloud N-gram Analysis Results from 2-grams, Mauritius

Source: (stakeholder interviews, Mauritius, 2019).

Appendix 8 – Dataset Description

Multiple sources were used to build this database; these are shown for the respective variables in the last column of the table below under the ‘Observation unit (analysis unit)’ section.

This database was built using several data sources. For the dependent (or endogenous) variable ‘renewable energy (RE) Uptake (Gwh)’, 2000 to 2018 data was sourced from the International Renewable Energy Agency’s (IRENA) ‘Trends in Renewable Energy’ online database. These records provide electricity generation (Gwh) at the country level, cumulatively broken down by up to 12 renewable energy technology types (e.g. marine, geothermal, offshore wind, mixed plants etc.). Data can be further disaggregated by grid connection: on-grid and off-grid. The data I used reflects both on-grid and off-grid RE uptake for up to 5 RE technology types (biogas, solid biofuels, solar photovoltaic, onshore wind, and renewable hydropower). The endogenous (or dependent) variable RE uptake (Gwh) is analysed alongside 10 exogenous (or independent) variables. Due to SIDS’ limited data availability, it was difficult to find all the needed data within one database. For my exogenous variables I referenced data from up to 7 different database sources. These included: countryeconomy.com, World Bank Open Data, knoema.com, idea.int, reeep.org and statista.com. Where necessary, country reports were also referenced.

Each observation represents the record total RE electricity generation (Gwh) per year, given changes in key exogenous variables recognised by national stakeholders as important influencers on RE uptake over time.

Observation Units

#	Variable name	Description	Type	Unit	Data Source(s)
Endogenous or Dependent Variable					
	RE electricity generation (RE Uptake)	Renewable energy electricity generation cumulatively broken down by up to 12 renewable energy technology types (e.g., marine, geothermal, offshore wind, mixed plants etc.)	Numerical - continuous	Gwh	https://tabsoft.co/2GuU9lA

Exogenous or Independent Variables					
1	**Debt per capita** (Real Debt 2015)	Estimated debt per inhabitant of the country	Numerical - continuous	US$	https://bit.ly/3l1qbVq
2	**Domestic credit provided to private sector** (Domestic credit)	Domestic credit in the form of loans, purchases of non equity securities, and trade credits and other accounts receivable, that established a claim for repayment	Numerical - continuous	% of GDP	https://bit.ly/2TTcb42
3	**A clear RE roadmap** (RE roadmap)	Presence of a clearly articulated national vision and plan	Categorical (binomial)	1 = yes, 2 = no	Country Reports
4	**Net official development assistance and official aid received** (Real NDA 2015)	Disbursements of loans made on concessional terms (net of repayments of principal) and grants by official agencies of the members of the Development Assistance Committee (DAC), by multilateral institutions, and by non-DAC countries to promote economic development and welfare in countries and territories in the DAC list of ODA recipients.	Numerical - continuous	current US$	https://bit.ly/34Xk3YH
5	**Sugar production**	Production of crops and crops processed.	Numerical - continuous	tonnes	https://bit.ly/3kWcE1g
6	**Civil Society Participation** Control variable	The extent to which the population is engaged in civil society activities. Measured based on 6 sub-indicators- civil society organisation (CSO) participatory environment, Engaged society, CSO consultation, Engagement in independent non-political associations, Engagement in independent political associations, and Engagement in independent trade unions. Scoring runs from 0 to 1, with 0 representing the lowest achievement in the	Ordinal	0 = lowest achievement, 1 = highest achievement	https://bit.ly/38dJ83z https://bit.ly/2HYxAqo

		whole sample and 1 the highest.			
7	**Impartial Administration** Control variable	The extent to which the executive, and public administration more broadly, does not abuse office for personal gain (excluding the courts and parliament). Measured based on 5 sub-indicators- Public sector corrupt exchanges, Public sector theft, Executive embezzlement and theft, Executive bribery and corrupt exchanges, Corruption. Scoring runs from 0 to 1, with 0 representing the lowest achievement in the whole sample and 1 the highest.	Ordinal	0 = lowest achievement, 1 = highest achievement	https://bit.ly/38dJ83z
8	**Rule enforcement** Control variable	The minimum level of active actor participation allowed within the energy sector measured based two sub-categories: h) Partially participatory if there is an attractive feed in tariff, interconnection standards, and either net metering/ billing, or IPPs permitted. i) Non-participatory if any of the partial participation conditions are not in place.	Categorical Dummy var	1 = partial participation, 0 = non-participatory	Country Reports
9	**Utility ownership status** (Utility Ownership) Control variable	Majority ownership status of the country's electricity grid as wither public or private.	Categorical (binomial) Dummy var	1 = state majority ownership, 0 = private majority ownership	Country Reports
10	**Global Oil Price** (Real GOP 2015)	Average global oil price	Numerical - continuous	US$ per barrel	https://bit.ly/3oTBVLU

Note: Please see full dataset separately attached in excel file labelled Greene_Dewasmes_202056525_DatasetAppendix8

Appendix 9 – Ordinary Least Squares Regression Code Details

The OLS model designed and implemented under the quantitative phase of this thesis (see chapter 7) was run using the Stata statistical software. Please see separately attached the Master Code pdf file labelled 'Greene_Dewasmes_202056525_RegresCodeAppendix9'.

