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Achieving 100% Renewable Energies for Small Island Developing States

How climate finance can accelerate the transition towards 100% renewable energies on island states like the Seychelles

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Authors: Stefan Wehner, Prof. Dr. Olav Hohmeyer, Björn Dransfeld, Michel Köhler, Sünje Callsen, Christine Nettersheim

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Contact: Stefan Wehner, the greenwerk.
E-Mail: sw@thegreenwerk.net

In cooperation with:

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Europa-Universität Flensburg

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Introduction

In the last years, increasing attention was drawn to Small Island Developing States (SIDS) and their specific role in climate change negotiations; the combination of having a negligible contribution to global greenhouse gas (GHG) emissions and yet being most vulnerable to the impacts of climate change requires innovative solutions. The fact that the 2017 UN Climate Change Conference is presided over by the Government of Fiji reaches far beyond this particular state, and accentuates the roles of not only Pacific but all SIDS[1] in the global climate action agenda.

Despite large differences amongst SIDS, they share some key characteristics leading to the extreme vulnerability towards adverse climate change related impacts. From a geographical perspective, SIDS are highly vulnerable to rising sea levels and generally suffer from an increased exposure to natural hazards. Often, the population density and growth rates are exceptionally high. In addition, the majority of SIDS suffers from a scarcity of natural resources, a strong dependence on imported fossil fuels for energy needs and high energy infrastructure costs[2]. The remoteness of most SIDS implies very limited or no economies of scale and complicated and resource intense transport[3].

Electricity generation in most SIDS is heavily dominated by fossil fuels; the use of inefficient diesel generators is widely spread. 95% of all energy consumed in SIDS stems from imported fuels[4]. This brings about high electricity rates for residents, businesses and industries, tying up large amounts of capital that have to be spent on fuel imports. Directly linked to this dependency is a large exposure to fluctuations of international oil price. Even though governments have tended to restrict the ability of power utilities to pass on higher fuel prices to customers, the overall financial economic drain is considerable and can amount to more than 10% of the national income (GDP) of some SIDS in times of high oil prices[5].

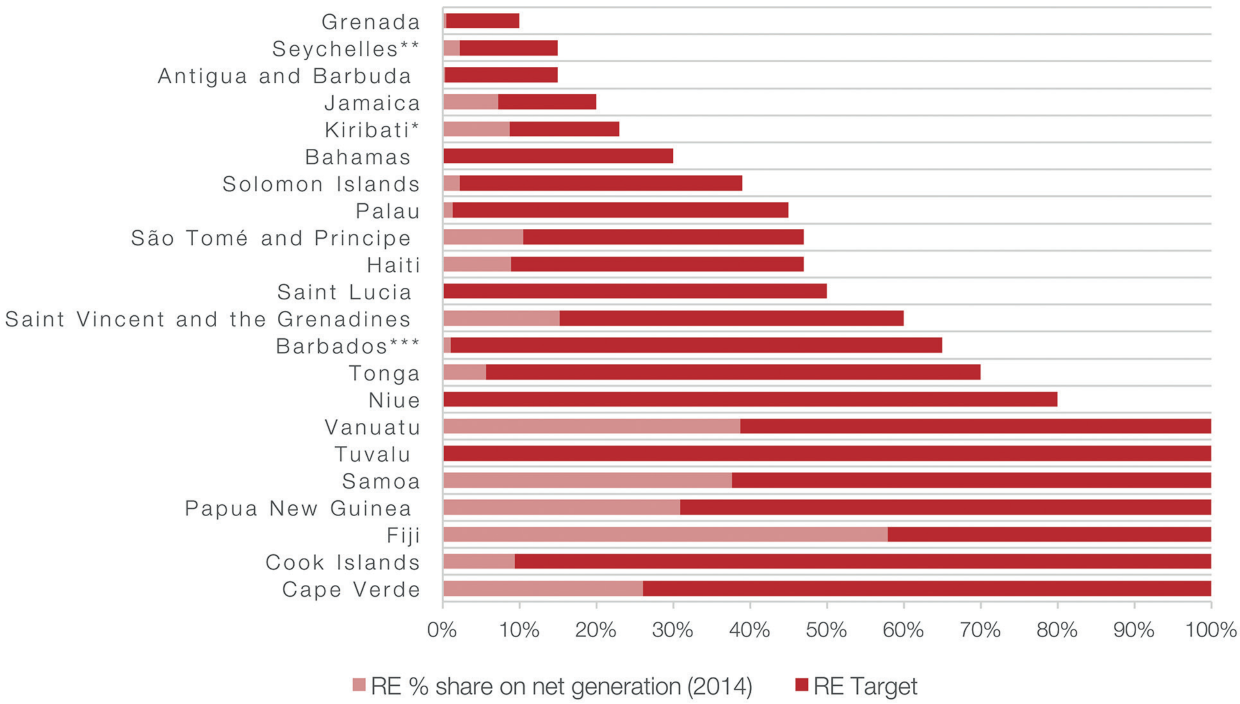
The extreme dependence on fossil fuels and the high expenditures for fuel imports in SIDS raise the economic rationale for a 100% transition towards renewable energy (RE) deployment. Most SIDS offer considerable potential for renewable energies, especially from solar and wind. The expected benefits of increased deployment of renewable energy on SIDS are manifold: Climate change mitigation, a decrease in the trade balance deficit, less exposure to volatile fuel prices, more self-reliant electricity supply, lower imports of fossil fuels and associated environmental risks, multiplier effects through lessons learned at local level, in the region and internationally[6]. Thus, deployment of renewable energies on SIDS can be masterpieces of climate change mitigation and sustainable development. Overcoming the reliance on fossil fuels can increase both resilience and economic viability of all SIDS.

