Strategic and Implementation Plan to Transfer Sustainable Energy Technologies that are SIDS-Appropriate

FINAL DRAFT STRATEGIC AND IMPLEMENTATION PLAN

Requested by:
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Foreword

This *Strategic and Implementation Plan to transfer Sustainable Energy Technologies that are SIDS-appropriate* is prepared by ing. Kevin de Cuba, MSc. and ing. Ruben Contreras-Lisperguer, MSc. of the Aruba Sustainable Development Foundation (ASDF), the authors would like to thank the SIDS DOCK Secretariat and the Caribbean Community Climate Change Center (CCCCC) for the entrusted task of preparing this report.

The authors would like to thank Dr. Albert Binger, SIDS DOCK Coordinator, and Dr. Rachael Williams for their guidance in developing this assessment. The ASDF thanks all individuals and organizations that assisted with data collection and shared their views of challenges and opportunities related to the sustainable energy development in SIDS.

Background

The international community, through such instruments as the 1992 Earth Summit and Agenda 21, has long highlighted *technology transfer* as a key determinant of sustainable development. SIDS governments have similarly embraced the goal of technology transfer, as reflected in the 1994 Barbados Program of Action adopted at the First Global Conference on the Sustainable Development of SIDS and its 10-year follow-up report, the 2005 Mauritius Strategy of Implementation.[1]

During the High-Level Conference of the Small Island Developing States (SIDS) that took place on May 7-8, 2012 in preparation for the Rio+20 Conference focused on "Achieving Sustainable Energy for All in Small Island Developing States".[2] Heads of state, ministers, leading development experts, civil society leaders, business executives and UN officials from 39 countries from the Caribbean, the Pacific, Indian Ocean, and Africa gathered to discuss policy strategies for sustainable energy development among island states. The Conference concluded with adoption of the "Barbados Declaration," which among other re-iterated the consensus among SIDS that a critical strategy to overcome the challenges to the increased deployment of SIDS-appropriate sustainable energy technologies in SIDS is to work toward the *transfer of appropriate technologies* by among other establishing mechanisms to incentivize and facilitate collective SIDS-SIDS collaboration and action.[3]

The Rio+20 Outcome Document of June 2012, included specific reference to SIDS reaffirming the special case of SIDS sustainable development due to their unique and particular vulnerabilities calling for (1) increased efforts to implement the BPOA and MSI, including the improvement and strengthening of the relevant entities within the United Nations system that support SIDS' sustainable development (art. 86), and (2) the strengthening of the Global Environmental Facility, with regularity in funding flows and reform of governance processes towards more transparent and democratic systems. In addition the simplification of procedures and assistance to the least developed countries and SIDS in accessing resources from the GEF (Art. 117).[4]

SIDS DOCK launched in December 2010 in Cancun, Mexico, during COP-16, is a SIDS-SIDS institutional mechanism composed of 30 Member States[5] and serves as a "docking station" through which SIDS can access global financial funds; in addition it functions as a SIDS-SIDS knowledge sharing and expertise hub on sustainable energy transition for the membership. Since its launch through 2011 and 2012 the SIDS DOCK Board and the SIDS DOCK Secretariat are undergoing a process of formal establishment and operationalization.

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[1] http://www.stimson.org/images/uploads/research-pdfs/Alain.pdf

[2] http://www.sustainableenergyforall.org/actions-commitments/country-level-actions/item/74-sids

[3] http://www.undp.org/content/dam/undp/library/Environment%20and%20Energy/Climate%20Change/Barbados-Declaration-2012.pdf

[4] http://www.sidsnet.org/about-sids/rio20

[5] As per July 2012, in the **Pacific Ocean**: Cook Islands, Fiji, Kiribati, Federated States of Micronesia, Marshall Islands, Nauru, Palau, Samoa, Solomon Islands, Tonga, Tuvalu, and Vanuatu; in the **Caribbean**: Antigua and Barbuda, Bahamas, Barbados, Belize, Dominica, Dominican Republic, Grenada, Jamaica, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Suriname, and Trinidad and Tobago; in the **Atlantic Ocean**: Cape Verde, Sao Tome and Principe; in the **Indian Ocean**: Maldives, Mauritius, the Seychelles.

This *Strategic and Implementation Plan* is prepared to guide the SIDS DOCK Board and Secretariat in the operationalization of SIDS DOCK in order for it to receive, manage and allocate funding to effectively increase the transfer SIDS-appropriate sustainable energy technologies and making them available in SIDS DOCK Member States to address SIDS energy needs and achieve the SIDS DOCK goals of increasing energy efficiency by 25 percent (2005 baseline); to generate a minimum of 50 percent of electric power from renewable sources; and a 20-30 percent decrease in conventional transportation fuel use by 2033.

Contents

ABBREVIATIONS

CC	Climate Change
EE	Energy Efficiency
GHG	Greenhouse Gas
GWh	Giga-watt-hour
kWh	Kilowatt hour
kW	Kilowatt
MW	Megawatt
PV	Photovoltaic
OTEC	Ocean thermal energy conversion
RE	Renewable Energy
RET	Renewable Energy Technology
RES	Renewable Energy Source
SET	Sustainable Energy Technology
SIDS	Small Island Developing States

Executive Summary

SIDS DOCK as a SIDS-SIDS initiative aims to bring added value to SIDS and the international development assistance community by approaching development assistance for sustainable energy development in a different way. It has established clear targets to trigger collective efforts among SIDS membership to address the needed energy development pathway.

The SIDS DOCK targets include:
Target 1 - Increase energy efficiency by 25 percent (2005 baseline) by 2033
Target 2 - Generate a minimum of 50 percent of electric power from renewable sources by 2033
Target 3 - 25 percent decrease in conventional transportation fuel use by 2033

The principal question to be answered in this report is *how SIDS-appropriate sustainable energy technologies can become increasingly available in SIDS in the coming 20 years?*

Among the instruments available and assessed, this report recommends SIDS DOCK to prioritize *Transfer of Technology* as a key instrument to assist SIDS to develop sustainable energy, but this will require a narrowing down of the general scope of *Transfer of Technology* to a *SIDS Focused Transfer of Technology* process.

SIDS have not, due to their obvious limitations (e.g. small size, remoteness, limited and fragile ecosystems, among other), and multiple barriers (e.g. lack of human resources, poor legal frameworks, high level of debt, among other), had success in securing financing to gain access or to deploy sustainable energy technologies in SIDS and remain highly dependent on international public and private finance, which are conditional on specific requirements. Among the pre-conditions or requirements a commonly reiterated barrier is the lack of critical economies of scale of the projects to be financed in SIDS.

Over the past 30 years the international development assistance community has focused their collective efforts on addressing the challenges or barriers in SIDS to create the adequate investment conditions determined by the international financing institutions, and aimed to identify and assist SIDS in preparing bankable projects in order to secure international financing for sustainable energy projects.

A key message of this report is that although over the past 30 years, efforts by the international development assistance community have led to significant progress in facilitating the *Transfer of Technology* through education (curriculum development), institutional capacity building, policy making, public awareness raising, assessment of renewable energy sources, technology assessments, and other commonly known tools or activities to address barriers to the increased investment in and deployment of renewable energy and energy efficiency technologies in SIDS. Still the current reality showcases that almost all SIDS are nowadays even more dependent on imported fossil fuels than 30 years ago; are dealing with high costs for energy import, generation and use; and host a limited amount of sustainable energy technologies to offset their energy challenges.

Although much of the above mentioned assistance has been absorbed and has led to an increased maturity of SIDS in dealing with their energy needs, the critical problem remains access to adequate financing. This is due to the unique limitations of the SIDS community around the globe where more than 60% are very small island nations (less than 1000 km^2) with very limited physical space, resources, economies of scale, and capacity to address all the demanded requirements (sometimes excessive risk avoidance requirements) set by multilateral development banks or other international public financing institutions or mechanisms, and subsequently resulting in having a private sector not willing to take high risks without sovereign guarantees or other co-financing sources, and opt for more attractive markets elsewhere in the world.

All the above lead to the critical questions, (1) whether the international development (ID) assistance community should continue to play by the rules and conditions set by the international financing institutions and established financing mechanisms, and continue to allocate efforts and resources on improving conditions in SIDS in order to qualify for financing (described in Scenario A) or (2) is the problem the inadequacy of existing international financing mechanisms to the unique needs and conditions of SIDS (described in Scenario B)?

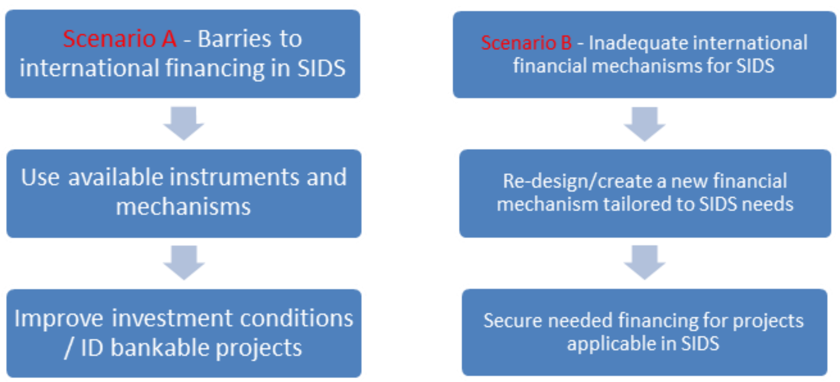

Figure 1 Alternative perspectives of sourcing adequate financing for deployment and transfer of RETs in SIDS

Another issue highlighted in this report is that not all renewable energy or energy efficient technologies are considered sustainable in SIDS context nor are they all suitable for island communities. Therefore when referring to *Transfer of Technology*, SIDS DOCK is recommended to focus efforts on making sure this occurs in a rational fashion recognizing the need to assess SIDS-appropriate sustainable energy technologies and making sure that collective efforts and resources are directed in the activities of making such technologies become accessible to SIDS communities and that the communities are able to accept and use these technologies in a proper manner to address the current and future energy needs. This is the reason for introducing the concept of "*SIDS Focused Transfer of Technology*".

This approach allows for the targeted allocation of collective resources to a specific common beneficial goal of guaranteeing access to suitable sustainable energy technologies at cheaper costs for SIDS and develop capacity for knowledge and skills, and infrastructure on which all SIDS can agree and where they do not directly and independently depend on each other to engage, accelerate or implement activities to achieve their respective national energy policy targets. This approach recognizes that SIDS are united but not uniform. Thus although all SIDS are striving for increased quality, reliability, equity and affordability of energy services to achieve sustainable development, each SIDS government first and foremost is responsible for developing economic, social and environmental programs to improve the quality of life for all their citizens and any solution will still depend on available resources and conditions in each respective SIDS.

Among the *SIDS-appropriate sustainable energy technologies* there are commercially and non-commercially available base load and intermittent energy generation technologies for generation and supply of energy or electricity, and current and futuristic energy efficient end-use technologies (appliances, vehicles, equipment, machinery and other) that need to be increasingly deployed in SIDS to use available energy or power more rational and efficiently. Each category of technology has different implications to SIDS and requires different level of attention and effort to making them available and useful to the island communities.

Next to securing resources to invest in and deploy commercially available SIDS-appropriate sustainable energy technologies, SIDS DOCK is recommended to allocate efforts and resources in building Research, Development and Deployment (RD&D) facilities and capacity in SIDS. This is considered the second most critical instrument to be used by SIDS DOCK to address the need to build up mid-to long term human capacity, and technology assessment, deployment, application and use capacity of island communities around the globe.

When referring to *SIDS Focused Transfer of Technology* as a principle instrument of SIDS DOCK to address the multiple energy development challenges faced by SIDS, this report recommends SIDS DOCK to look at narrowing down its specific efforts to the two critical issues highlighted above, including (1) allocating resources to deploy present commercially available SIDS-appropriate sustainable energy technologies in SIDS, and (2) allocate resources and efforts to building the Research, Development & Deployment capacity and infrastructure in SIDS to enable island communities to further develop future, currently non-commercial sustainable energy technologies that are suitable to SIDS and possibly beyond. With other words the activities or strategic actions to be developed by SIDS DOCK have to be narrowed down to activities that contribute to the specific goals set by SIDS DOCK and are critical to the *Transfer of Technology* process. The SIDS DOCK Secretariat needs to recognize that there is no need to add another player in the international development assistance community to provide assistance as energy awareness, energy policy making, or other activities being developed or used by other international, regional and sub-regional partners.

The rationale is that SIDS DOCK needs to find its niche to avoid the overlap and competition with other existing international organizations and other partners of the international development assistance community, and define clearly a specific focus (SIDS) where SIDS DOCK can have significant impact and added value on improving the transfer of SIDS-appropriate sustainable energy technologies to SIDS around the globe.

Recommended strategy

In order to answer the critical questions of how SIDS-appropriate sustainable energy technologies can become available in SIDS and what role SIDS DOCK should play in this effort, the following issues need to be taken in to account:

Above all, there is a need for clarification of the official institutional status or "raison d'être" of SIDS DOCK. Is SIDS DOCK (1) a new SIDS-SIDS multilateral organization, (2) a SIDS technical assistance agency, or (3) a SIDS financing and technical assistance mechanism?

The answer to this question will determine the concrete role and added value SIDS DOCK may bring to SIDS and the international community. It is highly recommended to establish SIDS DOCK as a new *international financing and technical assistance mechanism* to <u>invest</u> in facilitating the *transfer of SIDS-appropriate sustainable energy technologies to SIDS* that includes specific additional technical assistance functions and fiduciary procedures and standards to complement this core function to enhance SIDS DOCK's success in leveraging the required resources, properly manage the funds, guarantee continuity, and coordinate efforts to achieve set goals by 2033.

The status as a new *SIDS financing and technical assistance mechanism* recognizes the fact that the available international financing initiatives or mechanisms are not adequate or suitable to the needs of SIDS and that a new framework or configuration is required. The significance of SIDS DOCK to international, regional and local financiers or donors will highly depend on the business model being proposed. In this case clarity and rationale regarding the allocation of resources and efforts, and the mechanisms to secure return on investment are determinants to sponsors or donors to SIDS DOCK. This aspect of setting up this *SIDS financing and technical assistance mechanism* is beyond the scope of this study, but is highlighted as the critical component of making SIDS DOCK a reality.

Strategy outline

Among the various policy tools/instruments and strategies available to address the challenges to the increased deployment and application of energy efficiency and renewable energy technologies in SIDS, *Transfer of Technologies* is considered a critical instrument to assist SIDS overcome the lack of technology assessment, deployment and application capacity. The proper assessment and selection of sustainable energy technologies (SETs) will reduce the public and investment risks of an island community aiming to opt for a suitable and sustainable technology option for the medium and long term to achieve the goals of guaranteeing a reliable, affordable and environmentally responsible low carbon economic development. The following phases outline the programs and strategies in the strategic plan.

Component 1 – Baseline assessment

This component focuses on performing a comprehensive baseline assessment of the annual energy conditions in each respective SIDS DOCK Member State as per the year 2005 on forward. Activities during this phase will specifically focus on gathering primary or first-hand data and statistics from the respective entities, agencies and ministries in charge of collecting and monitoring data. The data will be properly processed in a database, the data interpreted, analyzed, verified and prepared for publication. A proper energy analysis will be executed to properly establish the reference conditions to enable SIDS DOCK to monitor the development, progress and effectiveness of activities by SIDS DOCK in achieving the set SIDS DOCK objectives.

Component 2 – SIDS-appropriate sustainable energy technology assessment
Following the baseline assessment SIDS DOCK will perform a comprehensive quantitative assessment of the renewable energy resources and energy technology assessment. An assessment will be performed to identify all commercially available energy technologies around the globe and assessed based on the criteria developed by ASDF/SIDS DOCK to identify SIDS-appropriate sustainable energy technologies. The pre-selected energy technologies will be categorized by their potential and ability to satisfy specific needs of SIDS DOCK Member States.

Component 3a – Deployment of commercial SIDS-appropriate sustainable energy technologies
A listing will be created of the technology developers and suppliers of the energy technologies that are categorized as SIDS-appropriate. This information will be processed in a database accessible to SIDS DOCK Membership at all times. SIDS DOCK Secretariat will engage with Member States in identifying specific prioritized and endorsed projects and rank them by order of technology needs resemblance, scale, potential output, and timeline. SIDS DOCK will dedicate efforts in establishing strategic partnerships in all the major SIDS regions to secure additional financial and technical support to deliver results. The objective of this component of the Strategic Plan is to invest in low-hanging fruit opportunities to showcase short term results and build further momentum around the image and capacity of SIDS DOCK to deliver upon the set objectives. The results will be used as input to the SIDS DOCK public education and awareness program, and other instruments to showcase SIDS DOCK's performance to leverage and secure more financing.

Component 3b – Assessment of RD&D needs and potential in SIDS
In parallel to phase 3a, SIDS DOCK will perform a comprehensive assessment of the research, development, and deployment capacity in the SIDS around the globe and identify the potential and need for investing in creating or improving the capabilities to perform RD&D activities with specific focus on SIDS-appropriate energy technologies. Strategic partners will be identified for the creation or fortifying of R&D capacity and facilities in SIDS.

Component 4a – Expand the commercial deployment of SIDS-appropriate sustainable energy technologies
After the first generation of "low hanging fruit" projects, SIDS DOCK will dedicate additional efforts in establishing long term strategic partnerships in all the major SIDS regions and transition its focus on becoming the principle mechanism for SIDS to secure international financing for investment in SIDS-appropriate energy technologies to address specific SIDS energy needs. The strategic alliance with other entities will enable SIDS DOCK to reduce its involvement in specific technical assistance themes that can be better or more effectively covered by specialized technical partner agencies as e.g. IRENA, UN-agencies, and other specialized international and regional organizations. SIDS DOCK as the principle

financing mechanisms by and for SIDS will dedicate significant efforts and resources on establishing the proper fiduciary standards and processes to increase its capacity to source, secure, manage and invest financing from donor countries and other financiers. The targeted focus on being the financing mechanism for investment in sustainable energy development in SIDS will allow SIDS DOCK to carve out its niche in the international development assistance community and bring significant added value to SIDS around the globe.

Component 4b – Creation, establishment and investment in R&D facilities in SIDS

This phase focuses on creating and/or furthering the R&D capabilities in SIDS. Financial and technical support will be provided for the design, construction and testing of prototypes that comply with the SIDS-appropriate energy technology criteria. The commercial potential of these prototypes will be assessed and support provided for the up-scaling and further testing of promising technologies. Support will be provided to strengthen research facilities (both in infrastructure and human capacity), and additional test facilities will be developed. SIDS DOCK will continuously promote the creation of public-private-partnerships (PPPs) to attract co-financing from the private sector and the involvement of technology developers and providers.