Appendix 10 – Automatic N-gram Analysis Software Code

Please see separately attached the R software code used to automatically conduct thematic analysis on primary interview data gathered via expert interviews from Barbadian and Mauritian stakeholders in pdf file labelled 'Greene_Dewasmes_202056525_RNgram CodeAppendix10'.

Appendix 11 - Interview Question Feedback Referenced According to the Main Themes Assessed in Thesis

Thesis Section Referencing Interview Feedback	Corresponding Interview Questions
Chapter 5, Section 5.4.1.1. Access to Resources	1. To what extent has access to external resources and funds from aid flows filled critical resource gaps that have contributed to the advancement of the Renewable Energy sector? And how? 2. To what extent has access to varying consumer financing options played a role in the uptake of Renewable Energy technology? 3. To what extent has access to external resources and funds from aid flows contributed to the advancement of the Renewable Energy sector? And how? 4. What have been some of the main contributions towards the advancement of the Renewable Energy sector made by development funded projects that otherwise would not have been possible?
Chapter 5, Section 5.4.1.2. Articulation of GET Vision and Plan	1. What main factors have driven advancements in the Renewable Energy sector? (e.g. political, economic and behavioural factors). 2. What have been the main obstacles faced in advancing the Renewable Energy sector over the last 30 years? 3. What is the single greatest reform currently needed to facilitate enhanced advancements in the Renewable Energy sector?
Chapter 5, Section 5.4.1.3. Resource Allocation	8. Who are the most significant actors driving change in the Renewable Energy sector? 9. What have been the main obstacles faced in advancing the Renewable Energy sector over the last 30 years?
Chapter 5, Section 5.4.4. Historical & Influential Context Conditions	1. What main factors have driven advancements in the Renewable Energy sector? (e.g. political, economic and behavioural factors). 2. Who are the most significant actors driving change in the Renewable Energy sector? 3. What have been the main obstacles faced in advancing the Renewable Energy sector over the last 30 years? 4. What is the single greatest reform currently needed to facilitate enhanced advancements in the Renewable Energy sector? 5. To what extent have local traditions, perceptions and core values in any way affected the consumer demand for Renewable Energy products?

Chapter 6, Section 6.4 The Importance of GET Actors	1. Who are the most significant actors driving change in the Renewable Energy sector? 2. What innovative and successful approaches have emerged to combat challenges and constraints faced in the advancement of the Renewable Energy sector and who have driven these advancements? 3. What main factors have driven advancements in the Renewable Energy sector? (e.g. political, economic and behavioural factors) 4. What is the single greatest reform currently needed to facilitate enhanced advancements in the Renewable Energy sector? 5. What have been the main obstacles faced in advancing the Renewable Energy sector over the last 30 years?
Chapter 6, Section 6.5.1. Decision Making & Rule Formation Chapter 6, Section 6.5.2. Rule Enforcement	1. Who are the most significant actors driving change in the Renewable Energy sector? 2. What main factors have driven advancements in the Renewable Energy sector? (e.g. political, economic and behavioural factors) 3. What have been the main obstacles faced in advancing the Renewable Energy sector over the last 30 years? 4. What is the single greatest reform currently needed to facilitate enhanced advancements in the Renewable Energy sector? 5. Over the last 30 years how would you rate the government's ability to be responsive to climate change issues in the policy-making and regulatory process? 6. What monitoring, evaluation and reform mechanisms exist that track the success of policies implemented and that systematically engage in reform together with wider stakeholders to improve the overall process?
Chapter 6, Section 6.5.3. Opportunity and Information Access	1. Who are the most significant actors driving change in the Renewable Energy sector? 2. What main factors have driven advancements in the Renewable Energy sector? (e.g. political, economic and behavioural factors). 3. What innovative and successful approaches have emerged to combat challenges and constraints faced in the advancement of the Renewable Energy sector and who have driven these advancements? 4. What have been the main obstacles faced in advancing the Renewable Energy sector over the last 30 years? 5. What is the single greatest reform currently needed to facilitate enhanced advancements in the Renewable Energy sector?