1 SIDS refer to countries listed according to the definition of the UN Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries and Small Island Developing States (UN-OHRLLS)
2 GIZ, 2014
3 Stock, P., 2014
4 Stock, P., 2014
5 ADB, 2008
6 IRENA, 2014

On the way towards 100% renewable energies

The Paris Agreement defines a global target to restrict global warming to well below 2°C above preindustrial levels and to pursue efforts towards 1.5°C. The goal of the Paris Agreement is translated into the so-called Nationally Determined Contributions (NDCs) that outline countries' pledges as contribution to global GHG emission reductions and their adaptation priorities. Moreover, the NDCs state the financial, technical and capacity-building support requirements for the NDCs implementation. The Paris Agreement requests countries to increase their climate mitigation ambition targets over time towards achieving a balance between anthropogenic emissions and removals by sinks, articulate their climate adaptation priorities, and find greater consistency between financial flows, low GHG emissions and climate-resilient development. Many Parties to the UNFCCC were quick in accepting those responsibilities - for instance, in November 2016, the 48 members of the Climate Vulnerable Forum (CVF) declared in Marrakech that they 'strive to meet 100% domestic renewable energy production as rapidly as possible, while working to end energy poverty and protect water and food security, taking into consideration national circumstances[7].

Figure 1: Renewable energy targets as per NDCs and current RE share of net generation in selected SIDS



* Up to 100% for individual islands;
** 100% as per Cabinet Decision in 2016;
*** Referring to total peak electrical demand

Note: All targets refer to the years 2020 (Cook Islands, Tuvalu, Niue, Saint Vincent and the Grenadines), 2025 (Samoa, Palau, Kiribati, Grenada, Cape Verde) or 2030 (all others); Source: Own analysis based on INDCs, IRENA (2017), UN Data (2017)

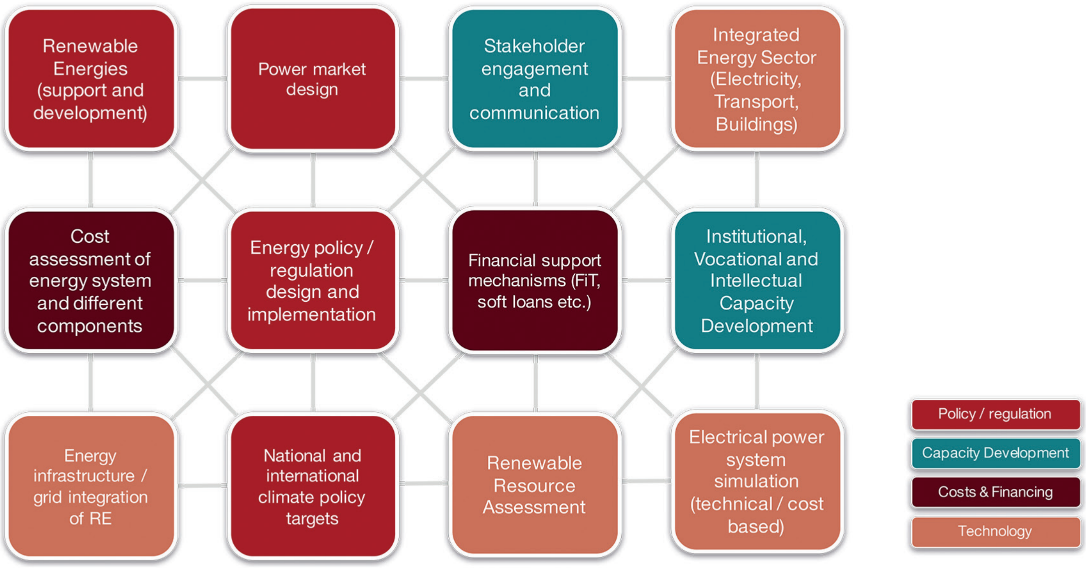
[7] CVF, 2016

As of July 2017, 34 SIDS have published NDCs including GHG emission mitigation and RE targets: Currently, 26 SIDS commit to corresponding targets until 2025 or 2030, of which 22 states formulate a precise RE target (in % of power generation). About one third aims towards a complete transition from fossil fuels to RE sources for energy generation. Naturally, each countries' individual situation and the potential for the adoption of RE technologies form the foundation for those targets and explain the heterogeneity of targets. On a meta-level, the targets can be recognized as a reflection of the pressing need of SIDS to escape from their strong dependence on fossil fuels and as a statement to more significant GHG emitters and their commitments to accelerate the development of low-carbon energy technologies, thereby addressing global challenges of energy security and climate change. However, the current shares of net energy generation from renewable sources as of 2014 clearly reveal the large gaps that exist between actual RE deployment and targets.

Energy roadmaps and policies

The implementation of their NDCs and the definition of Long-Term Strategies (LTS) requires a coordinated and harmonized roadmap. Within their low emission development strategies, most SIDS focus on the energy sector, since other sectors such as industries are less prevalent. In the energy sector an integrated energy approach should be considered. This means beside power generation also the transport and building sector should be covered. Hence, SIDS need comprehensive Energy Roadmaps with corresponding energy policies that are supplemented with a financing strategy and that help overcoming barriers for renewable energy investments for also gaining related Sustainable Development Benefits. Importantly, such Energy Roadmaps should reflect the energy agenda of important stakeholders in the energy sector. Based on the assessment of needs, the following elements should be defined under the Energy Roadmaps: policy measures, technology requirements, costs and financing needs and capacity development necessities for successful implementation. The identified measures should be combined and integrated under the national energy strategy and aim at the most appropriate market structure for sustainable development and stable prices of renewable energies (see Figure 2).

Figure 2: Elements for integrated energy and financial roadmaps



Source: Own illustration

The roadmaps identify and recommend the most relevant and necessary measures, instruments and actions, while their development should also rely on sound stakeholder engagement and participation. In addition, the roadmaps inform about upcoming funding needs, which impacts financial planning within the sector and provides important investment signals for other sectoral actors such as businesses or investors.