The general technology transfer process involves many stages, including from basic research, applied research and development through incubation, demonstration, (niche) market creation, and ultimately the widespread commercial scale up, diffusion and deployment. The interaction and feedback between these stages is essential for making innovation breakthroughs and requires a long-term financial commitment and wide-scale involvement of different actors and stakeholders.

Component 5 – Monitoring, evaluation and increased deployment of commercial SIDS-appropriate SETs

The results of SIDS DOCK efforts and evolution of R&D of energy technologies is a dynamic process where SIDS DOCK will have to continuously monitor and evaluate the progress made regarding the SIDS DOCK targets, in addition determine the stage of development of energy technologies and assess which ones are in testing/demonstration phase, pre-commercial, or commercially applicable and suitable to SIDS.

In collaboration with strategic partners, SIDS DOCK will allocate significant efforts on assisting the SIDS DOCK members in establishing clear EE, RE and fuel transition policies and action plans to outline how each respective SIDS aims to achieve the set SIDS DOCK targets. Also significant resources will be allocated to developing guidelines, data processing tools, and primary data gathering capacity in each respective SIDS DOCK member in order to properly measure in-country progress made towards achieving the SIDS DOCK targets.

In summary, it is recommended to consider SIDS DOCK principally as a financing mechanism with additional or complementary technical assistance capacity or features to support this central mission, and in particular focus on two key issues, (1) allocate resources to deploying commercially viable, but SIDS-appropriate sustainable energy technologies to satisfy the current energy needs, and (2) allocate resources and efforts on building the research, development and deployment capacity and infrastructure in SIDS to further develop future or new energy technologies that are suitable to SIDS to address the future energy needs of island communities. Based on a very initial estimation of costs for the implementation of the strategic implementation plan, a cost range of US$175.6 – 257.5 million is estimated to be required over the period 2013 – 2033 for the transfer of SIDS-appropriate SET to SIDS DOCK member states. This is based on the perspective of identified critical activities and programs. This is an initial effort to identify the potential resources required to enable SIDS DOCK to facilitate and assist its membership to achieve the set SIDS DOCK targets.

In addition, although not included in the scope of this study, ASDF identified and assessed three key issues that are critical to the preparation of this *Strategic and Implementation Plan* which is (1) determining the strength and weakness of SIDS DOCK and its position within the international development assistance community, (2) the need to define the institutional configuration of SIDS DOCK (possibly as financing mechanism) and (3) the need to establish a monitoring system to measure the progress made in SIDS under a global framework that can be accredited to future efforts by SIDS DOCK.

A suggested institutional set up of SIDS DOCK as a *SIDS financing and technical assistance mechanism* is shared as food for thought to start the discussion regarding the official status, raison d'être, and operational set up of SIDS DOCK.

Suggested organizational configuration

Although beyond the scope of this study, the authors of this report used this opportunity to share some ideas as food for thought, regarding a possible configuration of SIDS DOCK as a *SIDS financing and technical assistance mechanism*.

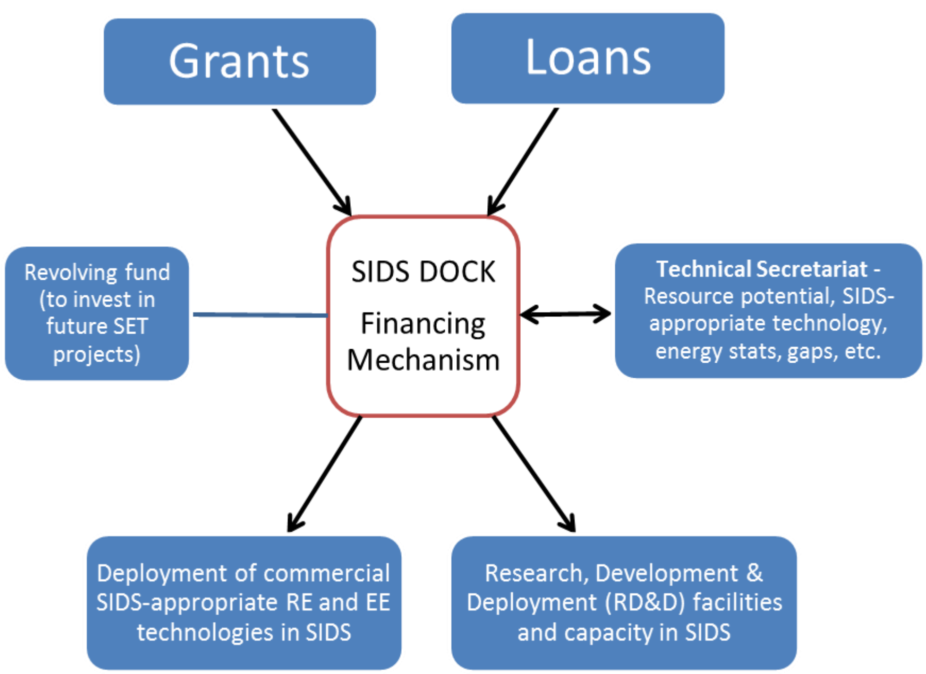

Figure 2 Possible configuration of a SIDS financing and technical assistance mechanism

The suggested business model of SIDS DOCK is to register SIDS DOCK as a foundation (with a status similar to a 501(c3) under US-tax law) that may be able to receive donor funding from the public and private sector in the form as grants or donations, while having simultaneously an advisory role to investors or large financing institutions aiming to invest or provide loans for specific lower-hanging fruit projects (more profitable projects). The configuration proposed is highly derived from the Global Environmental Facility (GEF)-5 model regarding technology transfer[6], but with specific modifications tailored to SIDS conditions and needs.

A key difference of SIDS DOCK to other financing mechanisms is that all donors or investors need to recognize at the outset the requirement to be more flexible regarding their return-on-investment and should be willing to abide to the conditions established by SIDS DOCK, since the conditions will not be as favorable as elsewhere in the global market, but where on the other hand the investment will have significant philanthropical value. Here is where a SIDS DOCK public outreach and awareness program for the general public and potential investors is critical to explain the rationale and the unique investment conditions for doing business in SIDS.

To make an investment decision, SIDS DOCK will use the investment intelligence provided by the *SIDS DOCK Technical Secretariat.* With other words the *SIDS DOCK Technical Secretariat* will in partnership with international technical agencies, create a data base of projects of priority to SIDS; gather available resource assessments done and make these publically available; monitor, analyze and publish energy statics per SIDS; identify the SIDS with similar needs and potential for applications of similar technologies (to assess bundling potential); assess the legislative framework applicable in the individual SIDS; provide updates regarding current and pre-commercial SIDS-appropriate sustainable energy technologies; provide updates and contacts to technology providers; and all that is required to have the proper project investment intelligence in place.

Revenue is generated by (1) collecting a fraction of the savings generated by off-setting the imported fossil fuels to generate power in SIDS by investing and deploying commercial SIDS-appropriate sustainable energy technologies, and (2) by investing in RD&D activities to allow or support SIDS to develop, patent, and sell new SIDS-appropriate energy technology patents, and target the global market of island communities and coastal zones to sell and deploy the technologies. These two principal instruments will not only enable SIDS DOCK achieve the 25-50-25 goals, but also generate significant socio-economic and environmental benefits to SIDS to enable them to achieve sustainable development.

This suggested business approach, serves only as food for thought and requires a proper assessment by a multifaceted team of financing, legal, policy, and technical experts. But if the mechanism for sourcing of financing is properly set up, SIDS DOCK will have the potential and capacity to allocate resources on these two critical instruments or focus areas that may facilitate the accelerated deployment of SIDS-appropriate sustainable energy technologies in SIDS and other island communities around the globe

[6] Global Environmental Facility (GEF), *GEF-5 and Technology Transfer*, website: http://www.thegef.org/gef/Technology_Transfer (visited October, 2012)

while carving its niche within the international development assistance community and bring added value.

1. Introduction

What is SIDS DOCK?

SIDS DOCK launched in December 2010 in Cancun, Mexico, is a SIDS-SIDS institutional mechanism composed of 30 Member States[7] (Table 1) and serves as a "docking station" through which SIDS can access global financial funds; in addition it functions as a SIDS-SIDS knowledge sharing and expertise hub on sustainable energy transition for the membership.

SIDS DOCK has four principal functions:
1. Assist SIDS transition to a sustainable energy sector, by increasing energy efficiency and development of renewable energy;
2. Providing a vehicle for mobilizing financial and technical resources to catalyze clean economic growth;
3. Provide SIDS with a mechanism for connecting with the global carbon market and taking advantage of the resource transfer possibilities that will be afforded, and;
4. A mechanism to help SIDS generate the financial resources to invest in climate change adaptation.

Table 1 SIDS DOCK Membership as of October 2012

Atlantic	Caribbean	Indian Ocean	Pacific
Cape Verde	Antigua and Barbuda	Maldives	Cook Islands
Sao Tome & Principe	Bahamas	Mauritius	Fiji
	Barbados	Seychelles	Kiribati
	Belize		FS Micronesia
	Dominica		Marshall Islands
	Dominican Republic		Nauru
	Grenada		Palau
	Jamaica		Samoa
	St Kitts & Nevis		Solomon Islands
	St. Lucia		Tonga
	St Vincent & the Grenadines		Tuvalu
	Suriname		Vanuatu
	Trinidad & Tobago		

The purpose of this strategic plan is to allow for a collective SIDS-wide discussion to identify and determine which instruments are suitable for a collective approach with regards to improving the transfer of SIDS-appropriate sustainable energy technologies and making these available to SIDS DOCK Member States to achieve the set SIDS DOCK targets of increasing energy efficiency by 25 percent (2005 baseline); generating a minimum of 50 percent of electric power from renewable sources; and a 25 percent decrease in conventional transportation fuel use by 2033.

[7] As per July 2012, in the **Pacific Ocean**: Cook Islands, Fiji, Kiribati, Federated States of Micronesia, Marshall Islands, Nauru, Palau, Samoa, Solomon Islands, Tonga, Tuvalu, and Vanuatu; in the **Caribbean**: Antigua and Barbuda, Bahamas, Barbados, Belize, Dominica, Dominican Republic, Grenada, Jamaica, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Suriname, and Trinidad and Tobago; in the **Atlantic Ocean**: Cape Verde, Sao Tome and Principe; in the **Indian Ocean**: Maldives, Mauritius, the Seychelles.

2. Outline of the strategic plan

This *Strategic Plan* is intended to facilitate discussion during the preparation, negotiation and decision-making process towards a multi-annual *SIDS DOCK Strategic Implementation Plan* on how to transfer SIDS-appropriate sustainable energy technologies to SIDS and achieve the set SIDS DOCK goals, to be executed by the SIDS DOCK Secretariat.

First, in Chapter **Error! Reference source not found.** a general background is provided regarding the importance of achieving low carbon economic development in SIDS and making SIDS-appropriate sustainable energy technologies available in SIDS.

In Chapter 4 a listing and categorization of identified barriers specifically relevant to the transfer of renewable energy technologies to SIDS is presented, gathered through literature study. The available instruments or tools to address the market barriers or challenges for the transfer of sustainable energy technologies in SIDS are also described and assessed.

It is important to make a distinction between the *deployment* and the *transfer* of SIDS-appropriate SETs. ***Technology deployment***[8] captures the installation, set up, testing and running of a technology, while ***Technology Transfer*** entails a more comprehensive approach including the process of transferring skills, knowledge, technologies, methods of manufacturing, samples of manufacturing and facilities among governments, universities and other institutions to ensure that scientific and technological developments are accessible to a wider range of users who can then further develop, innovate, and use the technology for new products, processes, applications, materials or services.[9]

Furthermore an explanation is provided regarding what *Transfer of Technology* entails and the reason for prioritizing *Transfer of Technology* as a principal instrument by SIDS DOCK to address the energy challenges in SIDS.

In chapter 5 includes an overview of the results of the SIDS-appropriate sustainable energy technology assessment with a listing of pre-qualified energy supply and end-use technologies. Also a recommended approach is presented regarding the operationalization of the monitoring and evaluation of future efforts of SIDS DOCK and its member states. An overview is provided regarding the critical elements necessary to develop a successful strategy for the transfer of technologies to SIDS. All this contributes to explaining how the transfer of SIDS-appropriate SET can be best effected.

In chapter 6 a strengths, weaknesses, opportunity and treat analysis is performed for SIDS DOCK to determine the most suitable manner SIDS DOCK could contribute or assist member states to achieve the set SIDS DOCK targets.

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[8] Definition of Deployment, see: http://www.pcmag.com/encyclopedia_term/0,1237,t=deployment&i=41136,00.asp (visited November 2012)
[9] Wikipedia, see: http://en.wikipedia.org/wiki/Technology_transfer (visited October 2012)

In chapter 7 the critically required activities and programs of the strategic and implementation plan are described. An initial attempt is made to estimate the amount of costs or resources needed to execute this draft strategic and implementation plan to enable SIDS DOCK member states to achieve the SIDS DOCK targets.

In summary this report culminates with recommendations regarding how SIDS DOCK could facilitate the proper and effective ***transfer*** of ***SIDS-appropriate sustainable energy technologies*** and increase the availability of these technologies in SIDS DOCK member states to achieve the SIDS DOCK goals of increasing energy efficiency by 25 percent (2005 baseline); generating a minimum of 50 percent of electric power from renewable sources; and a 25 percent decrease in conventional transportation fuel use by 2033.

3. Importance of achieving low-carbon economic development

Climate change is happening in an accelerated rate whereby in one human generation drastic changes in the environment can be observed. Massive glaciers historically known to retract only a few meters over hundreds of years are now retracting by miles within decades.[10] This and the melting of polar ice caps has considerable impact on the global water cycle and balance that on its turn impacts the global weather conditions and contributes to the increase in weather related disasters and the slow but steady rise of the sea-level.

3.1 Climate Change impact on SIDS

Climate Change is considered one of the major threats to SIDS sustainable development. The majority of island communities and low-lying coastal zones around the globe are subject and vulnerable to sea level rise and the increased frequency, intensity and variety of weather triggered disasters (e.g. hurricanes, droughts, floods, etc.). These phenomena impact the resilience of island communities to external shocks and capacity to achieve sustainable development.

Thus global climate change[11] is increasingly impacting the environment and carrying capacity of SIDS. As their population, agricultural land, and infrastructure tend to be concentrated in the coastal zone, any rise in sea level will have significant and profound effects on their economies and living conditions; the very survival of certain low-lying countries will be threatened. Inundation of outlying islands and loss of land above the high-tide mark may result in loss of exclusive economic rights over extensive areas (e.g. for access to fishing areas) and in the destruction of existing economic infrastructure as well as of existing human settlements. Furthermore, it may affect vegetation and saline intrusion that may adversely affect freshwater resources.

Please see Table 2 that includes a brief summary of processes triggered or intensified by climate change and that impact the capacity of SIDS to achieve sustainable development.

Table 2 Climate Change impacts in SIDS[12]

ISSUE	IMPACT(S) to SIDS
Natural Disasters	In the last decade an increased amount of storms, hurricanes and cyclones are observed causing flood and other damages to SIDS around the globe. Impacting the capacity of SIDS to recover from natural disasters. Due to the small human resource base, lack of access to technologies and funds, SIDS have very limited disaster mitigation capability. This is expressed in limited hazard forecasting ability and limited insurance coverage.
Coral bleaching	Increase in average sea surface water temperatures (SST) can lead to bleaching of coral reefs; warmer sea water alongside other environmental and anthropogenic factors as pollution and physical damage caused by divers, lead

[10] Braash, G., World View of Global Warming, the Photographic Documentation of Climate Change, see: http://www.worldviewofglobalwarming.org/pages/glaciers.html (visited September 2012)

[11] Climate Change is the process of changes in the atmosphere that influence temperature, precipitation, storms and sea level beyond the natural variability due to increased Green House Gas (GHGs) emissions caused by human activities, among the GHGs are Carbon Dioxide (CO2), Methane (CH4) and Nitrous Oxide (N2O).

[12] United Nations (UN), *Programme of Action for the Sustainable Development of Small Island Developing States (SIDS), UN Documents, Gathering a body of global agreements*, UN website: http://www.un-documents.net/sids-act.htm (visited October, 2012)

	to coral bleaching (dying of coral reefs). Coral reefs located along the coastline of SIDS are principal attractions to divers and are an important touristic (economic) activity. Next to having an economic function, coral reefs are shelters for many fish and submarine species and represent habitats with high levels of biodiversity.
Food security	Climate change can alter the distribution of zones of upwelling and affect both subsistence and commercial fisheries production in maritime territories, while on land in some cases extensive periods of drought can drastically impact the yield of agricultural activities and impact food security.
Beach erosion	Many SIDS are confronted with beach erosion. Climate change influences wind patterns that lead to changes of sea wave formations, currents and velocity. In the case of SIDS, the combination of change in currents (partly also due to construction of peers) and increased frequency and intensity of storms lead to coast line beach erosion, whereby beautiful white beaches are changing (moving away) and decreasing slowly over time. This can have significant economic impacts on SIDS that are known as beach destinations.
Waste disposal and contamination	The isolation or remoteness of some SIDS and their dependence on a marine and limited terrestrial resource base make the existing landfills used to dispose of waste, highly vulnerable to heavy rainfall or weather related damages. Weather related disasters can impact the containment of toxic and hazardous wastes and chemicals, and radioactive materials that can leach to the surrounding. All SIDS share the problem of how to safely dispose of solid and liquid wastes, particularly the wastes generated by urbanization, which otherwise result in the contamination of groundwater and lagoon areas. Point source pollution from industrial wastes and sewage, inappropriately sited, poorly managed garbage dumps, and the disposal of toxic chemicals are significant contributors to marine pollution and coastal degradation. Limited land area makes the option of landfill siting unsustainable and more vulnerable to extreme weather events in the long term triggered by climate change.

The point of highlighting some of these climate change impacts to SIDS is to clarify that they are not always instantly observable in SIDS and can only be explained via indirect inter-related events that are long term, multi-dimensional and cross-frontier in nature. But in summary, climate change can lead to loss of natural assets necessary to sustain SIDS economies, increase the price of energy, increase risks to natural disasters and/or epidemics, altering populations purchase power, especially for the poorest and most disadvantaged part of the population, and challenging access to clean water and affordable services as health, education, and food for all the citizens. These are among the reasons for having climate change as a top-priority area for SIDS for intervention by the international community.