	6. In what way has the ownership status of the national grid affected the advancements in the Renewable Energy sector?
Chapter 7, Section 7.2.1. Main Assumptions on the Factors Impacting GET Success	1. What main factors have driven advancements in the Renewable Energy sector? (e.g. political, economic and behavioural factors). 2. What have been the main obstacles faced in advancing the Renewable Energy sector over the last 30 years? 3. Who are the most significant actors driving change in the Renewable Energy sector? 4. In what way has the ownership status of the national grid affected the advancements in the Renewable Energy sector?
Chapter 7, Section 7.3. Research Design	
Chapter 7, Sections: 7.5.2.1. Overcoming poverty 7.5.2.2. Resource allocation 7.5.2.3. National and external market conditions 7.5.2.4. Climate governance 7.5.2.5. SIDS' developing country landscape	

Notes:

To protect the identities of interview subjects, a further breakdown depicting the exact thematic interview question(s) linked to each interviewee referenced is not provided.

Relevant feedback from interview subjects that was provided on the question ‘any additional comments?’ was inserted under the relevant section headings.

Please see appendix 3 for full interview instrument.

Appendix 12 - Overview of Jamaica's Renewable Energy Sector Transition Over the last 27 Years (1992 to 2018)

Sphere of Governance Activity	Relevant Development(s) Observed	Key Actor(s)	Focus	Problem Scope	Typical Timescale[67]
Strategic	• Consensus on the United Nations Conference on Environment & Development, Agenda 21, June 1992 (United Nations, 1992; DESA, 2000). • Programme of Action for the Sustainable Development of SIDS or The Barbados Programme of Action (BPOA) (1994, rev. 1999, 2005, 2012) (United Nations, 1994). • Ratification of the UN Framework Convention on Climate Change (UNFCCC), 1995 (ECLAC- United Nations, 2019) • Ratification of the Kyoto Protocol, 28.06.1999 (ECLAC- United Nations, 2019). • Mauritius Strategy for Implementation of the Programme of Action for the Sustainable Development of SIDS (2005, rev. 2010) (United Nations, 2005). • The SIDS Sustainable Energy Initiative launched (SIDS Dock, 2010) (Henderson, 2013). • The Third World Summit on Sustainable Development- 'The Future We Want' Outcome Document (Rio+20 Earth Summit, 2012) (United Nations, 2012). • Development of the Caribbean Community (CARICOM) Energy Policy (2013) (CARICOM, 2013). • Development of the Caribbean Sustainable Energy Roadmap (C-SERMS, 2013)	National Government; CARICOM Secretariat	Culture	Abstract/ societal system	Long term (approx. last 30 years: 1992 to 2018)

[67] According to Loorbach (2010).

	(Ochs, Alexander, et. al., 2015). ● UN General Assembly Resolution adopted on the Small Island Developing States (S.A.M.O.A.) Pathway, 2014 (United Nations, 2014). ● Nationally Appropriate Mitigation Action (NAMA) drafted in 2014 (NAMA Database, 2015). ● Paris Agreement: Nationally Determined Contribution (NDC) Communicated to the UNFCCC, 2015 (UNFCCC, 2015). ● Adoption of the 2030 Agenda for Sustainable Development, 2015 (Sustainable Development Goals or SDGs) (United Nations, 2015). ● Voluntary national review on implementation of the 2030 Agenda for Sustainable Development, 2018 (Planning Institute of Jamaica, 2018).				

Tactical	• Green Public Procurement- Environmental Guide to Green Procurement published by the Government, 2000 (National Contracts Commission, 2001). • National Energy Policy introduced, 2009 (The Ministry of Energy and Mining Jamaica, 2009). • Updated public sector procurement policy published, 2010 (Government of Jamaica, 2010). • IPPs Permitted- 2001 All-Island Electric Licence, allowed other persons than JPS to compete for the right to develop new generation capacity, 2011, 2016 (Barrett, et al., 2013). • Public Loans/ Grants provided by national and international sources, 2012 (Makhijani, et al., 2013); (Caribbean Policy Research Institute, 2014). • Net Billing framework- JPS Net Billing pilot programme initiated by the OUR, 2012 (Doris, et al., 2015). • Tax Reductions and Exemptions available, 2013 (Caribbean Policy Research Institute, 2014). • Tax Credits available, 2013 (Makhijani, et al., 2013). • Interconnection Standards present- The Electricity Act (2015)- generation, transmission, distribution, supply dispatch, use of electricity and connected matters (Planning Institute of Jamaica, 2018).	National Government; The National Regulator; International Donors	Structures	Institutions/ regime	Midterm (5-approx. last 15 years: 2000 to 2019)