Sustainable development benefits

The transition from energy supply based on imported fossil fuels to a system with 100% share of renewable sources will lead to numerous sustainable development benefits. The most obvious contribution is an improved overall efficiency of the energy sector that entails increased energy security and an electricity supply providing more reliable energy at stable costs for businesses and individuals. The economic benefit of reduced fossil fuel imports will save scarce financial resources and stop the drain of hard currency[8]. 100% renewable energies can boost the local economy and increase the domestic tax income. In some cases, the electricity costs can be decreased by 40% and beyond (as compared to conventional electricity generation in times of high oil prices)[9]. Higher electrification rates through mini-renewable-energy-systems in areas formerly isolated from the grid will ensure better services related to health, education, communications, etc., contributing to their socio-economic development[10].

An integral part of the successful deployment and operation of renewable energy production sites is the integration, training and empowerment of local stakeholders in SIDS. An energy transition to

8 Roper, 2005
9 Hohmeyer, 2015
10 IRENA, 2012

renewable sources will offer new occupations and sources of income besides tourism as a current key sector for revenue creation. Local capacities in planning, constructing, operating and maintaining renewable energy plants will be built, and management and regulatory/ monitoring skills for public authorities will be enhanced. This will in turn generate the provision of employment and business opportunities and, thus, generate economic growth[11].

By replacing the widely spread inefficient fossil fuel generators, the associated local air pollution with particulate matter and other polluting emissions (i.e. SOx and NOx) will be reduced. Under an integrated energy roadmap, a switch to electric mobility based on a 100% renewable power supply may further reduce local air pollution and reduce the financial burden of fuel imports even further. The improved air quality will have an overall positive impact on the natural resources (especially water and soil), improve the quality of life and decrease public health cost.

Barriers to overcome

Typical barriers for the implementation of Energy Roadmaps and the deployment of renewable energies are political, administrative, technical, and financial aspects. Important financial barriers are the substantial upfront costs for renewable energies and the absence of financial incentive schemes. The scarcity of available finance, a generally insufficient experience with private sector investments, poor investor perceptions and a lack of economies of scale aggravate these problems. For SIDS, their remoteness brings about additional costs for imported equipment and shipping of spare parts as well as external expertise, since typically manufacturing, e.g. for wind and solar technology, is absent[12,13].

In addition, overcoming the prevailing practice can be challenging. The lack of regulatory frameworks to incentivize investment in renewable energy projects is another main barrier. Missing political commitment may impede participation of state-owned and private utilities as well as private investors, which is a prerequisite for successful renewable energy integration. In most SIDS, there exists a severe shortage of trained local professional staff able to plan, develop, operate and maintain renewable energy projects and installations[14]. Furthermore, there tends to be a lack of consultation between different stakeholders and even if numerous projects are under development, the integration into existing systems is not taken into account and data is hardly available[15].

Technically, renewable energy solutions for SIDS such as mini-grids with high shares of fluctuating supply specifically raise the question of energy storage. Since for smaller systems natural conditions can impede certain storage solutions (like pumped hydro storage approaches on some SIDS[16]), battery

11 Stock, P., 2014
12 Roper, 2005
13 GIZ, 2014
14 Dornan, M., 2014
15 IRENA, 2016
16 Blechinger, 2014

storage may become a promising option. For larger SIDS like Barbados[17] and the main islands of the Seychelles[18], pump storage hydro systems can be the lowest cost storage option.

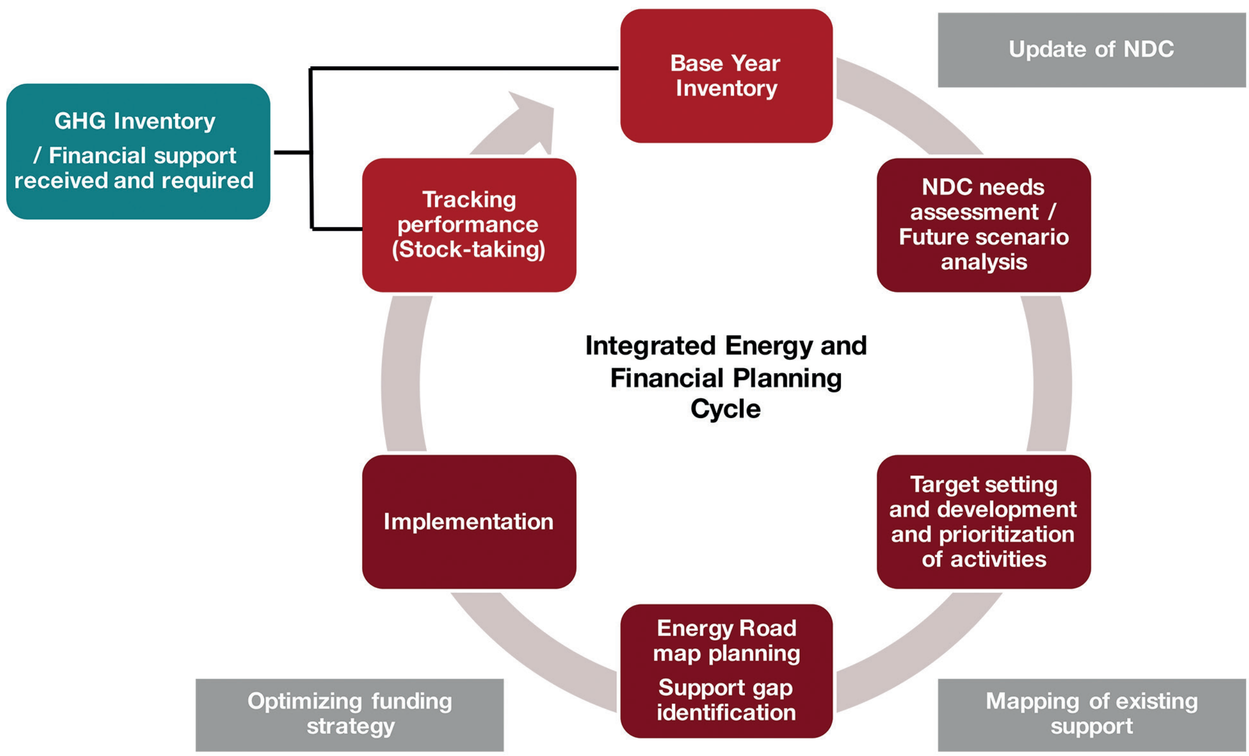
Furthermore, there is limited land area on islands resulting in competing interests and uses. There might be also concerns about the impacts of renewable energy projects on the landscape and local environment, such as noise of wind turbines and glare from PV systems.