Now, with increasing frequency of financial, energy and food crises, the competition is or can become very tough for SIDS and requires innovative and efficient practices to remain relevant in the globalized economy. SIDS are therefore increasingly aiming to become less reliant on a single or limited economic sector by diversifying and becoming more resilient to external shocks by reducing dependency on high foreign exchange expenditures such as imported energy.

SIDS DOCK member states acknowledge the need to develop sustainable energy to drive and balance social and economic development while maintaining or protecting the environment as the way forward to mitigate the risks and impacts of climate change and achieve sustainable development. SIDS as a group also recognizes that it is the smallest contributor to greenhouse gas emission in the global context leading to anthropogenic induced climate change. Nevertheless SIDS see the development and use of renewable sources of energy and the dissemination of sound and efficient energy technologies to achieve a low carbon economic development as having a central role not only in mitigating the adverse impacts of climate change, but mainly to offset the dependency on costly imported fossil fuels (impacting the national budgets) and developing new industries and markets around green energy technologies. These will help in making the island economies more competitive and resilient to external shocks.

A critical problem for SIDS is that they remain dependent on global action to address, mitigate and adapt to climate change impacts that are exacerbated by unsustainable productive practices emitting GHGs at significant quantities elsewhere around the globe and limit SIDS capacity to safeguard themselves.

Figure 3 Male, Maldives, Source: Amazing Places on Earth.com (2012)

Therefore the importance of achieving low carbon economic transition in SIDS is not only to avoid or limit the negative social-environmental and economic repercussions locally, but has in addition significance for the global community in showcasing how to achieve low carbon economic development while dealing with multiple environmental and socio-economic pressures that challenge the islands' carrying capacity. SIDS are the "canary in the coal mine" and showcase the possible future challenges the global community will be faced with, recognizing the physical and ecological limits of the earth.

In this context the carrying capacity is defined as the maximum capacity (mainly determined by available space) of an island community that can be supported indefinitely by the island's ecosystem without destroying this same ecosystem. Islands that can showcase that they are capable of generating, and rationally and efficiently use all of their energy from renewable energy sources, while dealing with challenges as technology choices, and other socio-economic and environmental needs and priorities, are of considerable value to the global community. SIDS' success in using sustainable energy to achieve greater economic resilience, and socio-environmental quality, will allow for the engagement of the international community to bridge the gap in awareness and increase the belief that sustainable energy development is possible at a larger scale; therefore we all have a stake in the success of SIDS sustainable energy development.

3.2 Technology as a solution to low carbon economic development

Technology innovation and in particular technology breakthroughs (e.g. the internet) have over time lead to drastic restructuring of economies and are critical driving forces for development and integration. Due to among other things, SIDS' current dependence on increasingly expensive global fossil fuels, climate change impacts, financial, food, and other major crises have led to the economic resilience of SIDS being drastically impacted. One key ingredient to address this is by using renewable energy technologies (RETs) for the production of base load and peak electric power from sources other than petroleum and the efficient use of power through energy efficient end-use technologies (EETs) in the production of goods and services to transition towards low carbon economies. RETs have increasingly become competitive in SIDS, due to the rising costs of diesel-fueled power generation and the declining production costs of RETs. SIDS acknowledge and want to use the available indigenous natural resources to develop a sustainable energy sector, but are confronted with multiple barriers to the access and deployment of sustainable energy technologies to secure reliable, affordable and clean energy.

3.3 SIDS-appropriate Sustainable Energy Technologies

At the same time not all renewable energy or energy efficient technologies are suitable to the conditions and needs in SIDS. Therefore the concept of *SIDS-appropriate sustainable energy technologies (SETs)* is introduced, *which enables SIDS to categorize energy technologies and prioritize energy technologies that are technically feasible, consistent with SIDS development objectives and that are better tailored to the conditions and needs in island communities.* This definition is in line with the principles of sustainable development, where the aim is to promote the deployment of energy technologies that enable island communities to continuously find a proper balance between social and economic priorities while protecting the environment for the current and future energy needs of the community.[13] A more elaborate description and extensive background analysis is provided in the *SIDS-appropriate Sustainable Energy Technology Assessment Report*.

[13] Derived from the World Commission on Environment and Development (WCED). Our common future. Oxford: Oxford University Press, 1987 p. 43

3.4 Making SIDS-appropriate Sustainable Energy Technologies available in SIDS

It is important to make a distinction between the *deployment* and the *transfer* of SIDS-appropriate SETs. ***Technology deployment***[14] captures the installation, set up, testing and running of a technology, while ***Technology Transfer*** entails a more comprehensive approach including the process of transferring skills, knowledge, technologies, methods of manufacturing, samples of manufacturing and facilities among governments, universities and other institutions to ensure that scientific and technological developments are accessible to a wider range of users who can then further develop, innovate, and use the technology for new products, processes, applications, materials or services.[15]

In the context of SIDS, both *Technology Deployment* and *Technology Transfer* are considered critical mechanisms to assist SIDS overcome the need for short term solutions to their energy needs and addressing the lack of technology assessment, deployment and application capacity in the longer term.

In this strategic plan, *technology deployment* is considered to be a sub-component or instrument under the *Technology Transfer* mechanism. And *Transfer of SIDS-appropriate SETs* is defined as "*a non-linear process to enable the increased deployment, use, development and innovation of sustainable energy technologies that are technically feasible, consistent with sustainable development objectives, and are better tailored to the conditions and suitable to achieve the set SIDS DOCK strategic goals and targets, and address the current and future energy needs in island communities*".

This is done to avoid further misinterpretation or misuse of these terminologies throughout the plan and capture both concepts under a common or holistic framework. The expected output of this report is an outline of a strategy for SIDS DOCK to making the transfer of SIDS-appropriate SETs to SIDS more effective.

[14] Definition of Deployment, see: http://www.pcmag.com/encyclopedia_term/0,1237,t=deployment&i=41136,00.asp (visited November 2012)
[15] Wikipedia, see: http://en.wikipedia.org/wiki/Technology_transfer (visited October 2012)

4. Key issues related to the transfer of RETs to SIDS

In this chapter specific focus is placed on understanding key issues related to the transfer of RETs to SIDS, including the barriers and factors influencing their effective transfer. The section culminates with a listing of the available instruments and possible interventions needed to address the barriers to the increased transfer of RETs to SIDS.

4.1 What is understood by Technological Maturity?

Technological maturity is an important element of the *Technology Transfer* process. The technology maturity enables SIDS to better determine the type of policies and activities that are needed to facilitate the deployment and advancement of the technology transfer. The technological maturity (Figure 4) is generally categorized through the following steps of the technology development lifecycle:

Figure 4 Technology Development Lifecycle

There are multiple factors that influence the speed, characteristics and effectiveness of deployment and transfer of SIDS-appropriate SETs in SIDS. These include among other, the social-economic and cultural differences, conditions of existing markets, grid system in place, infrastructure available, and as indicated above, the technology maturity.

4.2 What are the general benefits of the Technology Transfer process?

Sustainable energy technology transfer concretely contributes to improving the quality of life of SIDS communities, by allocating resources and efforts to improving among other things, human capital (know-how), infrastructure, technology base, governance, regulatory regime, and investment climate to enable island communities to offset their dependency on costly imported fossil fuels. This creates great potential for local economic development and diversification (e.g. a wide range of local job opportunities from low-skill to high-skill and from agricultural activities to high-tech technology development), fostering local investments, mitigating climate change, and generating savings to invest in climate change adaptation needs.

4.3 What are results of past international efforts related to Technology Transfer to SIDS?

The concept of *Technology Transfer* is not new, in 1979 the Vienna Program of Action on Science and Technology for Development[16] recognized that the most striking difference between developed and developing countries is their technological capabilities. In order to promote development in the developing countries, recognizing the lack of resources available in these countries, a proposal was

[16] Retrieved from: http://www.jstor.org/discover/10.2307/20692112?uid=3739584&uid=2129&uid=2&uid=70&uid=4&uid=3739256&sid=21101157296211

presented to secure resources and commitment on the part of the developed countries to transfer technology to these developing countries.

Several global initiatives have been set up since, including more recently initiatives which are part of the international climate change negotiations and other international forums. Examples include the Expert Group on Technology Transfer under the UNFCCC[17], and the Climate Technology Initiative under the International Energy Agency (IEA).[18]

Most international organizations have over the past decades assisted SIDS through their respective programs, initiative and technical bodies, by securing or making funds available on a cost sharing basis to facilitate the process of technology transfer. Yet, after 33 years of efforts, it is still uncertain whether these technology transfer programs have helped or not, to improve the deployment of RETs in developing countries. Some claim that these programs did have positive results while others assert that nothing has changed. Nevertheless, it is an irrefutable fact that as per 2012 only a handful of SIDS have been able to do better in deploying RETs, while the majority have actually become more fossil fuel dependent dealing with higher cost for energy services. Today there is an increasing level of general consensus that the breach between rich developed countries and SIDS in the world has widened in the last 30 years.

Besides the Vienna Program (1979), the international community has made several efforts to support RETs transfer specifically to SIDS. The 1992 Earth Summit where Agenda 21 was introduced (the Rio Declaration on Environment and Development) highlighted technology transfer as a crucial determinant of sustainable development. SIDS governments also embraced the objective of technology transfer as key to improving social and economic conditions. This is clearly reflected in the 1994 Barbados Program of Action adopted at the First Global Conference on the Sustainable Development of SIDS and during the follow-up in 2005, the Mauritius Strategy of Implementation.[19]

However, in 2004, during the review of the Barbados Program of Action implementation it was noted that at that time technology transfer in SIDS remained an issue to be addressed or developed, and highlighted the need for a separate funding mechanism to support RETs transfer.[20]

In 2010, the five-year review of the Mauritius Strategy of Implementation (MSI+5) took place.[21] And despite the efforts, again several SIDS were not on track to achieving the Goals and some had even regressed. In particular, the impact of the multiple global crises continued to threaten progress and had further widened the growing socio-economic disparities. Regarding the energy sector, results show that

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[17] UNFCCC, Expert Group on Technology Transfer, see UNFCCC website: http://unfccc.int/essential_background/convention/convention_bodies/constituted_bodies/items/2581.php (visited September 2012)

[18] International Climate Initiative: mission is to bring countries together to foster international co-operation in the accelerated development and diffusion of climate-friendly and environmentally sound technologies and practices, see website: http://www.climatetech.net/about/ (visited September 2012)

[19] UN official decision documents. Retrieved from: http://www.sidsnet.org

[20] Earth Negotiations Bulletin 8, no. 41 (2004). Retrieved from www.iisd.ca/vol08/enb0841e.html

[21] Ibid. 6 ??

rather than an increase in the use of RETs the import of fossil fuel increased, where in some cases the fossil fuel share almost doubled in absolute terms between 2000 and 2010.

Furthermore, the implementation of regional clearinghouses to promote and support RET transfer based on the Mauritius Strategy of Implementation to satisfy the need to improve resilience in SIDS is still pending. Also, according to the Organization for Economic Cooperation and Development (OECD) investments in R&D for RET transfer, are crucial for economic growth, job creation, and improved living standards. However, R&D investments by or in SIDS is still a pending matter with few exceptions.

At the Rio+20 World Summit, after 20 years (from Rio-1992) it was recognized that despite the abundance of potential sources of renewable energy in SIDS, still today (2012) almost all remain exclusively dependent on imported petroleum for electricity generation and transportation. This heavy dependence not only leaves these countries vulnerable to the volatility of international oil prices, resulting in a significant strain on the public finance, but also resulting in negative environmental impacts. Addressing these and other environmental issues requires a dramatic change in how we think about development assistance, and the need to re-assess our past and current strategies in assisting the transfer and deployment of RETs in SIDS.

Despite these challenges, the SIDS have made tremendous efforts in innovating and applying mature technologies to their context. Nonetheless, significant constraints in access and optimal use of such technologies persist, including insufficient human know-how, institutions, R&D infrastructure, access to finance, and poor knowledge of globally available technology and knowledge networks. In conclusion there is an urgent need for a stronger international cooperation with access to large funds aimed to invest in and build in-situ new RE R&D infrastructure and capacity to facilitate and accelerate RET deployment and transfer which are in line with SIDS DOCK's objectives.

4.4 What are the existing barriers or challenges to RET transfer in SIDS?

While the majority of SIDS are located in parts of the world with high density and quality of renewable energy sources (RESs), many have a poor enabling environment for technology deployment and transfer, and in order to improve this there is a need to identify and assess the existing barriers to the deployment and transfer of SETs to SIDS. Technology transfer is a fluid and non-linear process that requires multiple interventions, activities, resources, and the involvement of multiple stakeholders over a long period of time.

Next to the commonly identified barriers to transfer of RETs to developing countries, SIDS have additional general absorptive capacity[22] challenges and unique characteristics distinguishing them from

[22] The Adsorptive capacity of a SIDS is defined as the stock of existing infrastructure, institutional capacity, and human capital that can both facilitate and constrain the absorption of RETs and play a key role both in short-term adaptive deployment and in laying the groundwork for medium-term technology advancement and innovation capacity. Extracted from Pueyo, A., Garcia, R., Mendiluce, M. & Morales, D., The role of technology transfer for the development of a local wind component industry in Chile, Energy Policy, 2011, see: http://www.deepdyve.com/lp/elsevier/the-role-of-technology-transfer-for-the-development-of-a-local-wind-60lXgDp04R (visited November 2012)

larger, continental, and developing nations in the world. Please see Table 3 for an overview of typical barriers to the transfer and deployment of RETs specific to SIDS.

Table 3 Identified barriers and needs to the *transfer* of sustainable energy technologies to SIDS[23,24,25]

Barrier	Description
Small size	There are many disadvantages that derive from *small size*, including a narrow range of resources, which forces undue specialization; excessive dependence on international trade and hence vulnerability to global developments; high population density, which increases the pressure on already limited resources as high competition between land uses and intensity of land uses; high degree of interdependence between human and environmental systems, overuse of resources and premature depletion; relatively small watersheds and threatened supplies of fresh water; costly public administration and infrastructure, including transportation and communication; and limited institutional capacities and domestic markets and limited export volumes, spatial concentration of productive assets which are too small to achieve economies of scale. Small size of SIDS triggers issues with bankability of projects and limited market size which restrict access to funds from international entities and market expansion. Small economies, dependence on external finance, small internal market, high dependence on natural resources, highly specialized in a few major economic sectors (tourism, agriculture, and financial services), limited production or manufacturing capacity.
Remoteness	High external transport costs, time delays and high costs in accessing external goods, delays and reduced quality in information flows, geopolitically weakened, economically disadvantaged, and reduced competitiveness. Isolation and no access to funds means no technology transfer and isolation from markets
Geographical dispersion	Geographic dispersion has been shown to be important for a number of questions in economics by triggering incomplete markets, lower investor recognition and insufficient diversification
Demographical factors	Limited human resource base, small population, rapid population changes and increases in population density, single urban centers, population concentrated on coastal zone, dis-economies of scale leading to high per capita costs for infrastructure and services.
Limited awareness and experience on management of intellectual property	Most SIDS have no R&D facilities and human technical capacity to develop and manage intellectual property
Lack of a critical mass of RD&D capacity to become competitive on a global basis	SIDS need a critical mass of scientific human capital to make their investment in R&D and technological innovation successful. SIDS need to invest heavily on quality human talent
Lack of information on resources and technology options	SIDS have a lack of reliable data regarding the type, quality and potential of resources. Without this data it is unlikely that the transfer of RETs will occur in a suitable manner
Lack of technical and absorption capacity	SIDS have no technical capacity to absorb technology
Risk in the adoption of new technologies	The contribution of new technologies to the economic growth can only be realized when and if the new technology is widely diffused and used. Diffusion itself results from a series of individual decisions from the beginning using the new technology to make decisions which are often the result of a comparison of the uncertain benefits of the new invention attached to the uncertain costs of adopting it. An understanding of the factors affecting this choice is essential both for economists studying the determinants of growth and for the creators and producers of such

[23] Secretariat of the Pacific Regional Environmental Program (SPREP), Pacific Islands Renewable Energy Projects (PIREP),
[24] De Comarmond, A., and Payet, R. *Small Island Developing States: Incubators of Innovative Adaptation and Sustainable Technologies?*, included in publication, *Coastal Zone and Climate Change*, edited by Michel, D., and Pandya, A.,The Henry L. Stimson Center, Washington, D.C., USA, 2010. See: http://www.stimson.org/images/uploads/research-pdfs/Alain.pdf (visited September, 2012)
[25] About SIDS, SIDS-A Special Case, SIDSnet website: http://www.sidsnet.org/about-sids (visited October, 2012)

	technologies
Nonexistent or poor allocation of resources for science and technology	The allocation of resources in SIDS is based on revenues generated from a relatively limited set of economic activities. These resources are mostly allocated for education and health rather than to technology R&D
Poor legal infrastructure to facilitate RD&D activities	Legal structures have an important influence on economic development; and that the failure of attempts to reform those structures has impeded growth. Attempts to eradicate corruption, among other issues impacts directly technology transfer
Poor physical infrastructure to execute RD&D activities	Poor physical infrastructure and paucity for R&D continue to reduce the performance or possibilities to transfer technologies and improve local capacities
Limited value given to protecting and expanding traditional knowledge	Traditional knowledge is thus the totality of all knowledge and practices, whether explicit or implicit, used in the management of socio-economic and ecological facets of life. This knowledge is established on past experiences and observation. It is usually a collective property of a society. Traditional knowledge plays a significant role in industry R&D programs. But traditional knowledge has been and continues to be an element in the commercialization of natural products, it is currently supplied to commercial interests through databases, academic publications or field collections and it should be paid for in some form
Science and technology poorly mainstreamed into the development process	Science and technology are often viewed as the powerful engines driving the new knowledge-based local, regional or global economy. Yet in many SIDS nations it is still not developed
Reliance on grant rather than accessing soft-loans	Limited access to large funds. Current system (World Bank-IDB-IMF) have no adequate tools to support SIDS
Vulnerability to natural disasters	SIDS are located in among the most vulnerable regions in the world in relation to the intensity and frequency of natural and environmental disasters and their increasing impact, and face disproportionately high economic, social and environmental risks and consequences. Natural disasters can have catastrophic impacts. These may be economic, social and environmental. Damage to infrastructure can severely impede economic activity; social impacts can include loss of life, injury, ill health, homelessness and disruption of communities. By their nature SIDS are particularly vulnerable
Fragile ecosystems	Small exposed interiors, large stretches of low-lying coastal zones, adverse effects of climate change and sea-level rise present significant risks to the sustainable development of SIDS, and the long-term effects of climate change may threaten the very existence and viability of some SIDS. Fragile ecosystems, because of low resilience to outside influences
Constraints on transport and communication	Poor infrastructure and logistical capacity to facilitate deployment and development of RETs in SIDS
Lack of natural resources (limited freshwater supply and space)	Close to the majority of SIDS having limited resources and space available, in some larger SIDS there is a high rate of depletion of non-renewable resources (as metal ores, fossil fuels as gas and oil for export)
Heavy dependence on imports and limited commodities	Majority of SIDS are heavily dependent on imports and limited commodities and therefore highly vulnerable to exogenous economic and financial shocks
Limited investment in the development of professional capacity	To develop the capacity of SIDS communities to perform core functions of government and to be able to learn and to bring continuation in the use of the new technologies deployed or transferred
Brain drain	High rate of migration of individuals with technical skills or knowledge to foreign countries

This non-exhaustive list of characteristics and barriers accentuates the uniqueness of challenges facing small island developing countries in general and highlights the need to address the energy development needs of SIDS in a non-conventional manner.[26] In order to improve RETs transfer in SIDS and to raise their internal capacities to adsorb, use, develop and innovate SIDS-appropriate sustainable energy technologies, it is necessary to develop a solid strategy to overcome these challenges.