Operational	• Introduction of RE technologies on and off grid from 2004 to present- onshore wind, solid biomass, renewable hydropower, solar PV (Barrett, et al., 2013); (IRENA, 2019). • Government and National Utility JPS facilitate grid access to renewables- GoJ Net Billing Policy, Standard Offer Contracts (SOC) and Requests for Proposals (RfP), 2012 (Barrett, et al., 2013). • Advancements in financing and investing in renewable energy technologies from 2013 to present- donor grants, investments, commercial and residential loans (Barrett, et al., 2013); (Caribbean Policy Research Institute, 2014). • Pilot and demonstration projects done from 2004 to present- E.g. 2012 Net Billing Policy programme, DBJ GreenBiz Pilot Programme, 2013 vertical axis turbines in Pedro Cay and 2018 Solar lamps inner city project (Barrett, et al., 2013); (Makhijani, et al., 2013); (Planning Institute of Jamaica, 2018).	National Utilities; Commercial banks and lending institutions; International Donors; Private sector; National Government; Civil Society	Practices	Concrete/ project	Short term (approx. last 0-5 years: 2005 to 2019)
Reflexive	• Ad hoc Reviews or M&E studies done between 2010 to 2018- OUR Expansion Plan, 2010; OLADE Review, 2013; World Watch Institute Report, 2013; Net Billing Policy Review, 2015; National Review of 2030 Agenda Implementation, 2018; TAPSEC Profile, 2018; OUR Presentation, 2018. (Barrett, et al., 2013); (Makhijani, et al., 2013); (Doris, et al., 2015); (Planning Institute of Jamaica, 2018); (TAPSEC, 2018); (Francis, 2018).	International Donors; National Government; National Regulator; Research Institutes	Culture Structure Practices	Societal system; Institutions/ regime; Concrete/ project	

Note: Generated guided by Loorbach's (2010) transition management approach (see chapter 2, table 2).

Abbreviations

ACP	African, Caribbean and Pacific States
AIMS	Africa, Indian Ocean, Mediterranean and South China Sea
AOSIS	Alliance of Small Island States
BB	Barbados
BL&P	Barbados Light & Power
CARICOM	Caribbean Community
CC	Climate Change
CEB	Central Electricity Board
DREAM	Disaster Risk and Energy Access Management
EBRD	European Bank for Reconstruction and Development
EE	Energy Efficiency
EL&P	Electric Light & Power
EVI	Economic Vulnerability Index
FiT	Feed in Tariff
GDP	Gross Domestic Product
GET	Green Energy Transition
GNI	Gross National Income
GTZ	German Technical Cooperation Agency
Gwh	Gigawatt hours

HDI	Human Development Index
ICAO	International Civil Aviation Organization
IMF	International Monetary Fund
INDC	Intended Nationally Determined Contributions
IPCC	Intergovernmental Panel on Climate Change
IPP	Independent Power Producer
IRENA	International Renewable Energy Agency
MARENA	Mauritius Renewable Energy Agency
MCB	Mauritius Commercial Bank
MLT	Multi-level Perspective
MS	Mauritius
MW	Megawatt
NAMA	Nationally Appropriate Mitigation Actions
NGO	Non-Governmental Organisation
NREL	National Renewable Energy Laboratory
NSD	National Sustainable Development
ODA	Overseas Development Assistance
OECD	Organisation for Economic Co-operation and Development
OLS	Ordinary Least Square
P.P.	Percentage Points
PPA	Power Purchase Agreement

QCA	Qualitative Comparative Analysis
RE	Renewable Energy
REEEP	Renewable Energy and Energy Efficiency Partnership
RER	Renewable Energy Rider
RfP	Requests for Proposals
S.A.M.O.A. Pathway	Small Island Developing States Accelerated Modalities of Action Pathway
SELA	Latin American and Caribbean Economic System
SIDS	Small Island Developing State
SNM	Strategic Niche Management
SOC	Standard Offer Contracts
SPREP	Secretariat of the Pacific Regional Environment Programme
SUNREF	Sustainable Use of Natural Resources and Energy Finance
TAPSEC	Technical Assistance Programme for Sustainable Energy in the Caribbean
TM	Transition Management
UN	United Nations
UN-OHRLLS	United Nations Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries and Small Island Developing States
UNCDP	United Nations Committee for Development Policy
UNCTAD	United Nations Conference on Trade and Development

UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change is an International Environmental Treaty
UNSD	United Nations Statistics Division
US	United States
WCED	World Commission on Environment and Development
WRI	World Risk Index

References (Chapters 1,2,3 and 8)

Ackbarally, N., 2013. *Climate Change Teaches Some Lessons.* [Online]
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