Overcoming the barriers: International support and climate finance needs for implementing energy roadmaps

As the ambitious renewable energy targets of SIDS demand large investments in power generation facilities and energy infrastructure, first of all from utilities and from the private sector, international support for the energy transition towards 100% renewable energies power supply is an essential prerequisite for the transformation in many cases.

The Energy Roadmaps require an integrated approach that also takes into account the improvement of coordination, communication and orientation through the maze of international climate finance. According to this principle, the first step on the path to 100% renewable energies includes a comprehensive assessment of needs and existing support, followed by the development of an Integrated Energy and Financial Planning Strategy to attract additional required resources (see Figure 3).

Figure 3: Integrated energy and financial planning strategy



Source: Own illustration

17 Hohmeyer, 2015
18 Hohmeyer, 2016

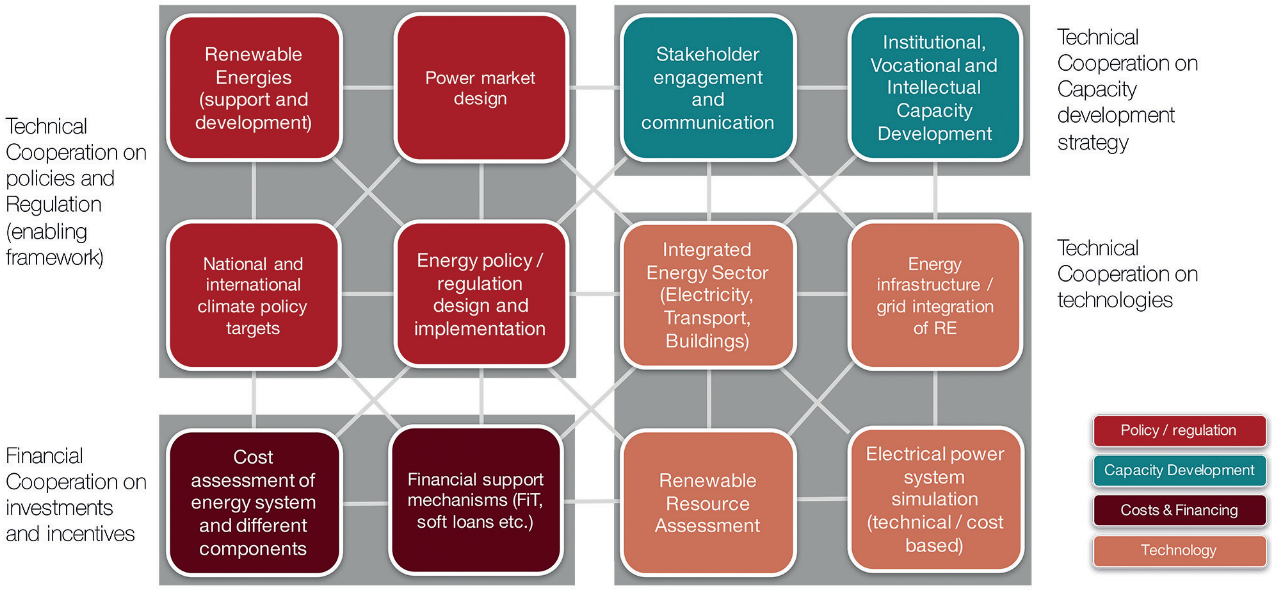
Hereby NDCs can serve as an overarching framework for national climate action, as they combine climate change-related policies and strategies across several sectors, supporting coordinated action in terms of envisaged impacts and resource allocation. For SIDS, they define whether international support (financial, technology transfer and capacity-building) is needed to achieve the targets set. However, so far most of the NDCs do not specify in detail what kind of support they require, oftentimes related to the fact that they also lack precise information on how to attain adaptation and mitigation targets. Ensuring a meaningful contribution by the power and energy sector to a country's economy-wide mitigation target requires the respective government to identify long-, mid- and short-term sectoral GHG reduction goals as part of the NDC. This inevitably involves an assessment of the current sectoral situation and prevailing trends for its future development, as well as a comprehensive dialogue with relevant stakeholders to lay the foundation for a shared long-term vision in line with national climate policy targets. For the implementation, (sectoral) action plans or Energy Roadmaps/low carbon strategies are an essential planning approach to ensure a step-wise transition in the direction of the final targets, including a close monitoring of progress.

Accessing national and international climate finance for supporting the implementation of national energy strategies towards 100% renewable energy

Industrialised Parties have pledged to provide a broad range of support (financial, technology transfer and capacity-building). However, the corresponding international climate finance architecture is evolving fast, and with various layers of multilateral, bilateral, domestic and private sources of funding it is becoming rather complex. Harnessing climate finance for achieving climate goals in a sustainable fashion thus requires a well-prepared navigation.