[26] About SIDS, SIDS-A Special Case, SIDSnet website: http://www.sidsnet.org/about-sids (visited October, 2012)

The timely access to the proper technology and learning how best to utilize this, is key to enabling SIDS transition towards sustainable energy development. There are different factors within the energy sector of SIDS that lead to the need for a differentiated approach and solutions. These include among others: utility ownership status, subsidies, fuel alternatives, technology type, socio-economic conditions, and financing.

Utility ownership status

A general commonality among the SIDS around the globe is that due to the small scale of the energy markets only one or a handful of utilities are responsible for power generation, transmission and distribution. The ownership structure and engagement in promoting renewable energy and energy efficiency technologies vary per utility operating in each respective SIDS.

There is no conclusive research that confirms that the utility ownership structure directly influences the rate of RET deployment in SIDS. But empirical experiences in Caribbean islands indicate that the ownership of utilities (public or privately owned) does influence the level of engagement in exploring and investing in RETs alternatives to bring into the power generation portfolio of the utility. A study conducted by UC Berkeley (Kammen and Shirley, 2011[27]) highlights the negative impacts of un-regulated private utilities in SIDS, where the lack of regulations create an environment that constrains the introduction of new technologies and the potential growth of new industry.

Table 4 lists the utilities and their ownership status, operating in each respective SIDS DOCK member state power sectors. Furthermore an indication is provided whether these utilities benefit from exclusive licenses for the generation, transmission and distribution of electricity and whether decentralized power generation is allowed or not.

Table 4 Ownership status of utilities in SIDS DOCK member states

Country	Utility	Ownership Status	Exclusive License?	Self-generation allowed?
Caribbean Region				
Antigua & Barbuda	APUA	Government owned		No
Bahamas	BEC	Government owned		No
	GBC	Joint venture of foreign utilities	Yes, until 2054	No
Barbados	BL&P	Privately owned	Yes, until 2028	No
Belize	BEL	Privately owned	Yes, until 2015	No
Dominica	DOMLEC	Public-Private owned	Yes, until 2015	YES
Dominican Republic	Multiple	Public and Private		YES
Grenada	GRENLEC	Public-Private owned	Yes, until 2041	YES, <10kW (net-metering) with a cap of 1% of national peak demand
Jamaica	JPSCO	Public-Private owned	Yes, until 2021	YES, some IPPs
St. Kitts and Nevis	SKELEC	Government owned	Yes, indefinite	YES
	NEVLEC	Government owned	Yes, indefinite	YES, IPPs (Wind)

[27] Renewable Energy Sector Development in the Caribbean: Current Trends and Lessons from History, Daniel Kammen and Rebekah Shirley, 2011, UC Berkeley. Retrieved from: http://rael.berkeley.edu/sites/default/files/Kammen-Shirley-JEPO.pdf (visited November, 2012)

St. Lucia	LUCELEC	Privately owned	Yes, until 2045	YES
St. Vincent and the Grenadines	VINLEC	Government owned	Yes, until 2033	YES, by license from utility
Suriname	EBS	Government owned	Yes, until 2022	N/A
Trinidad and Tobago		Public and Private		No
Pacific Region				
Cook Islands	Te Aponga Uira O Tumu te Varovaro (TAU)	Government owned	N/A	N/A
Fiji	Fiji Electricity Authority	Public and Private (Licensed by FEA)	N/A	N/A
Kiribati	Public Utilities Board	Government owned (Statutory authority)	N/A	N/A
Federated States of Micronesia	Chuuk Public Utilities Corporation, Kosrae Utility Authority, Pohnpei Utilities Corporation, Yap State Public Service Corporation	Government owned	N/A	N/A
Marshall Islands	Majuro Electric Company, Kwajalein Atoll Joint Utility Resources	Government owned	N/A	N/A
Nauru	Nauru Phosphate Corporation	Government owned	N/A	N/A
Palau	Palau Public Utilities Commission	Government owned	N/A	Yes
Samoa	Electric Power Corporation	Government owned (operates commercially)	N/A	N/A
Solomon Islands	Solomon Islands Electricity Authority	Government owned (operates commercially)	N/A	N/A
Tonga	Tonga Power Limited	Government owned	N/A	N/A
Tuvalu	Tuvalu Electric Corporation	Government owned	N/A	N/A
Vanuatu	UNELCO	Gov regulated (URA)-Concession	N/A	N/A
Atlantic Region				
Cape Verde	ELECTRA	Public-Private owned	Yes, until 2020	Yes. But there is "No" feed in tariff
Sao Tome and Principe	Empresa de Agua e Electricidade (EMAE)	Public-Private owned	N/A	Yes
Indian Ocean Region				
Maldives	State Electric Company (STELCO)	Government and private.	N/A	Yes
Mauritius	Central Electricity Board (CEB)	Government owned	N/A	Yes

Seychelles	Public Utilities Corporation (PUC)	Government owned	N/A	Yes

The reason for highlighting utility ownership structure is because it is a factor influencing the institutional capacity in place to regulate the electricity market and allow for the accelerated deployment of RETs. Throughout the history of power sector development in SIDS, most SIDS have traditionally left the electricity generation capacity planning up to the utilities, thus allowing utilities to self-regulate. Most utility staff (regardless of ownership structure) are comfortable with technologies familiar to them, and do not have the incentive to step away from using such technologies, since most utilities are in a monopolistic situation, and all the costs of investment, and increase in operation and maintenance (O&M) costs are factored in the electricity rate to the final consumer.

Kammen and Shirley, 2011 indicate that government owned utilities or in cases where the governments are more forceful in designating authority over assets and functions of private utilities, the utilities tend to be more responsive to policy mandates from SIDS governments. In particular when these are introduced through negotiations with the utility and include specific tangible targets to enable the utilities to shift towards the increase in use of RETs. In some cases the government has to step in and enforce modifications to existing exclusive licenses to allow for the introduction of independent power producers (IPPs) that are specialized in RET system development and operation.[28] Furthermore in some SIDS there is a public agency that is capable of performing electricity forecasts and planning exercises to guide the power sector development, while in others this is non-existent. Where in cases utilities are responsible for capacity expansion planning this does not always fall in line with the general society's perspectives and needs.[29]

The above means that the combination of utility ownership structure, the power sector institutional configuration, and government policies and regulations in place within a SIDS energy sector, can incentivize or delay the deployment of RETs. Therefore it is highly recommended to perform detailed power sector diagnostics in each respective SIDS DOCK member to have a better sense of (1) whether the utility is a monopoly, (2) what the ownership structure of the utility is (private, public, public owned but corporatized and/or public-private), (3) whether the utility has an exclusive license to generate, transmit and distribute power, (4) whether IPPs are allowed, (5) what is the institutional configuration clarifying the allocation of responsibilities for regulation, capacity expansion planning, etc.

Subsidies

Depending on conditions in country, some SIDS governments have fossil fuel subsidies in place to help reduce the average electricity rates to the final consumers to relieve the burden of high monthly utility bills in households (e.g. St. Kitts and Nevis[30]). The majority of such types of subsidies focus on subsidizing the purchase, storage, and/or final retail price of diesel or other fuels for power generation and transportation. In the Caribbean some SIDS have decided to join the PetroCaribe initiative to purchase

[28] Ibid 22. (Aruba is cited as example)
[29] Ibid 22
[30] IMF, 2012. Retrieve from: http://www.imf.org/external/np/sec/pr/2012/pr12228.htm

petroleum below market values (subsidized by the Venezuelan government), offsetting the upfront cost per barrel to pay back over a period of decades with a 1% interest rate.[31] This process required the investment of participating SIDS in new or additional storage capacity at terminals to increase to storage capacity to comply with a threshold volume of petroleum to make the supply of petroleum more cost-effective. This initiative has led to temporary relief, but with increasing costs of the global petroleum prices its effect may not be as obvious as initially expected. Subsidies to lower costs of conventional fuels or energy services based on the use of conventional fuels distorts the power market and tends to be one of the critical barriers to attracting private investment and the increased deployment of RETs in SIDS.

Fuel switch and supply alternatives

In some SIDS, an alternative for the imported diesel is explored by looking into either cheaper fuel types or investing in infrastructure to be able to receive alternative fuel suppliers and types. Some utilities have opted to switch from diesel to heavy fuel oil (HFO) or lower grade fuels to run their power generators, because of the lower price of these alternatives. Unfortunately due to the composition of such fuels (lower quality fuels), they lead to higher O&M costs over time, negative environmental impacts (higher sulfur content), and reduce the lifetime of the power generators (through corrosive components in the fuel).[32]

Some SIDS are investing in new gas terminals and storage capacity anticipating the availability of cheaper compacted natural gas (CNG) or liquefied natural gas (LNG) becoming increasingly available with new vessels being constructed and supply routes being established throughout the major SIDS regions. In the past few years, there has been an increased tendency to close refineries and storage depots in SIDS and retrofitting these to gas and storage terminals.[33, 34]

Centralized vs. decentralized power generation

Both centralized and decentralized grid-connected and off-grid RETs have been deployed and are used with different levels of success and degrees in SIDS around the globe. Centralized and decentralized power generation is a critical issue for SIDS. SIDS that are archipelagos, as the Bahamas and the Maldives[35] are composed of hundreds of small cays, atolls or islands of which some are inhabited. In these cases small, most of the times, hybrid systems are required to provide electricity in the isolated or outer island communities to allow these to become self-sufficient. The island of Tokelau (New Zealand)

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[31] Petrocaribe: The Current Phase of Venezuela's Oil Diplomacy in the Caribbean, Jacome, 2011. Retrieved from: http://library.fes.de/pdf-files/bueros/la-seguridad/08723.pdf

[32] Heavy Fuel Oil-Is that the final measure?, Mahadevaiah, 2006. Retrieved from: http://www.eicusa.com/Heavy%20Fuels-Is%20that%20the%20final%20answer.pdf

[33] Dominican Republic announces the construction of a natural gas terminal at a cost of 350 million dollars. Retrieved from: http://www.dominican-republic-live.com/dominican-republic/news/year-2012/january-2012/dominican-republic-announces-the-construction-of-natural-gas-terminal.html

[34] Jamaica Seeking Equity Investors In LNG Company. Retrieved from: http://jamaica-gleaner.com/gleaner/20120502/business/business1.html

[35] The Republic of the Maldives comprises of 1192 small coral islands located south-east of India in the Indian Ocean. Only 199 islands are inhabited. The total population of the Maldives was 270,000 in 2000 [6]. A quarter of the population resides in the capital Male´, located in the center of the republic where most of the economic and commercial activities take place. Over the past twelve years, 89 islands have been developed into tourist resorts. Note that all the islands except capital Male´ and the resort islands are considered as 'outer islands'. Extracted from: van Alphen, K. et al, Renewable Energy Technologies in the Maldives – Realizing the potential, Renewable and Sustainable Energy Reviews, Elsevier, 2006

has recently become the first solar-powered island, where for a population of 1,411 people with an investment of MUS$5.8 about 4,032 PV panels and 1,344 batteries were installed to supply 150% of the island's electricity needs while offsetting 2,000 barrels of diesel per year.[36] This is an example showcasing that PV/battery hybrid technology is a mature technology and due to PV's modular characteristics is easier and cost-effectively installed in isolated areas, but on the other hand this project wasn't possible without the financial support from the New Zealand Aid Program. Tokelau being a territory of New Zealand is therefore in a different position compared to the independent island states.

In larger or main islands of SIDS, the power sector is generally dominated by a single utility that is responsible for power generation, transmission and distribution. Due to the lack of power sector planning authorities, utilities are left to determine the capacity expansion needs. Most utilities that are engaged in incorporating RETs tend to only consider or opt for utility-scale RETs neglecting the possibility of having small IPPs or household RET systems installed.

Due to the high electricity rates, citizens are increasingly demanding the authorization to generate power at the household. This includes allowing households to interconnect to the grid for net-metering. Several islands, as Grenada have embarked on allowing households to generate power and interconnect to the grid based on an interconnection policy developed by the utility GRENLEC and the government.[37, 38]

The focus of activities to accelerate deployment and facilitate transfer of RETs depends on the demand for utility-scale and/or decentralized modular RETs in SIDS. It is recommended to assess in each respective SIDS jurisdiction the existing electricity acts that determine whether IPPs are allowed to generate or whether decentralized residential RETs are allowed and can be interconnected to the national grid. All this information is normally captured in an Energy Sector Diagnostic, National Energy Policy and/or Action Plan.

Base load vs. Intermittent RETs

RETs encompass technologies that are intermittent, dispatchable, or use base load power generation technologies. Majority of RETs applicable in the SIDS use intermittent RES. Some technical features that highly influence the deployment rate of RETs in SIDS include (1) whether they have small electricity grid systems with installed capacities ranging between (<5 – 100s of MW), (2) have different peak load demands, and (3) are highly based on a single technology (diesel or fuel powered power generators) that can be dispatched when needed. In recent years there has been an increased focus on developing energy storage technology (fly wheels, batteries, etc.) and better operational management systems (SMART-grid solutions) to allow for the increased penetration of intermittent energy technologies

[36] Energy Revolution blog, see: http://www.e-rev.org/post/35684566473/r-d-pacific-tokelau-island-chain-becomes-worlds-first (visited November 2012)
[37] RENEWABLE ENERGY EFFORTS IN THE CARIBBEAN, Caribpro. Retrieved from: http://www.caribpro.com/Caribbean_Property_Magazine/index.php?pageid=694
[38] REEGLE, Country profiles. Retrieved from: http://www.reegle.info/countries/grenada-energy-profile/GD

(>30%) in smaller grids.[39] This process and access to these technologies will impact the speed and potential of SIDS to deploy and transfer RETs to achieving their set targets as becoming 100% reliant on renewable power generation in the near to mid-term. It is recommended to have at an early stage an idea of the need for base and peak load needs to identify and assess available RETs suitable to address these needs.

Socio-economic conditions

The *level of income per capita* is a determining factor for the deployment of household-type RE and EE technologies. In higher income SIDS, confronted with high electricity rates, a larger fraction of households have greater capacity to purchase or secure credit to buy and install decentralized small-scale RETs. The most commonly deployed technologies in SIDS include Solar Water Heaters (SWH) for heating water and Solar Photovoltaic technologies (PV) for power generation. But even in cases where the level of income per capita is reasonable, an additional limiting factor experienced in most such SIDS is that some utilities have the *sole licensing right and responsibility* for the generation, transmission and distribution of power in islands established in long-term Electricity Acts that in some cases even prohibit the application of grid-connected decentralized RETs as solar PVs. See Table 4 for an overview of SIDS where self-generation is allowed.

Even though none of the SIDS DOCK members are classified as "low income" countries the wealth distribution within SIDS can vary significantly. Medium-high income households that could potentially invest in decentralized household RET systems still only represent a smaller fraction of the general community. The problem is that SIDS are confronted with high and increasing costs of import of energy, consumer goods and all other products used or consumed in the SIDS, making the cost of living in SIDS more expensive than in industrialized nations with higher average income. A key conclusion is that financing capacity remains the determining factor whether a RET project is developed or a RET is installed at the household level in SIDS.

Creditworthiness of SIDS

At the national level, most SIDS around the globe are highly indebted and have limited borrowing capacity or capacity to provide sovereign guarantees for investments to be made in SIDS.[40] The so-called Fitch, Moody's or Standard & Poor's credit ratings of countries are common financial indicators used by the private sector investors to determine the creditworthiness of SIDS. Most SIDS are not ranked high as attractive destinations for investment.[41] These ratings also influence the public sector financial institutions in their approach and lending credits made available to SIDS to stand guarantee or co-finance larger utility-scale RET projects. SIDS require a broader set of indicators or criteria that better reflect the uniqueness and vulnerabilities of SIDS to access concessional financing from multilateral

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[39] Smart grids in Latin America and the Caribbean, De Nigris and Coviello, ECLAC, 2012. Retrieved from: http://www.eclac.org/publicaciones/xml/1/47451/SmartGridsinLatinAmericaandtheCaribbean.pdf (visited November, 2012)

[40] High Level Review Meeting on the Implementation of the Mauritius Strategy for the Further Implementation of the Barbados Programme of Action for the Sustainable Development of Small Island Developing States. Retrieved from: http://www.sidsnet.org/msi_5/docs/hlr/statements/opening/Jamaica.pdf

[41] World Investment Report, 2012, UNCTAD. Retrieved from: http://unctad.org/en/PublicationsLibrary/wir2012overview_en.pdf

banks or public sector financial institutions.[42] Furthermore in order to accelerate RET deployment and transfer, there needs to be an attractive investment climate in place.[43] This requires among other things, investment in infrastructure, human capital, and improvement of the institutional capacity to streamline the process of licensing and project development to create less bureaucracy and impediments to the development of RET projects. All these needed conditions require financial resources, which tend to be scarce or not available in SIDS. Thus in order to accelerate or facilitate the deployment and transfer of RETs to SIDS, the overall socio-economic, financial creditworthiness, and investment climate of SIDS has to be taken into account.

Renewable Energy Project Financing

Financing for RET projects can come from public or private sources, and a general commonality among SIDS is that there is limited local public or private financing available to invest in RET projects. Furthermore the international public financing is not easily accessible for investment in RET projects due to established requirements (risk mitigation requirements) to secure such type of financing.[44] Some SIDS have focused on improving the conditions for projects to become commercially attractive or bankable to attract private financing. But in SIDS, mainly due to the relative small scale of projects, this quickly leads to a narrowing down of available financing sources and instruments. Most commercial financiers will quickly discard RET projects to be developed in SIDS even if they are attractive. An example is that the same level of application procedures and transactions costs are needed for a small RET project in a SIDS versus a large scale RET project elsewhere with higher scale of return-on-investment potential.[45, 46]

Another element is that RET projects generally require high up-front capital to be developed. This includes turn-key investment and project development costs. The turn-key investment costs are the costs accrued from the purchase or manufacturing of site-specifically tailored technologies (this can range from turbine and boiler sizes, to supporting infrastructure as a dam wall), through their delivery, and installation at the project site.[47]

Project development costs are described as costs related to the verification of the RES to be used by the RET project. For instance in the case of wind energy technology, the general standard is to gather at minimum 1-year wind data to be able to determine the suitability and potential performance of the future wind farm; in the case of geothermal energy development, the geothermal heat source can only be confirmed by drilling expensive exploratory slim-holes, and this is still not sufficient since extraction

[42] University of West Indies, Centre for Environment and Development, *The growing vulnerability of small island developing states*, Final Draft, Mona, Kingston, Jamaica, 2002, see: http://www.un.org/special-rep/ohrlls/sid/sid2004/Univ.%20of%20W.Indies-Growing.pdf (visited November 2012)
[43] Climate Change: Technology Development and Technology Transfer, UN. Retrieved from: www.un.org/esa/dsd/resources/res_pdfs/.../tec_technology_dev.pdf
[44] Financing renewable energy in developing countries, UNEP, 2012. Retrieved from: http://www.unepfi.org/fileadmin/documents/Financing_Renewable_Energy_in_subSaharan_Africa.pdf
[45] UN Technical Cooperation. Retrieved from: http://esa.un.org/techcoop/flagship.asp?code=cpr97g31
[46] Renewable Energy Policies and Barriers, Beck and Martinot, 2004, GEF. Retrieved from: http://www.martinot.info/Beck_Martinot_AP.pdf
[47] Ibid, 39, 40, 41

and injection wells need to be drilled to have a complete picture of the geothermal resource quality and possible depletion rate.[48]

These features of RET projects make them costly at the up-front of the project life time, but they have a common element of requiring very low O&M costs, making these projects cost-competitive based on their lifecycles while generating socio-economic and environmental benefits that are not internalized in the financial performance break-down. Financing RET projects in SIDS requires a greater degree of context sensitivity, a more careful consideration of logistical and operational requirements, as well as better understanding of the dependency of project success on broader cooperation between all participants involved, particularly with the communities in which such projects are located.[49]

The small scale and nature of RET projects in SIDS reflects a deadlock for project developers aiming to secure investments for RET projects in SIDS. International public financing mechanisms have in recent years dedicated attention on identifying the critical challenges and risks to investment in RET projects (regardless whether these are to be developed in SIDS) to better tailor their financing mechanisms to the conditions and needs in developing countries. These barriers and risks can generally be categorized by the following financing barriers and project risks shown in Table 5.

Table 5 Barriers and Risks for Investment by RE technologies, Source: World Bank[50]

	Financing Barriers						Project Risks			
	Lack of Long-Term Financing	Project Financing	High and Uncertain Project Development Costs	Lack of Equity Financing	Small Scale of Projects	High Financial Costs	High Exposure to Regulatory Risk	Uncertainties over Carbon Financing	High Costs of Resource Assessments	Uncertainties over Resource Adequacy
Grid-connected										
Wind	High	Med	Low	Low	Low	Med	Med	Med	Low	Med
Solar	High	Med	Low	Low	Med	High	Med	Med	Low	Med
Small Hydro	High	Med	Med	Med	Med	Low	Med	Low	Med	High
Biomass	High	Med	Low	Low	Med	Med	Med	Med	Low	High
Geothermal	Med	Med	High	Med	Low	Low	Med	Low	High	Med
Off-grid										
Solar	Med	Low	Med	High	High	Med	Low	Low	Low	Med
Micro-hydro	Med	Low	Med	High	High	Med	Low	Low	Low	Med

[48] ASSESSMENT OF ENERGY RESERVES AND COSTS OF GEOTHERMAL RESOURCES IN HAWAII. Retrieved from: http://energy.hawaii.gov/wp-content/uploads/2011/10/AssessmentOfEnergyReservesAndCostsOfGeothermalResourcesInHawaii.pdf

[49] Mauritius Strategy for the Further Implementation of the Programme of Action for the Sustainable Development of Small Island Developing States. Retrieved from: http://www.unesco.org/csi/B10/mim/sids_Strategy.htm

[50] The World Bank, Climate Investment Funds, (CIF), *Financing Renewable Energy, options for Developing Financing Instruments using Public Funds*, http://siteresources.worldbank.org/EXTENERGY2/Resources/SREP_financing_instruments_sk_clean2_FINAL_FOR_PRINTING.pdf (visited November 2012)

Having this overview of financing barriers and project risks in place, the central message by international financing institutions is to allocate resources and secure technical assistance to address these barriers in order to make the RET projects in SIDS commercially attractive or bankable. Now, among the possible strategies recommended to improving the bankability of RET projects in SIDS the following instruments are generally highlighted:

Bundling of RET projects in or among SIDS is considered a possible strategy to improve the economies of scale to secure adequate private financing. Bundling can occur in different fashions, including the virtual gathering of project info and collective planning of similar kind of RET projects. Unfortunately in the context of SIDS, having to deal with multiple jurisdictions, differentiated socio-economic conditions, political cycles, and investment conditions, and different decision-making schemes, bundling can be very complex, expensive and time consuming.

Aggregation is another strategy that can be used to reduce the transaction costs attached to each RET project. This is in other words, standardizing certain project specifications, processes, agreements, and documentations used (as using standard power purchase agreements - PPAs) to appraise projects. This standardization can lead to reduced transaction costs and therefore reduced project development costs and increased level of RET project bankability. Although this is a viable strategy to be implemented among SIDS, the overall effect on the project bankability generally still remains minimal to secure proper financing.

Market expansion can be created by physically interconnecting SIDS to create a larger energy market to allow for the development of larger scale RET projects and address the imbalance between supply and demand among SIDS and other parties. Addressing the scale of RET projects may lead to securing adequate and more cost-effective financing, but is challenged by the high degree of complexity of dealing with several differentiated jurisdictions, national interests, grid and energy sector characteristics, ownership and operation of the interconnection system.

Transfer of Technology is another strategy or instrument that is generally recommended to improving the identification and development of bankable RET projects for the increased deployment and use of sustainable energy technologies suitable to SIDS. This is a process that entails a series of activities that address multiple financing barriers mentioned above and includes building specialized human and technical capacity in the mid-to long term, to among other (1) optimally assess, deploy, apply and use energy technologies, and (2) building proper RD&D infrastructure and use the gained knowhow to develop and apply new technologies suitable to SIDS.

The difference of this latter strategy to the other ones mentioned above is that collective resources and efforts are targeted to a specific common beneficial issue of guaranteeing access to suitable sustainable energy technologies at cheaper costs for SIDS and develop capacity for knowledge and skills generation on which all SIDS can agree and where they do not directly and independently depend on each other to engage, accelerate or implement activities to achieve their respective energy policy targets.

This approach recognizes that SIDS are united but not uniform. Thus although the global energy issues and challenges facing all SIDS as dependency on imported energy are similar in nature and that all SIDS are striving for increased quality, reliability, equity and affordability of energy services to achieve sustainable development, each SIDS government first and foremost is responsible for developing economic, social and environmental programs to improve the quality of life for all their citizens and any solution will still depend on available resources and conditions in each respective SIDS.

4.5 What are the available instruments to improve RET transfer to SIDS?

After a review of the multiple barriers, conditions and factors that impede the increased transfer of RETs to SIDS, the possible instruments or activities needed to solve or address these barriers are discussed in this section.

It is important to understand at the outset that not all listed instruments are suitable or applicable to the conditions and needs in SIDS. Neither are all instruments or activities suitable or applicable when referring to (1) SIDS-appropriate SET *deployment* and (2) the *transfer of* SIDS-appropriate SET.

Table 6 lists a non-exclusive overview of available instruments and possible activities required to solve or address the barriers to the transfer RETs to SIDS.

Table 6 Instruments and required interventions for RET transfer to SIDS[51,52]

Function or Focus	Possible instrument or intervention activities
Building Competence and Human Capacity	(1) Upgrade existing science curricula in primary and high schools to guarantee better transition to college and university programs (engineering, physics, etc.); (2) Invest in or subsidize higher education for sustainable development, through curriculum creation/development, apprentice programs at RET firms, vocational training for ancillary support activities to RET business; (3) Subsidize scholarships for SIDS citizens to attend international MSc and PhD programs in specialized RET sector topics; (4) Fortify and upgrade existing educational institutions, universities and research facilities.
Creating and Sharing New Knowledge	(1) Perform high resolution RET resource assessments; (2) Develop energy road-mapping and associated systems analyses; and (3) Execute grid capacity studies.
Knowledge Diffusion / Creating Collaborative Networks	(1) Initiating or joining international cooperation networks; (2) Support community groups working towards energy access; and (3) Support micro-finance networks.
Developing Infrastructure	(1) Invest in grid modernization; (2) Invest in vehicle electrification infrastructure; and (3) Improve and invest in biomass logistics and processing infrastructure.
Providing Finance	(1) Establish loan guarantees mechanisms[53];

[51] Derived from Miller, M., Renewable Energy Innovation Policy: Success Criteria and Strategies, U.S. National Renewable Energy Laboratory (NREL), Draft ofNovember 2012, available upon request.

[52] Secretariat of the Pacific Regional Environment Programme (SPREP), Pacific Islands Renewable Energy Project (PIREP), *Financing mechanisms for renewable energy development in the pacific islands*, Samoa, 2005, see: http://www.sprep.org/attachments/climate_change/FinancingMechanismsforREDevelopment_000.pdf (visited November 2012)

[53] Loan guarantees help to reduce the perceived risk for finance of RETs, this would allow both reduced interest rates to borrowers and a higher rate of loan acceptance for finance from commercial and development banks.

	(2) Provide interest subsidies[54]; (3) Support financing and insurance of RET systems; (4) Support or introduce energy technology micro-finance models; (5) Provide or access grants for assistance[55]; (6) Remove barriers to novel finance pathways.
Establishing Governance and the Regulatory Environment	(1) Establish distributed generation and micro-grid interconnection standards; (2) Designate RET project development areas; (3) Set energy efficiency standards; (4) Remove barriers to novel business models, such as energy performance contracting or solar system leasing.
Creating Markets	(1) Establish renewable portfolio standards; (2) Enforce feed-in-tariffs; (3) Introduce energy efficiency obligations; (4) Demand public procurement of RET systems in government buildings; (5) Provide incentives for alternative fuel vehicles and energy efficiency.

The specific recommended instruments are elaborated in the strategic plan for transfer of SIDS-appropriate SETs to SIDS described in Chapter 7.

4.6 Summary of findings

Among the spectrum of issues to be addressed to improve the conditions to accelerate the deployment and transfer of RETs to SIDS presented in Table 6, most require funding to be implemented or become reality. This in general terms does not only mean that access to project financing is complicated or limited in the SIDS context, but any effort or intervention needed to improve the conditions in SIDS to facilitate the process of accessing or providing finance, deploy and transfer RETs requires investment (funds).

This basic funding is not widely available in SIDS since throughout the years SIDS have become more and more reliant on international financial or technical aid to supplement debt financing and other un-anticipated financial burdens, as hurricane-, flood- and earthquake-damages to the build infrastructure and productive capacity, thus the overall SIDS economies.[56, 57]

This is an important factor to bear in mind when furthering the process of determining what is most practical and effective to do in helping SIDS to increase the transfer of RETs in their respective island communities.

[54] Interest subsidies help to reduce the interest rate seen by borrowers thereby making loans more acceptable for RE projects that have marginal rates of return on investment

[55] Grants for technical assistance has been a popular modality used by multilateral development banks to allocate public resources on the preparation of business plans, financial analysis of RE projects, preparation of loan applications, and preparation of project development plans to assist potential project implementers in the development of their projects to meet the requirements of financial institutions.

[56] Dominica: Natural Disasters and Economic Development in a Small Island State. Retrieved from: http://www.odi.org.uk/sites/odi.org.uk/files/odi-assets/publications-opinion-files/4792.pdf

[57] Small island developing states: natural disaster vulnerability and global change, Pelling and Uitto, 2001. Retrieved from: http://www.tc.umn.edu/~blume013/pelling_Uitto_sm_islands.pdf

5. How to effect transfer of SIDS-appropriate SETs to SIDS

5.1 Identified and assessed SIDS-appropriate SETs

The process of identification and assessment of commercial and pre-commercially available renewable energy supply and end-use technologies to classify technologies as SIDS-appropriate SETs is a critical step in facilitating the process of technology transfer. After an extensive assessment, there is currently an initial list of renewable energy supply technologies that can be prioritized and invested in to making them increasingly available in the SIDS DOCK member states.[58]

Table 7 shows the results of the SIDS-appropriate sustainable energy technology assessment performed for SIDS DOCK. It ranks the SIDS-appropriate renewable energy supply technologies that have the greatest promise of compliance to the conditions and needs in SIDS DOCK members to enable them achieve sustainable development.

Table 7 SIDS-appropriate RETs ranking[59]

Ranking	SIDS-appropriate Renewable energy supply technology	Applicable in:	# of SIDS DOCK MS	Comment:
1.	Solar PV technology	All SIDS DOCK members	30	Good RES, modular technology
1.	Bio-gasification technology	All SIDS DOCK members	30	Good WTE option, small scales available
2.	Wind Energy technology	Majority of SIDS DOCK members except Sao Tome & Principe	29	Mature technology, good wind regimes
3.	Ocean Thermal Energy Conversion (OTEC)	Majority of SIDS DOCK members except Belize and Suriname	28	Base load alternative, low space footprint, large RES potential
3.	Bio-anaerobic technology	Majority of SIDS DOCK members except Bahamas and Tonga	28	Good WTE option, small scales available
4.	Run-of-River Hydro power technology	Majority of SIDS DOCK members except Antigua & Barbuda, Bahamas, Barbados, St. Kitts and Nevis, Cook Islands, Kiribati, Marshall Islands, Nauru, Palau, Tonga, Tuvalu, Cape Verde, Maldives and Seychelles	16	Where RES available, highly recommended
5.	Geothermal binary cycle	In Dominica, Grenada, St. Kitts and Nevis, St. Lucia, St. Vincent & the Grenadines, Cook Islands, Fiji, Samoa, Solomon Islands, Tonga, Vanuatu, Sao Tome & Principe, and Mauritius	13	Where RES available, highly recommended
5.	Ocean Current Technology	In all the Caribbean, except Belize, Suriname and Trinidad & Tobago; in Maldives, Mauritius and Seychelles	13	Base load alternative, low space footprint, large RES potential

[58] Aruba Sustainable Development Foundation (ASDF), SIDS-appropriate sustainable energy technology assessment, December 2012, available upon request.
[59] Aruba Sustainable Development Foundation (ASDF), SIDS-appropriate sustainable energy technology assessment, December 2012, available upon request.

6.	Liquid biofuels – lignocellulosic ethanol	In Belize, Dominican Republic, Jamaica and Suriname	4	Only alternative to conventional transport fuel

5.2 Maturity level of identified and assessed SIDS-appropriate Sustainable Energy Technology

In order to better prioritize and streamline activities and efforts to facilitate the transfer of SIDS-appropriate SETs, three broad technology innovation clusters categories are used in this report, namely (1) Technology venturing, (2) Commercial Scale-up and (3) Adaptation (see Chapter **Error! Reference source not found.** for more detail).

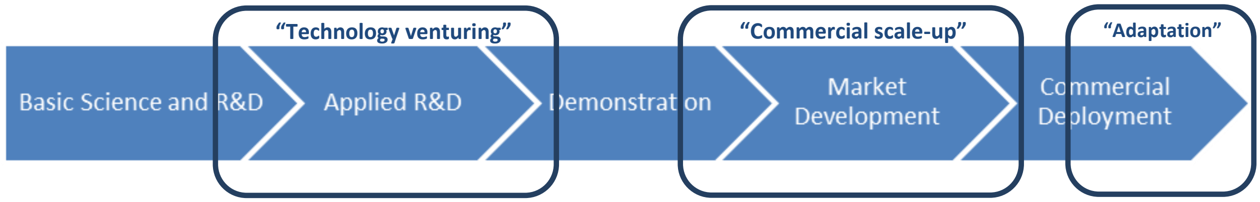


Figure 5 RET innovation clusters within the technology development lifecycle[60]

Commercially available renewable energy technologies fall in the "Adaptation" category that groups technologies that require specific efforts to introduce them into new markets (in this case SIDS markets), which typically require less activities and investments of scientific nature, but more so on developing novel marketing, business models or financing structures. Thus within this report's context, all efforts, resources and activities are allocated or directed to (1) improving the market conditions, and (2) commercial deployment of the commercially (mature) SIDS-appropriate SETs that tend to have a short-medium term horizon.

On the other hand SIDS-appropriate SET that are pre-commercial will fall in the "Technology venturing" and "Commercial scale-up" categories, which will require activities and investments of highly scientific nature, as investments in building research and development (R&D) capacity and infrastructure to enable the development, advancement and/or innovation of pre-commercial SIDS-appropriate SETs to make them available in the mid-to long term horizon in SIDS.

Table 8 shows an overview of SIDS-appropriate SETs pre-selected based on the *SIDS-appropriate sustainable energy technology assessment*.[61] These technologies have been grouped under the three technology innovation clusters categories described above.

[60] Miller, M., U.S. National Renewable Energy Laboratory (NREL), Renewable Energy Innovation Policy: Success Criteria and Strategies, Draft of December 2012, available upon request.

[61] Aruba Sustainable Development Foundation (ASDF), SIDS-appropriate Sustainable Energy Technology Assessment, SIDS DOCK Secretariat, October 2012, available upon request.