Therefore, for the successful use of climate finance sources, an **enhanced funding strategy should be established**, which is in line with and complements the Energy Roadmap elements. This funding strategy requires a **mapping of needs, existing support and gaps**, reflecting different categories of support such as technical cooperation on policies and regulation, capacity development, technology transfer and financial cooperation allowing access to funds (see Figure 4). In addition, a comprehensive overview of potential donors and domestic institutions is required, who are well-suited to provide the required assistance in different sectors. This mapping should consider both domestic and international support.

Figure 4: International technical and financial support elements for the implementation of integrated energy roadmaps



Source: Own illustration

In this context of optimizing the funding strategy for the energy roadmaps, an important aspect relates to the most suitable composition of support instruments, donors and partners for addressing identified gaps. The funding strategy should consider all required financial needs, capacity- and institution-building activities, legal support or technology transfer needs, define the respective climate finance instruments (e.g. grants, loans, equity, insurances or guarantees), and identify suitable support institutions and channels that can provide the needed activities and resources (bilateral, domestic, private and multilateral sources such as the GCF, Adaptation Fund, GEF, MDBs, NAMA Facility, AREI, etc.). A suitable funding strategy matches the support gaps for implementation of the Energy Roadmaps with assistance options from donors and recommends relevant partners.

In this regard, independence and country-ownership are of utmost importance; hence, activities should not solely rely on external support but focus on improved capacity of focal points and institutions. The relevant domestic institutions should be enabled to manage the subsequent processes of identifying needs and gaps as well as to attract support.

The case of the Seychelles

The Seychelles consists of 115 islands, the majority being unpopulated. The three main granite islands are Mahé, Praslin, and La Digue with a population of approx. 95,000[19]. Whereas in the past the economy relied heavily on agriculture, today the Seychelles possess a growing service and public sector, and the economy is more diversified with a vibrant tourism, finance and fishing industries as well as exporting processed goods such as coconuts, vanilla and seafood.

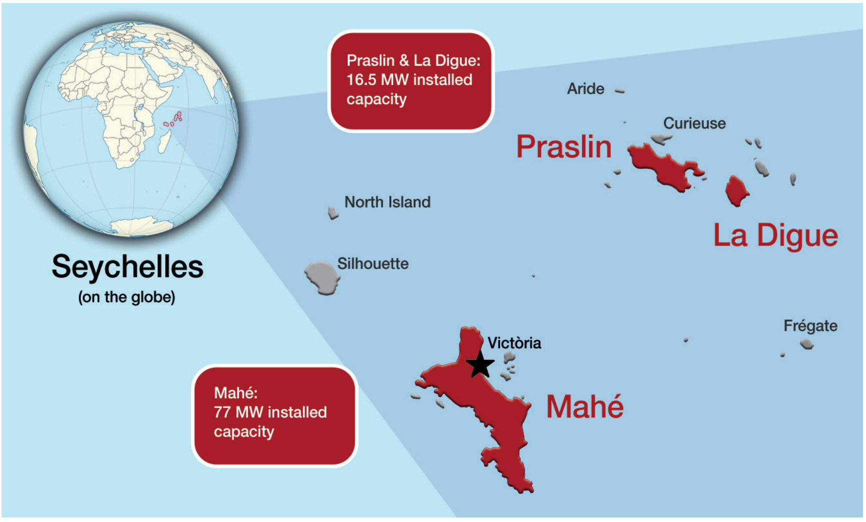
[19] NBS, 2016

Current energy situation

The electricity system in the Seychelles grid consists of two separated systems of 77 MW in Mahé and of 16 MW in Praslin and La Digue, respectively. Both systems are primarily supplied by diesel generators (of 97% and 99%, respectively) fuelled with light (LFO) and heavy fuel oil (HFO), while the share of solar and wind power in the electricity mix is minor (approx. 2.5%). This entails an enormous dependency on mineral oil products for power generation and fuel for transportation, which at the same time implies a high vulnerability to crude oil price volatility.

The fuel costs constitute the major share of the power costs (more than 90% in the Seychelles); price fluctuations of crude oil come directly at the expense of both the overall economy as well as the individual end-consumers. In 2014, fuel imports for electricity production amounted to 4% of the Seychelles' annual national income (gross domestic product). Together with the imports of transport fuels, more than 5% of the national income is used to cover fuel bills.

Figure 5: Geographic and main islands of the Seychelles



Source: Adopted from Wikipedia / CC BY-SA 3.0

Regarding GHG emissions, about 90% of all domestic CO_2 emissions stem from power generation and the road transportation sector. As to power generation, the Public Utilities Corporation (PUC) and auto-producers in the Seychelles currently emit approximately 0.28 $MtCO_2$/a. Assuming an annual energy production increase of 3% (based on historical trends), the total baseline emissions would increase to 0.44 $MtCO_2$/a in 2030, a rise of almost 60%. Road transportation caused emissions of additional 0.09 $MtCO_2$/a in 2015 and is estimated to increase to 0.15 $MtCO_2$/a in 2030[20]. In its National Climate Change Strategy and NDC, the Seychelles committed to reduce their economy-wide absolute GHG emissions by 21.4% in 2025 and 29.0% in 2030 relative to business-as-usual GHG emissions - subject to international support.