Table 8 SIDS-appropriate sustainable energy technologies maturity stage[62,63]

	Near-term "Adaptation" stage	Mid-term "Commercial scale-up" stage	Long-term "Technology venturing" stage
Energy Supply			
Wind Energy Technology	Cost-competitive wind turbines/power systems	R&D: (1) Low-wind speed wind turbines (2) Off-shore wind turbines (3) New storage technology is expected by 2015-2020	R&D: (1) Better and more reliable and efficient wind turbine technology (2) Material component development to withstand maritime salinity environment
Solar Energy Technology	Grid-parity PV systems	R&D: (1) Reduction of cost and increase of efficiency (2) New storage technology is expected by 2015-2020	R&D: (1) Better and more reliable and efficient technology (2) Material component development to withstand maritime salinity environment
Hydro power Technology	Hydro run-off-river technology	R&D: Reduction of cost and increase of efficiency of small-scale run-off technology	R&D: Concept designs
Geothermal Energy Technology	Mid/Large scale application of binary cycle geothermal systems (base load energy source)	R&D: Improve technology and fluid characteristics of other geothermal sub-technologies through R&D	R&D: Concept designs
Bio-energy Technology	Deployment of commercial gasification and bio-anaerobic digestion technology	R&D: Demonstration units of cellulosic ethanol	R&D: Concept new designs
Ocean Energy Thermal Conversion Technology	Deployment of first commercial OTEC technology	R&D: Demonstration units of OTEC Technology (land based, floating, platform, etc)	R&D: Concept designs
Ocean Current Energy Technology		R&D: Demonstration units of Current energy technology	R&D: Concept designs
End use and infrastructure			
Transportation	(1) Introduction of Hybrid vehicles (2) Improve efficiency of public transportation	Introduction of electric vehicles	Solar/electric vehicles
Buildings	(1) Introduce EE measures (2) Improve building	Introduce new materials Solar Thermal Air Conditioning	Innovative insulation materials - Vacuum Insulated Panels

[62] Aruba Sustainable Development Foundation (ASDF), SIDS-appropriate Sustainable Energy Technology Assessment, SIDS DOCK Secretariat, October 2012, available upon request.
[63] Derived from UNDESA, Climate Change: Technology Development and Technology Transfer, http://www.un.org/esa/dsd/resources/res_pdfs/publications/sdt_tec/tec_technology_dev.pdf

	codes		
Industry	Introduce EE measures	Introduce new pollution codes	
Electric Grid and infrastructure	Introduce EE measures	Smart-grid	
Products & Appliances	Introduce a new importation code	Lab facility to testing imported products and appliances	

Among the identified SIDS-appropriate sustainable energy supply technologies, (1) the ocean thermal energy conversion technology, (2) ocean current energy technology and (3) cellulosic ethanol technology are still in the pre-commercial stage (in either the *commercial scale-up* or *technology venturing* stage), which highlights the narrow scope of available technologies, which are (1) solar PV technology, (2) wind energy technology, (3) biomass gasification technology, (4) bio-anaerobic digestion technology, (5) hydro run-off-river technology, and (6) binary cycle geothermal energy technology that can or are readily deployed and/or “adapted” to SIDS conditions.

Currently SIDS have no or limited R&D capacity to develop SIDS-appropriate energy supply and end-use technologies, the majority or all technologies shown in Table 8 have been develop in high income, and industrialized nations, with the purpose of exporting these to external markets. This reality has to be taken into account when investigating the need and required efforts and investments in building up RD&D capacity and infrastructure in SIDS to advance SIDS-appropriate sustainable energy technology development and innovation.

5.3 How to measure performance and monitor progress regarding SIDS DOCK targets

In order to be able to monitor and evaluate the progress of the *SIDS DOCK Strategic Implementation Plan* to achieve the set SIDS DOCK goals, the creation of a baseline report, indicators and a standardization of reporting procedure are all critical elements. The SIDS DOCK Secretariat needs to be able to guarantee that sourced and secured financing is properly allocated to activities, projects or programs that contribute to achieving the SIDS DOCK goals.

The principal targets of SIDS DOCK are as follows:
Target 1 - Increase energy efficiency by 25 percent (compared to 2005 baseline) by 2033
Target 2 - Generate a minimum of 50 percent of electric power from renewable sources in 2033
Target 3 - 25 percent decrease in conventional transportation fuel use by 2033

Target 1 - Increase energy efficiency by 25 percent (2005 baseline) by 2033

In order to be able to measure the increase of energy efficiency compared to the energy use and consumption conditions in year 2005 in each of the SIDS DOCK Member States the following factors have to be taken into account:

(1) Energy conversion efficiency of the electricity generating system;
(2) Efficiency in the transmission, distribution, and final delivery of electricity to users; and

(3) End-use electricity efficiency based on the portfolio of end-use technologies in the island community.

Addressing energy efficiency requires a holistic approach where starting from the macro-level and narrowing down to identifying and targeting more specific issues is important. With other words, the increase of renewable electricity generation has to occur in parallel to the increased rational and efficient use of that same electricity. From the efficient power generation from machinery used to the efficient transmission, distribution or delivery of the electricity to the final user (limited losses) is very critical to guaranteeing cost-effectiveness and sustainability of these same systems. Furthermore the energy consuming appliances portfolio by sectors in the society (e.g. commercial, industrial or residential sectors) up to the national level has to increasingly consist of more high energy efficient appliances, machinery or technologies. Behavioral changes are additional strategies that contribute beyond energy efficiency to energy conservation that can significantly contribute to achieving the set target among all SIDS.

What are the current commitments made by SIDS DOCK membership regarding EE?

The level of policy commitments made by the SIDS DOCK membership is an important indicator to the viability of SIDS DOCK achieving the set goals by 2033. Table 9 lists the voluntary commitments or pledges made by the SIDS DOCK members at the RIO+20 UN Conference on Sustainable Development in June 2012 regarding energy efficiency targets to be achieved in the future.

Table 9 2012 Commitments by SIDS DOCK Membership regarding Energy Efficiency improvement[64,65]

			Required target	Adopted EE target	2005 EE rate
		SIDS DOCK Membership	**25% by 2033 (compared to 2005)**		
CARIBBEAN	1	Antigua and Barbuda		N/A	N/A
	2	Bahamas		N/A	N/A
	3	Barbados		22% by 2029	N/A
	4	Belize		N/A	N/A
	5	Dominica		N/A	N/A
	6	Dominican Republic		N/A	N/A
	7	Grenada		N/A	N/A
	8	Jamaica		N/A	N/A
	9	Saint Kitts & Nevis		N/A	N/A
	10	Saint Lucia		20% (PS[66]) by 2020	N/A
	11	Saint Vincent & the Grenadines		15% by 2020	N/A
	12	Suriname		N/A	N/A
	13	Trinidad and Tobago		N/A	N/A
[illegible]	14	Cape Verde		30% by 2030	N/A

[64] Rio+20 United Nations Conference on Sustainable Development, Voluntary Commitments, June 2012, see: http://www.uncsd2012.org/allcommitments.html (visited November 2012)

[65] International Renewable Energy Agency (IRENA), Policy Challenges for Renewable Energy Deployment in Pacific Island Countries and Territories, IRENA Policy Brief, 2012, see: http://irena.org/documentdownloads/publications/policy_challenges_for_renewable_energy_deployment_PICTs.pdf (visited November 2012)

[66] PS: Public Sector

	15	Sao Tome & Principe		N/A	N/A
Ind.	16	Maldives		N/A	N/A
	17	Mauritius		N/A	N/A
	18	Seychelles		N/A	N/A
PACIFIC[67], [68]	19	Cook Islands		N/A	N/A
	20	Fiji		N/A	N/A
	21	Federated States of Micronesia		N/A	N/A
	22	Kiribati		N/A	N/A
	23	Marshall Islands		50% (HH[69]) and 75% (PS) by 2020	N/A
	24	Nauru		N/A	N/A
	25	Palau		N/A	N/A
	26	Samoa		N/A	N/A
	27	Solomon Islands		N/A	N/A
	28	Tonga		N/A	N/A
	29	Tuvalu		N/A	N/A
	30	Vanuatu		N/A	N/A

What is needed to be able to gather data and measure progress?

The EE progress and measure of progress imply (1) the need for implementing a legal framework; (2) implementation of EE measures under the EE legal framework; (3) establishing national awareness campaigns; and (4) establishment of a methodology and infrastructure that allow authorities to gather primary data and obtain a realistic picture of the EE progress. This is for most SIDS unfortunately not in place, meaning that no or limited verifiable data is available regarding the EE rates at the national level or by sectors of the economy. Table 9 includes a column where SIDS representatives can contribute with providing initial/macro EE rates for their respective SIDS for the year 2006.

EE Legal Framework

First there is the need for introduction of a legal instrument that outlines specific EE measures per sector of the economy. This can include for instance the enforcement of regulations to limit the importation of non-EE goods (e.g. appliances, cars, machinery, etc.) into a SIDS.

In general the EE legal framework should include:

- A national policy statement and framework for Energy Efficiency goals that clearly states the long term policy target (in this case the recommended time frame is by 2033 – in line with SIDS DOCK targets);
- A package of measures including energy efficiency programs for appliances and equipment, energy efficiency standards for buildings and energy efficiency measures across the commercial, transportation, government and industrial sectors; and
- A mechanism for coordination of trade and import related to energy efficiency goods, products and any machinery.

[67] S. Fifita, Secretariat of the Pacific Community, *Options for Energy Security in the small island states of the Pacific*, PECC Seminar 2 on Marine Resources: Oceans as a Source of Renewable Energy, Hawaii, USA, March 28-28, 2012.
[68] Final – Barbados Declaration on Achieving Sustainable Energy for All in Small Island Developing States (SIDS), May 08, 2012
[69] HH: household

EE measures by sector

Table 10 lists a set of energy efficiency measures that could be considered to include in the national package of EE improvement measures in SIDS.

Table 10 Suggested Energy Efficiency Measures to enable SIDS to gather data and measure progress

Sector	EE measures
Commercial Building Sector	• Provide a road map to assist SIDS's building sector to adapt to the new building standards; • Energy certification of new and existing buildings that are sold, rented out or leased; • Require public sector buildings to display the energy certificate to the public; • Establish national energy certification procedure(s); • Demand annual energy performance certificates for buildings; • Introduce new standards for the energy performance of air conditioners; • The energy certificate should be issued on the basis an energy audit. It is issued by authorized technicians who have the required training for performing energy audits and certification of buildings; • Financial incentives should be created, e.g. in the form of a fund that will encourage and stimulate all programs and projects which will foster implementation of EE measures in buildings. (e.g. reduction of taxation for 10 years in a "x" percentages, non-import taxes during the first 5 years to increase the importation of EE machinery and materials for construction, etc.)
Transportation sector	• Restrict the use of vehicles older than 20 years; • National assessment of vehicle efficiency measures, liters of fuel consumed per kilometer and CO2 emission standards (e.g. include this in the existing car inspection procedures and requirements); • Introduce or lower CO2 emissions standards and demand high fuel efficiency standards for vehicles imported into SIDS; • Offer a tax reduction or provide economical support to replace old vehicles for new EE vehicles or alternative fuels vehicles; • Offer supportive assets/infrastructure (electric charging stations/parking lots) to incentivize increased use of green-vehicles within a period of time (average 3-5 years); • Introduce organizational measures (toll fees, congestion charging, parking space control, parking fees, freight transport control in urban areas, urban traffic infrastructure control); • Implementation of fuel diversification initiatives, to incentivize the increased use of clean fuel vehicles by conducting and enhancing technical capacity to use alternative fuels (laboratories, testing facilities, etc.); and • Introduce alternative fuels vehicles (Compressed Natural Gas, Biogas, Bio diesel, Bio ethanol, LPG and Hydrogen) as well as propulsion system equipped with batteries and fuel cells.
Industrial Sector (if applicable)	• Introduce consistent energy efficiency standards for appliances and equipment and a process to enable industry to adjust to increasingly stringent standards over time; • Increase awareness and knowledge about the possibilities and economic benefits of investing in energy efficiency; • Monitor and analyze energy consumption rates –to allow for setting goals for the industry sector; • Facilitate/demand energy audits and benchmark studies by industry sector; • Pilot projects (implementation of projects, best practices, replicability and disseminate information about them); • Facilitate capacity building by training and education; and • Support business and industry with incentives to acquire know-how, skills and human capacity to implement cost-effective energy efficiency opportunities and therefore meet the

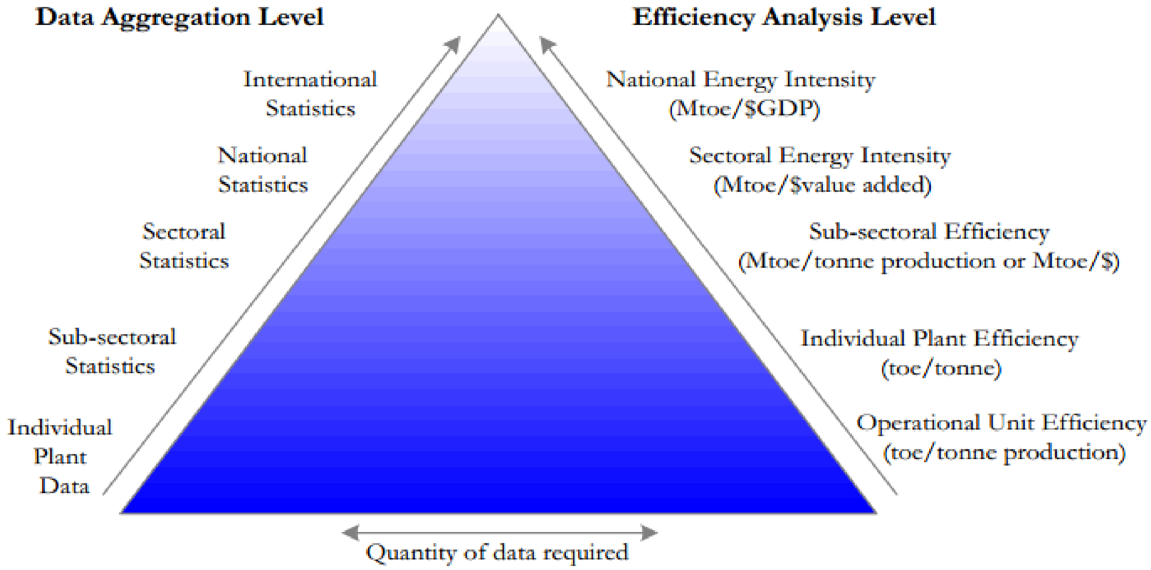
	challenges of a low carbon economy.
Public Sector	• Establish a system for monitoring energy consumption in all government facilities; • Implementation of energy audits in priority facilities; • Demand energy certification of public buildings; • Introduce series of educational and motivational workshops and seminars for employees of Gov. administration; and • Compensate governments working to improve the energy efficiency of their own buildings and operations.
Residential Sector	• Support households to reduce energy use by providing information and advice regarding the EE technology imported to SIDS, financial assistance and incentives to promote the shift from old technology to the new EE technology and pilot programs at the community level; • Introduce higher energy efficiency standards to deliver substantial growth in the number of highly energy efficient homes and buildings; and • Introduce new standards for the energy performance of air conditioners.
Cross cutting sectors	• Create SIDS National Energy Efficiency Program (SEEP); • SEEP will be complemented with a SIDS Energy Efficiency Action Plan (SEEAP); • Programs and plans for energy efficiency in local communities, by which is fortified by general energy efficiency policy and its implementation procedure; • Definition of energy audits, energy services and contracting of the energy impacts; • Improve EE for electricity generation and distribution (improve technology, equipment, etc.); • Definition of energy audits, energy services and contracting of the energy impacts; • Define criteria for educating energy auditors, as well as its rights and obligations; • Address potential regulatory impediments to the take up of innovative demand side initiatives and smart grid technologies.

What indicators are recommended to measure EE performance levels in SIDS DOCK member states?

Indicators are useful because they show policy makers where energy savings can be made.[70] In this case EE indicators are relevant as a tool to understand economic, energy, emissions and human activities interactions and their interrelations.

The appropriate level of detail of the EE indicators is presented in Figure 6. The amount of data required to assess and measure quantitatively EE indicators has a critical role and it increases significantly when the level of aggregation becomes more detailed. So, before start assessing the EE indicators it is necessary to establish a "mechanism" that allows SIDS DOCK to have access and gather the data required to measure the indicators. Additionally, the data must be consistent, validated and comprehensive.

[70] http://www.iea.org/topics/energyefficiencyindicators/



Source: Phylipsen *et al*, 1998.

Figure 6 Energy Efficiency analysis levels based on quantity of data

Table 11 lists some recommended indicators for EE performance and monitoring in SIDS. These have to be double checked in more detail once national SIDS statistics are gathered and there is a better view of available statistical capacities in each respective SIDS.

Table 11 Recommended Energy Efficiency Indicators

Indicators	Components
Energy intensity: manufacturing, transportation, agriculture, commercial and public services, residential sector	-Energy use in each sector and by manufacturing branch -Corresponding value added
Energy consumption per capita	-Energy use (total primary energy supply, total final consumption and electricity use) -Total population
Efficiency of energy conversion and distribution	Losses in transformation systems including losses in electricity generation, transmission and distribution
Net energy import dependency	– Energy imports – Total primary energy supply

Target 2 - Generate a minimum of 50 percent of electric power from renewable sources in 2033

In order to be able to measure the increase of contribution of renewable energy to the overall power generation in each of the SIDS DOCK Member States the following factors have to take into account:

(1) The installed capacity of each power generating system in MW; and

(2) The energy conversion efficiency and load factor of the electricity generating systems.

What are the current commitments made by SIDS DOCK membership regarding RE?

The level of policy commitments made by the SIDS DOCK membership is an important indicator to the viability of SIDS DOCK achieving the set goals by 2033. Table 12 lists the voluntary commitments or pledges made by the SIDS DOCK members at the RIO+20 UN Conference on Sustainable Development regarding renewable energy targets to be achieved in the future.