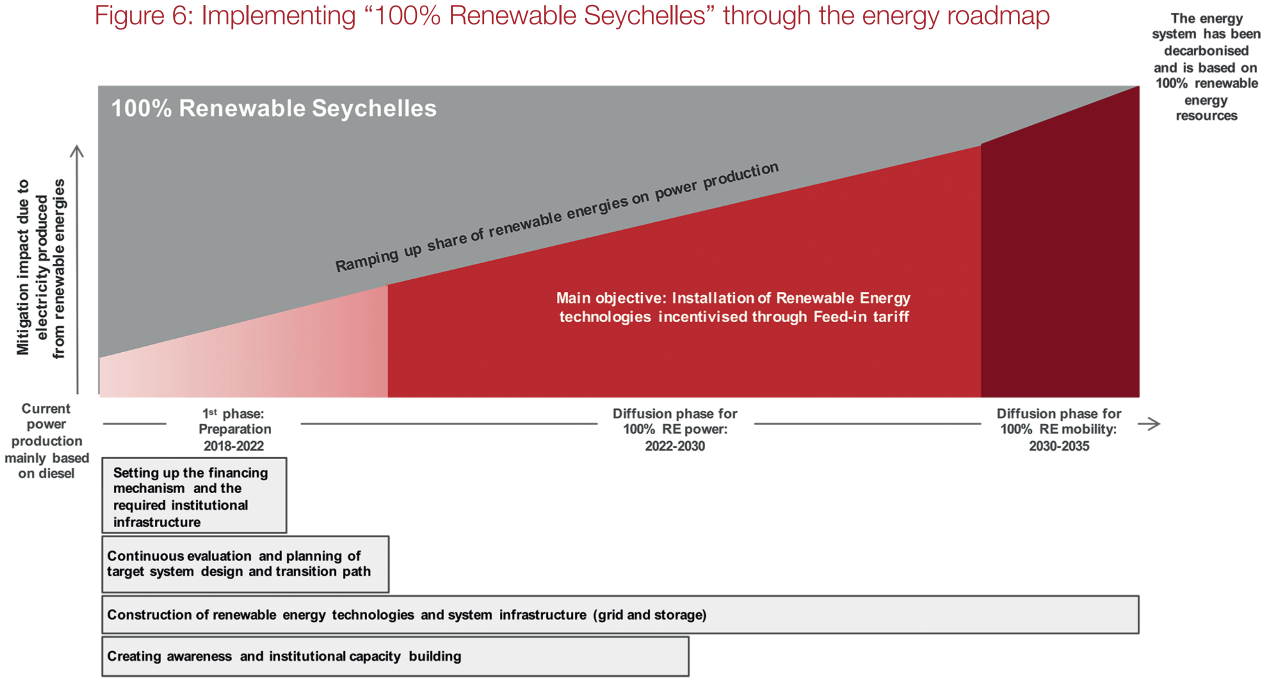
20 Source: Own calculation, assuming 3% energy production/demand increase and grid emission factor of 0.59 tCO_2/MWh; considering production figures from PUC and SEC energy data for 2013 and 2015

Feasibility of 100% renewable energy supply

The Seychelles have a substantial potential of renewable energy resources, which until now remains almost untapped. The 2010 National Energy Policy proposed a target for 15% of energy supply to be met by renewable energy sources in 2030. The anticipated achievement for the year 2020 is 5%. In the long term, the Policy envisages that 100% of energy supply in the power sector will be from renewable energy sources[21].

In 2016, the idea of "100% Renewable Seychelles" gained momentum: A proposal to develop a 100% Renewable Energy Roadmap for Seychelles presented by the Ministry of Environment, Energy and Climate Change (MEECC) was adopted and approved by the Cabinet of Ministers in April 2016. Since then, the MEECC and its partners have been working on a "100% Renewable Seychelles" Energy Roadmap.

Figure 6: Implementing "100% Renewable Seychelles" through the energy roadmap



Source: MEECC, 2016

In preparation of these political decisions, a first analysis of the power supply of the three main granite islands and a possible development towards a complete renewable power supply was conducted. The feasibility study "A 100% Renewable Seychelles"[22] shows that a power supply solely from renewable sources is technically feasible. The island of Mahé can be supplied with electricity from renewable energy sources every hour of the year under a scenario with 50 MW of installed wind power capacity, 125 MW of installed solar energy (PV) capacity, an assumed liquid biomass volume of 25 GWh/a equivalent to 5,000 t of biodiesel and a pump storage hydro plant with a storage volume of 1 GWh. The same has been investigated for the islands of Praslin and La Digue, yielding similar results.

21 Intended Nationally Determined Contribution (INDC) of the Seychelles
22 Hohmeyer, 2016

Envisaged instruments and measures

In order to reach the envisaged target, a draft Energy Roadmap until 2030 was developed. For its implementation and in order to trigger the 100% renewable energy development, a number of regulatory or policy measures are needed to create appropriate and favourable conditions[23]:

- Set up a policy for Feed-in tariffs (FiT) and regulatory framework (specific ordinances) to guide the smooth development towards the target;
- Set up the policy framework in a way that the investment in the new renewable power technologies is generated on the island, thereby keeping the income generated from renewable power production in the Seychelles' economy; while encouraging more local investments, foreign investments will also be needed;
- Use a policy for wind and solar power that enables a broad local participation in the investment for generating additional income for as many Seychellois citizens as possible;
- Enhance stakeholder engagement, i.e. involve as many citizens in the planning and development of wind and solar energy as possible to spread the idea as widely as possible and to guarantee the maximum acceptance of the new technologies (i.e. explore the use of a community investment model; youth education);
- Improve the grid capacity and quality in those locations foreseen for larger renewable power production sites, and the site of the pump storage hydro power plant. This may include a possible sub-sea cable connecting Mahé, Praslin and La Digue to reduce overall system costs by reducing the need of pump storage to only one plant instead of two as presently considered;
- Keep the existing power generation facilities as back-up as long as possible, as they complement the expansion of renewable power supply very well;
- Build up a specialised labour force for planning, construction operation and maintenance of the necessary technologies and their full-scale system integration.
- By including E-mobility in the transport sector, another important area of concern regarding GHG emissions can be addressed.

The roadmap aims at enabling the ramping-up of renewable energy production, i.e. through employing of domestic renewable resources and diffusion of electric vehicles. The political support framework shall help mobilizing public and private investments by establishing an incentive scheme based on FiTs. For the implementation, the Seychelles seek provision of technical support for improving the regulatory framework conditions for private investments, and for strengthening individual and institutional capacities at governmental and non-governmental institutions. The aim is to set up implementation plans for energy infrastructure investments (renewable energy plants, storage, grid) that allow for a comprehensive 100% renewable energy strategy and expansion plan.

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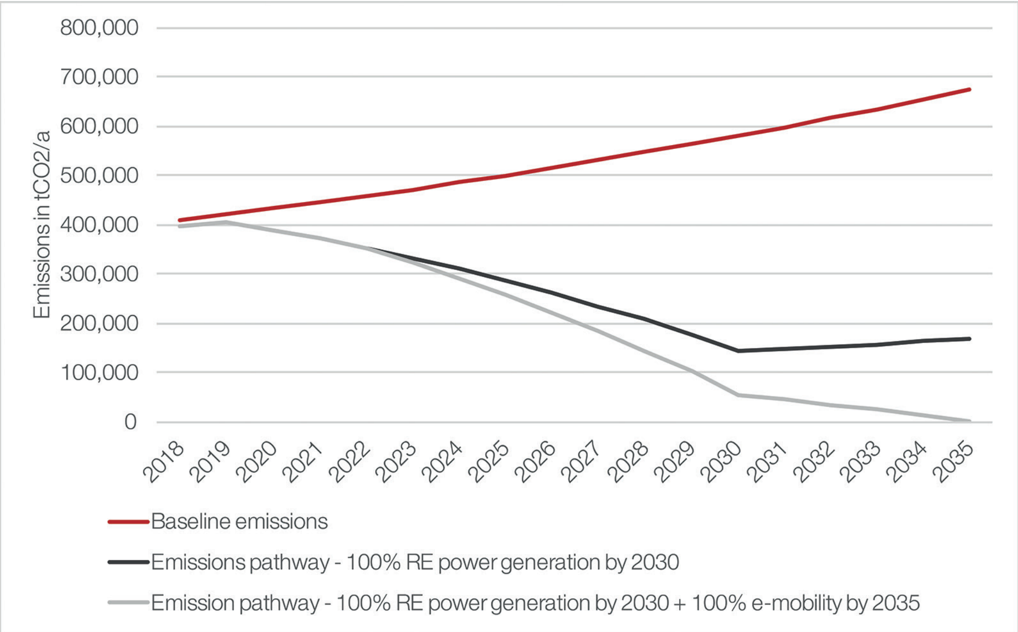
23 MEECC, 2016

Potential impacts

Potential impacts of the “100% Renewable Seychelles” transformation relate to financial, environmental and social matters. Overall, the energy system will be decarbonised and be based on 100% renewable energy resources. Once this transition of the energy system is achieved, the system can be enlarged to generate sufficient renewable electricity to power all private cars, small trucks and busses, assuming the present fleet being gradually exchanged with electrical vehicles.

In terms of expected GHG emission reductions, the realisation of the “100% Renewable Seychelles” strategy will amount to an accumulated 2.8 $MtCO_2$ until 2030 in power generation. Once the transport sector is supplied with the necessary infrastructure and electricity for electric mobility, an aggregated volume of 6 $MtCO_2$ can be reduced until 2035 (power generation and transport). These figures are based on the assumption of an annual energy production increase of 3% (current CO_2 emissions of power generation from PUC and auto-producers). Against the baseline, emission reductions will rapidly ramp-up to reach up to 0.53 $MtCO_2$/a in 2030 and 0.68 tCO_2/a in 2035. Additionally, annual emissions from road transportation of approx. 0.09 $MtCO_2$/a in the year 2015 can be added, which are estimated to increase to 0.17 $MtCO_2$/a in 2035. By 2035, 90% of all domestic emissions in the Seychelles could be completely eliminated.

Figure 7: Emission development under the 100% Renewable Seychelles roadmap



Source: Own illustration based on MEECC, 2016

A 100% renewable power supply will cost about 2.3 SCR/kWh; compared to the average electricity rate charged to the customers of 3.85 SCR/kWh[24], the full system costs amount to just about 60% of the average rate charged.

[24] Hohmeyer, 2016

With the 100% renewable energy strategy, Mahé's fuel imports for electricity production can be reduced by about 40 million EUR/a. At the same time, renewable energy technology investment of approximately 280 million EUR would be needed until 2035. Assuming a local production share of 20% of the investment, technology worth 15 million EUR/a would need to be imported annually (2020-2035). Thus, the average net import reduction amounts to about approx. 25 million EUR/a[25]. This corresponds to about 5.5% of the negative trade balance in 2014[26].

Table 1: Estimation of potentially mobilised private investments in solar PV and wind energy as well as public investments in storage facility

Energy system	Unit	Total	Specific investment cost (EUR/kW)	Total investment required (mill. EUR)
Solar PV - electricity grid only - with e-mobility	 MW MW	 140 188	 1,500 € 1,500 €	 210 € 280 €
Wind	MW	56	1,050 €	60 €
Total (solar and wind) **- electricity grid only**	 **MW**	 **196**		 **270 €**
- with e- mobility	**MW**	**244**		**340 €**
Pump storage	MWh	1,250	1,080 €	155 €

Source: MEECC, 2016

The implementation of the Energy Roadmap requires initial (international) public grant funding for creating an enabling environment to trigger these large private investments, i.e. investment in solar, wind and pump storage plants. It shall further strengthen institutional capacity for mobilising additional public resources e.g. from international climate finance such as the GCF (to finance important energy system infrastructure and storage facilities) in order to accelerate scaling up and to allow for a complete systemic change to 100% renewable energies. Stakeholders have identified technical, policy and institutional capacity requirements for a successful speedy transition to a low carbon development pathway and promoting the deployment of sustainable renewable energy technologies and encouraging increase capacity and output. The current specific needs to start this transition comprise the following three key areas: 1) Designing and implementing policy measures and mechanisms to support renewable energy investments (private and public-private); 2) Implementing feasibility studies covering all potential renewable energy sources in the country; 3) Building capacity of relevant public-sector energy administration agencies, educational institution and utilities.