Table 12 Current commitments by SIDS DOCK Membership regarding renewable energy use[71,72, 73]

			Required target	Adopted RE target	Current RE use (per 2012)
		SIDS DOCK Membership	**50% by 2033**		
CARIBBEAN	1	Antigua and Barbuda		15% by 2030	<1%
	2	Bahamas		N/A	<1%
	3	Barbados		29% by 2029	<1%
	4	Belize		N/A	~45%
	5	Dominica		100% by 2020	~25%
	6	Dominican Republic		10% by 2015	17.5%
	7	Grenada		20% by 2020	<1%
	8	Jamaica		15% by 2020	~5%
	9	Saint Kitts & Nevis		20% by 2015	~2%
	10	Saint Lucia		20% by 2020	<1%
	11	Saint Vincent & the Grenadines		30%/2015 - 60%/2020	~10%
	12	Suriname		N/A	73%
	13	Trinidad and Tobago		N/A	<1%
Atl.	14	Cape Verde			
	15	Sao Tome & Principe			
Ind.	16	Maldives		100% by 2020	
	17	Mauritius		35% by 2025	
	18	Seychelles		15% by 2030	
PACIFIC[74, 75]	19	Cook Islands		50%/2015 – 100%/2020	~30%
	20	Fiji		90% by 2015	~60%
	21	Federated States of Micronesia		20% by 2020	~4%
	22	Kiribati		10% by 2020	<1%
	23	Marshall Islands		20% by 2020	<1%
	24	Nauru		50% by 2015	<1%
	25	Palau		20% by 2020	<1%
	26	Samoa		20% by 2030	~48%
	27	Solomon Islands		100% by 2030	~3%
	28	Tonga		50%/2012-100%/2020	<1%
	29	Tuvalu		100% by 2020	<1%

[71] Rio+20 United Nations Conference on Sustainable Development, Voluntary Commitments, June 2012, see: http://www.uncsd2012.org/allcommitments.html (visited November 2012)

[72] International Renewable Energy Agency (IRENA), Policy Challenges for Renewable Energy Deployment in Pacific Island Countries and Territories, IRENA Policy Brief, 2012, see: http://irena.org/documentdownloads/publications/policy_challenges_for_renewable_energy_deployment_PICTs.pdf (visited November 2012)

[73] Aruba Sustainable Development Foundation (ASDF), SIDS-appropriate Sustainable Energy Technology Assessment, SIDS DOCK Secretariat, October 2012, available upon request

[74] S. Fifita, Secretariat of the Pacific Community, *Options for Energy Security in the small island states of the Pacific*, PECC Seminar 2 on Marine Resources: Oceans as a Source of Renewable Energy, Hawaii, USA, March 28-28, 2012.

[75] Final – Barbados Declaration on Achieving Sustainable Energy for All in Small Island Developing States (SIDS), May 08, 2012

	30	Vanuatu		100% by 2013	~8%

What is needed to be able to gather data and measure progress?

There is a need for the introduction of a strong legal framework to secure the fast deployment of RETs in SIDS. Some potential instruments include:

Table 13 Suggested instruments to enable SIDS to gather data and measure progress on RE power generation

Type of Function	Instruments
Demand Policies	• SIDS must enact a Renewable Energy Law, which establish a framework under which utilities are required to pay full price for electricity generated by renewable energy sources while offering consumers of renewables-generated electricity discounted rates. In addition this Law will require utilities to purchase all renewable power generated in SIDS. This measure will encourage entry into the renewable energy generation business and increased the demand for renewable power equipment. • Release a Medium and Long-Term Development Plan for Renewable Energy in SIDS which will force power companies which owned installed capacity of over 1 MW to have renewable energy installed power capacity accounting for 20 percent of total capacity by 2020 and 50 percent by 2030. This measure will trigger a surge of investment in the wind, solar and geothermal equipment industry, reflecting the fact that renewable power equipment was less costly to install and operate than a decade ago.
Incentive Policies	• Implement a multi-million economic Stimulus Package for renewable energy projects deployment in SIDS. • Devote substantial resources to R&D in the energy sector, addressing themes such as OTEC, hydrogen and fuel cell technology, energy efficiency and renewable energy.
Support activities	• Perform a scoping analysis of all actors operating in the field of promoting, facilitating and deploying sustainable energy technologies to SIDS, in particular the ones addressing Transfer of Technology needs. • Establish strategic partnerships with other key actors/stakeholders to build upon past efforts, platforms and successes booked • Perform a detailed energy sector diagnostic to understand per SIDS what the conditions and performance is, who the critical actors are, and what their nature and responsibilities are within the sector

What indicators to use to measure RE performance levels in SIDS DOCK member states?

Table 14 lists some recommended indicators for RE power generation performance and monitoring in SIDS. These have to be double checked once more detailed national SIDS statistics are gathered and there is a better view of available statistical capacities in each respective SIDS.

Table 14 Recommended RE power generation indicators

Indicators	Components
Resources-to- production ratio	– Total estimated RE resources – Total energy production from RE sources
RE shares in electricity generation	– % of Primary energy supply, final consumption and electricity generation and generating capacity by renewable energy – % of Total primary energy supply, total final consumption, total electricity generation and total generating capacity
GHG emissions from electricity generation	GHG emissions from electricity generation

Target 3 - 25 percent decrease in conventional transportation fuel use by 2033

In order to be able to measure the decrease in the use of fossil fuels for transportation in each of the SIDS DOCK Member States the following factors have to take into account:

Land based:
(1) The amount of registered vehicles in a SIDS (vehicle fleet, including private, commercial, and public vehicles);
(2) The fuel efficiency (MPGs[76]) of vehicles as part or fraction of the vehicle fleet in a SIDS;
(3) The frequency of use or average distance achieved annually by vehicles in the transport sector.

Maritime:
(1) The amount of registered maritime vehicles (boats, ferries, etc.) in a SIDS;
(2) The fuel efficiency (MPGs[77]) of vehicles as part or fraction of the vehicle fleet in a SIDS;
(3) The frequency of use or average distance achieved annually by vehicles in the transport sector.
Sustainable transportation is a broad term for the use of multiple types of technologies or products and includes also behavioral changes that contribute to the reduction of consumption of conventional fuel for transportation.

What are the current commitments made by SIDS DOCK membership regarding switching from conventional fuels for transportation?

The level of policy commitments made by the SIDS DOCK membership is an important indicator to the viability of SIDS DOCK achieving the set goals by 2033. Table 15 lists the voluntary commitments or pledges made by the SIDS DOCK members at the RIO+20 UN Conference on Sustainable Development regarding targets to switch to alternatives to conventional fuel use for transportation in the future.

[76] MPG: Miles per Gallon
[77] MPG: Miles per Gallon

Table 15 Current commitments by SIDS DOCK Membership regarding switching from conventional fuels[78,79]

			Required target	Adopted/pledged fuel use target	Current fuel use
		SIDS DOCK Membership	Switching from conventional fuel use by 25% in 2033		
CARIBBEAN	1	Antigua and Barbuda		N/A	N/A
	2	Bahamas		N/A	N/A
	3	Barbados		N/A	N/A
	4	Belize		N/A	N/A
	5	Dominica		N/A	N/A
	6	Dominican Republic		N/A	N/A
	7	Grenada		N/A	N/A
	8	Jamaica		N/A	N/A
	9	Saint Kitts & Nevis		N/A	N/A
	10	Saint Lucia		N/A	N/A
	11	Saint Vincent & the Grenadines		15% by 2020	N/A
	12	Suriname		N/A	N/A
	13	Trinidad and Tobago		N/A	N/A
Atl.	14	Cape Verde		2% by 2030	N/A
	15	Sao Tome & Principe		N/A	N/A
Ind.	16	Maldives		N/A	N/A
	17	Mauritius		N/A	N/A
	18	Seychelles		N/A	N/A
PACIFIC[80, 81]	19	Cook Islands		N/A	N/A
	20	Fiji		N/A	N/A
	21	Federated States of Micronesia		N/A	N/A
	22	Kiribati		N/A	N/A
	23	Marshall Islands		20% more EE by 2020 (not off-setting)	N/A
	24	Nauru		N/A	N/A
	25	Palau		N/A	N/A
	26	Samoa		N/A	N/A
	27	Solomon Islands		N/A	N/A
	28	Tonga		N/A	N/A
	29	Tuvalu		N/A	N/A
	30	Vanuatu		N/A	N/A

[78] Rio+20 United Nations Conference on Sustainable Development, Voluntary Commitments, June 2012, see: http://www.uncsd2012.org/allcommitments.html (visited November 2012)

[79] International Renewable Energy Agency (IRENA), Policy Challenges for Renewable Energy Deployment in Pacific Island Countries and Territories, IRENA Policy Brief, 2012, see: http://irena.org/documentdownloads/publications/policy_challenges_for_renewable_energy_deployment_PICTs.pdf (visited November 2012)

[80] S. Fifita, Secretariat of the Pacific Community, *Options for Energy Security in the small island states of the Pacific*, PECC Seminar 2 on Marine Resources: Oceans as a Source of Renewable Energy, Hawaii, USA, March 28-28, 2012.

[81] Final – Barbados Declaration on Achieving Sustainable Energy for All in Small Island Developing States (SIDS), May 08, 2012

What is needed to be able to gather data and measure progress?

Since the transportation sector is the largest consumer of fuel, reducing oil consumption from transportation sector is a much greater challenge than we can assume initially. It will require the development of a strong legal framework.

Table 16 Suggested instruments to gather data and measure progress of reduction in conventional fuel use for transport

Type of Function	Instruments
Disincentives	• Reductions in oil consumption from transportation by increasing the cost of driving with petroleum based fuel taxes • Eliminate subsidy for petroleum based fuels • Increase taxes or forbid the use of vehicles with more than 20 years
Incentives	• Increase the popularity and promote the importation of alternative motor vehicles through tax benefits/credits or deductions
Support activities	• Introduce pilot projects to testing electric vehicles in the context of SIDS • Introduction of pilot project to testing different types of vehicles (electric, hybrid, etc.) and alternative fuels

What indicators to use to measure reduction in conventional fuel use for transportation SIDS DOCK member states?

Table 17 lists some recommended indicators for measuring and monitoring the reduction in use of conventional fuel for transportation in SIDS. These have to be double checked once more detailed national SIDS statistics are gathered and there is a better view of available statistical capacities in each respective SIDS.

Table 17 Recommended Indicators to measure fuel use in the transport sector

Indicators	Components
Importation of vehicles	– Total of EE vehicles imported – Total of vehicles with more than 20 years replaced
Number of beneficiaries of tax deduction/credit/benefits	Total number of persons with the benefit
GHG emissions from transport sector	GHG emissions from vehicles

Efforts should be directed towards initial implementation of rational and accessible indicators, because currently the level of data available in SIDS for complex and more detailed indicators is not readily available. This issue is clearly reflected in Figure 6, where the level, quality, and complexity of indicators increase by the availability of quality primary data. This is applicable to all indicators proposed throughout this report. In this report the indicators proposed should only be considered as indicative values. Only after the implementation of suggested instruments or activities to improve the conditions to enable SIDS to gather primary data and monitor progress it may become possible to develop and use more complex and relevant indicators to evaluate SIDS DOCK interventions and monitor progress towards achieving the set SIDS DOCK targets.

5.4 Critical ingredients for effective Transfer of SIDS-appropriate SETs to SIDS

Before elaborating on the specific instruments and activities to be incorporated in a strategic plan for the Transfer of SIDS-appropriate SETs, it is important to highlight the key elements or ingredients to secure a successful technology transfer process. From literature can be derived that the following ingredients are essential for a proper technology transfer process[82]:

(1) *The presence of a regional and/or local technology development base (host SIDS)* - This means that some SIDS (2-3 in each SIDS major region) will have to take an incubator function for innovative technologies based on the use of local social and ecological conditions in the technology transfer; have

(2) *The proper relationship and information exchange between technology provider and client* – This means that a demand-driven approach is taken for SIDS, where for instance a methodology is created and shared among SIDS to determine the characteristics of SIDS-appropriate sustainable energy technologies and help guide the allocation of resources and efforts to generate solutions to specific SIDS energy needs for sustainable development; and

(3) *Significant funding* – last but not least, significant and adequate funding is the critical determinant for making the idea of transfer of SIDS-appropriate sustainable energy technologies to SIDS a reality.

The requirement of adequate and significant funding, is "the elephant in the room" when it comes to SIDS real need to address their energy development challenges.

5.5 Summary of findings

As is repeatedly highlighted in this report, access to adequate financing is considered the most critical barrier to the wide-scale transfer, deployment and use of sustainable energy technologies in SIDS.[83] Now, in order to improve the conditions and chances to secure adequate private financing for RET projects to help SIDS transition to a sustainable energy development pathway and achieve the set SIDS DOCK targets, a critical issue to be clarified is that financial resources need to be secured and invested in SIDS to (1) address the market conditioning needs for the deployment of commercially available SIDS-appropriate sustainable energy technologies on the short to medium term, and (2) address the lack of technology assessment, application and use capacity in SIDS to guarantee the continued innovation, development, deployment and use of future SIDS-appropriate sustainable energy technologies in the mid to long term.

In other words, in order to set up the adequate training programs, building up training staff, and coordinated efforts among educational institutions, funding is needed. In order to address and improve the regulatory framework to facilitate the improved process of *Transfer of Technology* to SIDS, funding is

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[82] NCSU: http://www.ncsu.edu/iucrc/PDFs/IUCRC%20Pubs/Tornatzky%20Waugaman%20and%20Gray%201999.pdf
WHO: http://apps.who.int/prequal/info_general/documents/TRS961/TRS961_Annex7.pdf
Asian and Pacific Centre for Transfer of Technology (APCTT):
http://www.business-asia.net/Pdf_Pages/Guidebook%20on%20Technology%20Transfer%20Mechanisms/Strategic%20Risks.pdf
REGIONAL SUSTAINABLE DEVELOPMENT REVIEW: http://www.eolss.net/Sample-Chapters/C16/E1-50-33-00.pdf
UNIDO: http://www.unido.org/fileadmin/import/userfiles/hartmany/wssd_tech_transfer.pdf

[83] Intergovernmental Panel on Climate Change (IPCC), Methodological and Technical Issues in Technology Transfer, see: http://www.ipcc.ch/ipccreports/sres/tectran/index.php?idp=223 (visited November 2012)

needed to involve legal specialists, and other experts to properly justify and guide the changes in regulatory issues. In order to perform general public outreach and improve awareness, significant campaigns have to be set up to be effective, this requires funding. The message here is that none of the recommended solutions, instruments or activities can be implemented without having access to adequate funding and making sure the right assistance is provided to SIDS through coordinated approach.

The key message is that without an international dedicated financing mechanism in place that is recognized by SIDS, that represents the interest of SIDS around the globe, and that has a coordinating role among SIDS and the international community, all suggested ideas, recommended approaches, instruments and activities may not be implemented quickly, comprehensively or effectively enough to safeguard the simple survival of SIDS communities.

The SIDS community has reached a point in time, where the choice is simple, where (1) the SIDS will continue to depend on the existing international development assistance framework that, as described in Section 4.3, over the past three decades have not led to significant or required changes in SIDS, or (2) SIDS have to take their destiny in own hands and establish a new financial mechanism specifically to address the energy development needs of all SIDS around the globe and guide the international development assistance community in how to be a partner to SIDS in achieving the goals and targets set by SIDS DOCK membership.

It is therefore highly recommended to consider SIDS DOCK as a new international financing mechanism with complementing specialized technical assistance capacity to become the principal source of funding and technical assistance for facilitating the transfer of SIDS-appropriate SETs in SIDS.

6. The role of SIDS DOCK in facilitating the transfer of SIDS-appropriate SET

6.1 SIDS DOCK Mission Statement

SIDS DOCK is a SIDS-SIDS Institutional Mechanism brought into life to facilitate the development of sustainable energy economy within small island developing states. The ultimate goal of SIDS DOCK is to increase energy efficiency by 25 percent (2005 baseline) and to generate a minimum of 50 percent of electric power from renewable sources and a 20-30 percent decrease in conventional transportation fuel use by 2033.

SIDS DOCK is currently envisioned to carry out four principal functions:
(1) Assist SIDS transition to a sustainable energy sector, by increasing energy efficiency and development of renewable energy; (2) Providing a vehicle for mobilizing financial and technical resources to catalyze clean economic growth; (3) Provide SIDS with a mechanism for connecting with the global carbon market and taking advantage of the resource transfer possibilities that will be afforded, and; (4) A mechanism to help SIDS generate the financial resources to invest in climate change adaptation.

Vision

To be the principal international *financing and technical assistance mechanism* (Docking Station) of and for Small Island Developing States to facilitate their transition towards sustainable energy economies.

Mission

To assist Small Island Developing States to increase the sustainable and responsible use of energy to achieve sustainable development.

Objectives

To improve the transfer of SIDS-appropriate Sustainable Energy Technology to SIDS DOCK Member States to increase energy efficiency by 25 percent (2005 baseline); to generate a minimum of 50 percent of electric power from renewable sources; and a 25 percent decrease in conventional transportation fuel use by 2033.

6.2 SWOT-analysis of SIDS DOCK

Based on the SIDS DOCK background documentations, the SIDS-appropriate Sustainable Energy Technology Assessment Report, and this report, several conclusions can be drawn on the strengths, weaknesses, opportunities and threats to SIDS DOCK (Table 18) in determining its role and position within the international development assistance community.

Table 18 SWOT-analysis results of SIDS DOCK

Strength	**Weakness**
SIDS DOCK is envisioned to become the principal financing and technical assistance mechanism to assist SIDS around the globe to achieve sustainable energy development. The strength of SIDS DOCK lies in the fact that it is an initiative by and for SIDS, created, built, promoted and managed by professional individuals originating from SIDS that appreciate and understand the needs and dynamics of SIDS communities including the political process and decision making.	There needs to be clarity what SIDS DOCK actually is. Is SIDS DOCK (1) a new SIDS-SIDS multilateral organization, (2) a SIDS technical assistance agency, or (3) a SIDS financing mechanism? The answer to this question determines the focus, reach, and potential of SIDS DOCK bringing added value to SIDS and the international community. This has to be done as soon as possible. This report recommends establishing SIDS DOCK as a new international financing and technical assistance mechanism. The widely known challenge of international development aid is that as long there is an external or extra-regional donor, there will always be conditions attached to the funds. The business of international assistance is in prioritizing certain groups/consultancies/businesses originating from the donor country in executing work/advice/assistance leaving a minor fraction of these donated funds to circulate in the SIDS economies. Thus as any international multilateral organization, SIDS DOCK will, unless introducing a different construction (business model) to guarantee financial sustainability, also be subject to the agendas of traditional high-income donor states around the globe. SIDS DOCK has to look at securing full membership beyond the existing SIDS (currently defined as island communities officially recognized by the United Nations as Small Independent Developing States, known as AOSIS) and incorporate all island communities (territories) around the globe that are to some extent confronted with the same challenges and opportunities to guarantee sustainable development. This will allow for bridge building between SIDS and developed nations around the globe that have islands within their territories. Significant lessons, exchange of best practices, and transfer of technology, is possible among island communities. The inclusion of island communities, either independent or non-independent, high- or low income, geographically isolated or not, all have a stake in increasing the transfer of renewable energy technologies, the rational and efficient production, conversion and use of energy, and reduced dependency on imported energy for power generation and mobility to guarantee the respective communities' wellbeing. This commonality is a strong binding factor that enables collective commitment, support and action under guidance provided by SIDS DOCK.
Opportunities	**Threats**
At the international level there is currently no such mechanism that is dedicated or with the specific focus on having a coordinating role and leveraging, securing, and	The most significant threats (external factors) impacting SIDS DOCK (as a Sustainable Energy focused mechanism) are all the ongoing crises, from food, water to financial crises, all impact

channelizing funds to invest in the transfer of sustainable SIDS-appropriate technologies to SIDS. This is a very specific mandate that allows SIDS DOCK to carve a specific niche in the international assistance efforts and bring specialized support and added value to the international community. There is limited competition to SIDS DOCK when specifically recognizing the principle mandate of SIDS DOCK compared to other existing international/multilateral financing or technical assistance institutions. SIDS DOCK fund raising mechanism is creatively set up to allow for a broader spectrum of public and private sponsors, donors or even investors.	the level of priority given to SIDS DOCK when compared to addressing food security, extreme poverty, conflict resolution, and other priorities possibly considered shorter-term. SIDS DOCK's dependency on the political/diplomatic core of SIDS and extra-regional funds from non-SIDS donors make it vulnerable to external shocks (crises). The political and diplomatic cycles can lead to significant changes in the level of international support, commitment, international significance, and continuity of SIDS DOCK efforts which on its turn is linked to SIDS DOCK's capacity to secure steady, continuous or reliable funds to guarantee the proper operation of SIDS DOCK in the future. Financing remains the most critical determining factor to the practical application of current technologies and knowledge.