25 Adapted from Hohmeyer, 2016
26 NBS, 2016

Outlook

The transition towards 100% renewable energy power supply on SIDS requires an individual strategic approach to successfully steer this ambitious transformation. Energy Roadmaps will support this planning progress and the implementation. They will initially define the necessary policy measures, technology requirements, capacity development necessities, costs and financing needs, and need to be reviewed and adapted over time.

However, the formulation and implementation of Energy Roadmaps faces significant barriers as the example of the Seychelles show. Besides a missing political framework for enabling the deployment of renewable energies, financial resources for covering the up-front investments are lacking. International support and climate finance can provide suitable solutions and increase ambition for both installed capacities and implementation timeframes. Once these barriers are overcome, renewable energy based energy systems on SIDS would be financially viable and stable, as countries can resolve the financial challenge of high fossil fuel dependency.

For successfully attracting international support and for accessing climate finance sources, the development of Energy Roadmaps has to be complemented by suitable funding strategies.

As a specific challenge in this regard is often the lack of institutions with sufficient capacity to coordinate and attract the required assistance, initial support on navigating through the maze of international climate finance opportunities for SIDS is required. Initial steps to kick-start such a process would be the formulation of funding and support needs, based on the Energy Roadmap and NDCs. This would allow identifying support gaps by comparing prioritized domestic activities for meeting NDC needs, and existing support initiatives in the country. Those support gaps should be assessed by scoping the need for technical and financial assistance, considering Energy Roadmap specifics and visions. A comprehensive package of relevant climate finance instruments (e.g. grants, loans, equity, insurances or guarantees), required capacity- and institution-building activities, legal support or technology transfer needs should be selected. Thereafter the country can approach the suitable support institutions and channels that can provide the needed activities and resources. As a result, the funding strategy matches the needs under the Energy Roadmap and helps to close the support gaps with well-suited assistance options from donors and relevant partners.

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the greenwerk., Germany, is an advisory network for climate and sustainable energy policy. Based on our background, expertise and network of experts, we offer a wide range of services to our clients in both developing and developed countries. Our work focuses on instruments and activities for promoting greenhouse gas mitigation and renewable energy, in order to foster international efforts and climate finance to combat global warming. On climate finance, the greenwerk. ***navigates public and private actors from developed and developing countries through different layers of the climate finance landscape.*** We help to operationalize results of the Paris Agreement, clarify contentious technical definitions on the UNFCCC level, assess the impact of transformational climate finance, analyse improved involvement of finance institutions such as MDBs, observe and provided services around the latest ***GCF and Standing Committee*** developments and offer support for accessing various funding sources. Our work includes assignments from the German Federal Minister for Environment, Nature Conservation, Building and Nuclear Safety (BMUB), German Environment Agency, GIZ, United Nations Development Programme, World Bank, CDKN etc.

the greenwerk. contributes to a global ***knowledge transfer on climate and energy policy through facilitation of capacity building missions and workshops*** in various countries and sectors, for numerous clients. Our focus hereby is on climate finance and GHG mitigation instruments, such as the ***GFC, NAMAs or market based mechanisms***, and their linkage with the climate policy landscape. In addition, we have authored guidance documents, online courses, newsletters and various other publications. In addition, the greenwerk. conducts research on innovative financing models for transformational changes in the energy sector and sustainable use of resources in the future.

Global Sustainable Energy Consultants Ltd. (GSEC), Barbados, is a network of international consultants founded by Prof. Dr. Olav Hohmeyer in 2015. Its prime focus is on the research based development of tailor made solutions for 100% renewable energy systems for SIDS.

Drawing on energy experts from all WMO regions (Africa, Asia, South America, North America, Central America and the Caribbean, Europe and South West Pacific) GSEC Ltd. offers consultancy services in ***Renewable Resource Assessment and Measurement Campaigns, Analysis and Simulation of 100% Renewable Energy Target Systems, Grid Simulation and Analysis of Renewable Energy Integration, Development of Transition Strategies and Road Maps, Development of Tailor Made Energy Policies and Support Measures***, and ***Design and Implementation of Information Campaigns***. GSEC Ltd. can draw upon more than 35 years of research and consultancy experience in renewable energy systems and climate change mitigation strategies of its founder and a large array of qualifications and experiences of its associated global consultant network.

Europa-Universität Flensburg (EUF), Germany, has a twenty-year track record in research and high level academic education in the field of sustainable energy systems. EUF has successfully developed the research based problem oriented Master Program ***Energy and Environmental Management*** for students from industrial and developing countries. For more than ten years EUF has helped developing countries around the world to set up higher education courses for sustainable energy systems. At the moment EUF is participating in such joint projects in Cambodia, Cuba, Laos and Myanmar.

The main research focus of EUF is on the development and application of ***open source and open data based energy system simulation models*** including economic as well as technical aspects. The research concentrates of ***100% renewable energy target systems*** and the ***development of transition trajectories*** to reach these targets. In connection to that research a number of PhD theses have already been completed or are still ongoing, which are focusing on the analysis of a ***100% renewable energy supply*** for different countries around the world like China, Ethiopia, Pakistan, St. Lucia, Thailand, Venezuela and Vietnam.

The second research focus is on the development of ***local climate change mitigation strategies*** to reach local climate neutrality in industrialised countries no later than 2050.

the greenwerk. GbR

Björn Dransfeld, Michel Köhler, Stefan Wehner
Große Theaterstraße 14
20354 Hamburg

info@thegreenwerk.net
www.thegreenwerk.net