6.3 Key partners with SIDS DOCK

After an extensive literature research only a handful of international institutionalized mechanisms are currently (as per 2012) established to specifically assist SIDS around the globe to improve their access, implementation and use of supply and end-use energy technologies that are suitable to SIDS.

Existing global mechanisms for sustainable energy development in SIDS

Sustainable Energy for All (SEFA)- At the international level, as an initiative of the United Nations, the Sustainable Energy for All initiative was launched in 2012 with the purpose of coordinating, consolidating and tracking at the global level all efforts that are directed or address three main issues, namely (1) ensuring universal access to modern energy services, (2) doubling the global rate of improvement in energy efficiency, and (3) doubling the share of renewable energy in the global energy mix.[84]

After careful review of publically available information, only the following initiatives described in Table 19 have been identified that have a global character, and that specifically focus on addressing SIDS energy development needs.

Table 19 Existing global mechanisms to support Technology Transfer of Renewable Energy Technologies to SIDS

Scaling up Renewable Energy Program (SREP)[85]	This is an initiative under the Climate Investment Fund managed by the Multilateral Development Banks (MDBs) where currently one SIDS, Maldives, is participating. The objective of the SREP is to pilot and demonstrate the economic, social and environmental viability of low carbon development pathways in the energy sector by creating new economic opportunities and increasing energy access through the use of renewable energy. Partners are: Department for International Development (DFID) and the Government of Netherlands, The African Development Bank (AfDB) and the World Bank Group (WBG), including the International Finance Corporation (IFC). Financing from SREP is guided by a number of principles. The financing will: • Address the additional costs and risks associated with renewable energy

[84] Source: http://www.sustainableenergyforall.org/objectives
[85] Source: http://www.climateinvestmentfunds.org/cif/srep

	technologies, which adversely affect the viability of investments. • Meet the specific requirements of removing financial and institutional barriers and to leverage additional public and private financing. • "Crowd-in" the private sector. • Finance investments and capacity building for both public and private sector entities. • Increase the installed renewable energy capacity in a country's energy supply in line with national energy plans. • Support proven renewable technologies.
Small Developing Island Renewable Energy Knowledge and Technology Transfer Network (DIREKT)[86]	This is a cooperation scheme involving universities from Germany, Fiji, Mauritius, Barbados and Trinidad & Tobago with the aim of strengthening the science and technology capacity in the field of renewable energy of a sample of ACP (Africa, Caribbean, Pacific) small island developing states, by means of technology transfer, information exchange and networking. The Objectives are: (1) to strengthen the internal science and technology capacity in the field of renewable energy of ACP-SIDS; (2) to foster sustainable cooperation between the science and technology community between the participant countries and the EU; and (3) to contribute to the transfer of research results on the key topic of renewable energies, by means of the establishment of "technology transfer centers" in the participant countries.
SIDSNet[87]	This initiative has the potential to act as a future strategic partner of SIDS DOCK to fulfill the role of a clearinghouse for SIDS. The mission of SIDSnet is to support the sustainable development of SIDS through enhanced information and communication technology. The objectives are: (1) Providing technical assistance and advice; (2) mobilizing the necessary support of the UN system and the international community; (3) providing secretariat support for both intergovernmental and inter-agency coordination mechanisms, including strengthening information activities for decision-making by SIDS and facilitation of networking among SIDS stakeholders; and (4) monitoring and reporting on progress made in implementation of the BPOA and MSI, including through the biennial cycle of the Commission on Sustainable Development.
SCCF[88]	The Special Climate Change Fund (SCCF) was launched at the COP-7 in 2001 with particular focus on four principle themes (1) adaptation, (2) transfer of technologies, (3) energy, transport, industry, agriculture, forestry, and waste management, and (4) provide support to economic diversification of fossil fuel dependent countries. During COP-13 in Bali (2007) a decision was made to provide a narrower geographical guidance to prioritize the most vulnerable countries, where the LDCs, SIDS and African countries were highlighted. As of 2012, only one project is financed by the SCCF which is benefitting SIDS. This is the PACC project[89] being implemented in the Pacific Region, but with a scope or focus on climate change adaptation, thus originating from the SCCF-A (Adaptation) funding line.
TNA[90]	Technology Needs Assessment (TNA) Project is being implemented by UNEP (a GEF implementing agency). The objective is to help participating countries to develop national technology needs assessment to determine how to secure investment and access technologies to address climate change mitigation and adaptation needs.

[86] Source: http://www.direkt-project.eu/
[87] Retrieved from: http://www.sidsnet.org/about-sidsnet
[88] Source: http://www.thegef.org/gef/sites/thegef.org/files/documents/eo_them_SCCF_unedited_final_report.pdf
[89] Source: http://www.thegef.org/gef/sites/thegef.org/files/documents/document/PACC_0.pdf
[90] Source: http://www.tech-action.org/perspectives.asp

	Among participating countries, only a handful of SIDS are involved, namely Mauritius, Cuba, and the Dominican Republic.
Poznan Strategic Program - TPP[91]	The GEF's Strategic Program on Technology Transfer, renaming it the Poznan Strategic Program on Technology Transfer requested GEF to consider long-term implementation of the strategic program. Under the Poznan Strategic Program, only one SIDS is participating in the Technology Transfer Projects (as of February 2012), which is Cook Islands. This project looks into realizing Hydrogen Energy Installations on Small Islands through Technology Cooperation with Turkey through UNIDO. There are several responsibilities that GEF can take in the long term implementation of the Program. The roles are as follows: (1) Support for Climate Technology Centers and a Climate Technology Network; (2) piloting Priority Technology Projects to Foster Innovation and Investments; (3) establish Private Public Partnership for Tech Transfer; (4) Technology Needs Assessments; and (5) GEF as a Catalytic Supporting Institution for Tech Transfer.
IRENA[92]	The International Renewable Energy Agency (IRENA) via its Irena Innovation and Technology Center (IITC) aims to provide its member states the means for an accelerated technological change and the use of innovation to transition to renewable energy based systems. This will be achieved through (1) analysis of renewable energy technology policies; (2) dissemination of information and increased awareness; (3) technologies and equipment overview and assessment of success-failure factors; (4) improved relevant knowledge and technology cooperation, and (5) joint RD&D and provision of information on the development and deployment of national and international technical standards in relation to renewable energy. IRENA is currently building a new program for 2013 on forward regarding Transfer of RETs in its member states.

Among all the highlighted global initiatives or mechanisms presented in Table 19 only one, DIREKT, has a specific focus on building the Technology Transfer capacity in SIDS. Unfortunately this initiative only includes a small number of SIDS.

Thus as of 2012 despite the existence of initiatives like DIREKT[93], the level of global SIDS coverage is still very limited and it is not enough to pool collective resources to address the energy development challenges. For a more effective performance SIDSNet[94] has the potential to act as a strategic partner of SIDS DOCK to fulfill the role of a clearinghouse. The Poznan Strategic Program has several key elements that could be linked to SIDS DOCK, as the Technology Needs Assessments (TNAs). By narrowing the focus of the TNAs on energy supply and end-use technologies that are SIDS-appropriate synergies can be created between SIDS DOCK and GEF. Furthermore IRENA via its IITC has a specific mandate to promote Technology Transfer and Innovation, and can become a key strategic partner to SIDS DOCK to provide the required specialized and tailored technical assistance required in SIDS in coordination with SIDS DOCK. IRENA is still in the process of expanding its membership to include more SIDS from the major SIDS regions. But has a unique leverage that its membership is also composed of nations with overseas departments or island territories that will allow for exchange of best practices and technology transfer among island communities. Next to these identified mechanisms with a specific mandate, there are

[91] Source: http://www.thegef.org/gef/content/gef-report-poznan-strategic-program-technology-transfer-sbi
[92] Source: http://www.irena.org/menu/index.aspx?mnu=cat&PriMenuID=44&CatID=131
[93] Retrieved from: http://www.direkt-project.eu
[94] Retrieved from: http://www.sidsnet.org/about-sidsnet

many other international and regional organizations, including most UN-agencies (e.g. UNIDO, UNEP, UNDP, UN-ECLAC, UNDESA, etc.) that are grouped under UN-Energy, that have several shorter-term programs, initiatives and projects running or in pipeline that relate to the transfer of RETs to developing countries. But since these are large agencies with divers core mandates and large project portfolios, these entities cannot be considered specialized or tailored agencies addressing specifically the sustainable energy development needs of SIDS. In sum there is presently no mechanism in place that has both a specific mandate to facilitate the Transfer of SIDS-appropriate Sustainable Energy Technology to SIDS and that has a global SIDS reach, as SIDS DOCK.

Existing specialized R&D centers of SIDS-appropriate sustainable energy supply technologies

Please see Table 20 for a non-exclusive overview of existing specialized R&D centers that focus attention on technologies that may qualify as suitable to SIDS.

Table 20 Existing specialized R&D Centers of SIDS-appropriate sustainable energy technologies

Category	Specific Technology	Where?	Who?	Purpose and further info:
Ocean Energy Technologies	Pelamis "sea snake" technology	Orkney Islands (Scotland)	European Marine Energy Centre (EMEC)	As the first center of its kind to be created anywhere in the world, it offers wave and tidal energy device developers the opportunity to test full scale grid connected prototype devices in unrivalled wave and tidal conditions. http://www.orkneymarinerenewables.com/emec.asp http://www.emec.org.uk/
Ocean Energy Technologies	Wave and Tidal	Ireland	Wave Energy, Hydam and Wavebob	Ireland, has decided to engage in R&D of ocean energy technologies as part of their national renewable energy development strategy. Up to now the Government of Ireland invested up to 1.2 MEUR in grant aid in this specific sector. Ireland has (1) 3rd level research expertise in turbine design at University of Limerick, (2) wave tank modeling testing at the Hydraulics and Maritime Research Centre of University College Cork and (3) wave energy modeling at Queens University in Belfast. http://www.marine.ie/NR/rdonlyres/86491414-3E7E-48E5-A0E1-287CA9191C61/0/OceanEnergyStrategy.pdf http://www.ucc.ie/en/hmrc/ http://www.ndbc.noaa.gov/
Renewable Energy and energy storage Technologies	SMART-grid and energy storage	Aruba, Dutch Caribbean	Netherlands Independent Applied Research Institute (TNO)	Sustainability and internationalization are two key focal points of the new TNO strategy (since January 2011). TNO Caribbean Branch is committed to enable an efficient, reliable and sustainable transition from fossil to renewable fuels and the sustainable management of natural resources in island states. http://www.tno.nl/index.cfm http://www.tno.nl/content.cfm?context=overtno&content=overtno&item_id=1066&Taal=2 (Caribbean Branch)
Renewable Energy Technologies	Solar and Wind energy technologies	Canary Islands, Spain	The Technological Institute and Renewable	The geo-political situation of the Canaries has facilitated ITER becoming a strategic, international center of R&D, acting as a bridge between three continents. http://www.iter.es/

			Energy Sources	
Science and Technology in General	Research in food production and biotechnology support these areas while other areas of research are the medical and energy sectors	Five from Europe and six from the Caribbean	EUCARINET	EUCARINET is a four-year INCONET Coordination Action, supported by the European Commission (DG RTD-INCO), whose main goal is to strengthen bi-regional sustainable dialogue on Science and Technology between Europe and the Caribbean. http://www.eucarinet.eu

The R&D capacity and infrastructure in place is very limited when focusing on RETs that may qualify as SIDS-appropriate. There is limited investment in the RD&D of technologies as Ocean Energy Technologies (e.g. Ocean Thermal Energy Conversion (OTEC), Ocean Currents Technology, Tidal Energy, etc.) that have great future potential and promise in SIDS context.[95] In other words, this field of R&D of RETs that are SIDS-appropriate requires considerable attention if the objectives of building technology transfer capacity in SIDS is to be achieved in the mid to longer term future. Furthermore there is limited systematic data available to properly assess the level of private-sector innovation inputs, including investments. Whereby some of these data access constrain is linked to concerns to protect intellectual property.

6.4 Summary of findings

Based on the SWOT analysis, it seems that SIDS DOCK is best positioned and even required to become a new international financing and technical assistance mechanism to bring about the critical need to have a dedicated entity or mechanism that specifically addresses the need to improve access to adequate financing and specialized assistance for the transfer of SIDS-appropriate sustainable energy technologies to SIDS.

[95] See tables 7 and 9

7. Activities and Programs needed to transfer SIDS-appropriate SE Technologies to SIDS

This chapter is dedicated to describing the several activities and/or programs required under the strategic plan for the effective transfer of SIDS-appropriate SETs to SIDS; these are detailed under point 4 of the strategy. The overall strategy is outlined as follows:

SIDS-appropriate SET Transfer Strategy:

1. Establish one or more common energy development goal(s) for the SIDS DOCK membership;
2. Establish clear quantifiable time-bounded targets and objectives for the SIDS DOCK membership;
3. Characterize (identify and assess) the likely technologies related and required to achieve the common energy goals (determine which RETs qualify as SIDS-appropriate SETs). Also determine the technology maturity and classify them upon their deployment potential (for direct deployment or that require adaptation or further development);
4. ***Determine most suitable activities or programs to address transfer of SIDS-appropriate SET needs;***
5. Establish the governance or institutional structure (e.g. SIDS DOCK as an International Financing and Technical Assistance Mechanism) and determine specific tasks, responsibilities and actions within the SIDS DOCK Secretariat; and
6. Prepare a detailed implementation plan that includes specific activities and programs, timelines and costs. In addition includes the likely set of stakeholders involved in promoting activities to achieve the set SIDS DOCK targets (International partner organizations).

1. Common energy development goals for the SIDS DOCK membership

A successful innovation strategy is based on:

(1) Having common and coherent macro-level policy goals and economic goals in place among the SIDS DOCK members that guarantees the sustained promotion or facilitation of multi-stakeholder engagement around an achievable, shared vision; and

(2) The second important element is that the strategy should enable a SIDS or region to appropriately position themselves to anticipate and benefit from commercially available mature SIDS-appropriate SE technologies and new upcoming SIDS-appropriate SE technologies under development.

There are multiple policy tools and instruments available to facilitate the Transfer of Technology to developing countries, but in the case of SIDS more specific attention is needed on the unique characteristics and conditions in SIDS as a sub-group within the international community. Furthermore it is important to realize that not all instruments are applicable to all stages of technology development and that *technology transfer* is itself a means to an end. As explained in Chapter 3, energy development is interrelated with low carbon economic growth, education, climate change mitigation, poverty alleviation, building competitiveness, and many other development concerns, to achieve sustainable development in SIDS. Based on the previous analysis of sustainable development needs in SIDS, the SIDS

DOCK membership recognizes that energy security, energy cost, and greenhouse gas emissions (climate change) are the principal impediments to the sustainable development of SIDS.

The following three principal common strategic goals are proposed:
Energy security is an ongoing issue for most SIDS DOCK members around the globe, whether due to geography, geo-politics, costs or all. Vulnerability to external energy shocks is impacting the SIDS economies and finding solutions to making SIDS economies more resilient to shocks is a goal that all SIDS could identify themselves with. In this case the most common focus area is reducing the dependence on imported fossil fuels.

High Energy costs in particular electricity rates in SIDS impede the capacity to sustain a healthy and competitive economy. Most SIDS face chronic exposure to high price energy sources and energy service prices since for more than 95% of these resources are imported. SIDS are geographically isolated or remote and also face other unique barriers as small market potential, high costs of materials and infrastructure, lack of human capital to address the energy sector needs.

Climate change mitigation and adaptation is an important element of SIDS overall development goals recognizing that climate change is one of the most critical factors impacting the ability of SIDS to achieve sustainable development. By allocating efforts and resources on the mitigation of greenhouse gas emissions, SIDS aim to showcase that although SIDS as a group is the smallest emitter of GHGs globally, SIDS remain the most vulnerable to climate change impacts. SIDS DOCK members are committed to transition to a low carbon economic development to have a demonstration role to the global community that sustainable development is achievable, even in under the challenging conditions in SIDS. The lowering of dependence on imported fossil fuels will generate savings to invest in adaptation needs to climate change.

By having these three long term strategic goals in place, it is clear to all SIDS DOCK members, all key stakeholders within each SIDS what SIDS DOCK is aiming for and that functions as the binding element among all stakeholders (from policy makers, academia, private sector people, common citizens, etc.) for the longer term horizon.

2. Quantifiable time-bound targets and objectives

In order to operationalize these goals, the SIDS DOCK has established the targets of (*1) increasing energy efficiency by 25 percent (2005 baseline) by 2033; (2) generating a minimum of 50 percent of electric power from renewable sources by 2033; and (3) achieving 25 percent decrease in conventional transportation fuel use by 2033.*

These quantifiable and time-bounded targets serve as good platform that can function as a guideline for the SIDS DOCK members to develop or modify existing national energy policies and establish a clear set of objectives for the next 20 years to justify national interventions, efforts, activities and regulations.

3. Identify and assess suitable sustainable energy technologies for SIDS

The introduction of *SIDS-appropriate sustainable energy technologies* captures energy technologies that are technically feasible, consistent with the concept of sustainable development and are tailored to the needs and conditions in SIDS.[96] The initial efforts are made through a qualitative assessment, using a newly developed SIDS-appropriate SET assessment method, to categorize and list commercial and pre-commercial energy supply and end-use technologies as SIDS-appropriate SETs for short, medium and long term deployment and transfer in SIDS. SIDS DOCK is recommended to use this assessment method as a starting point for identifying and assessing energy technologies through a quantitative process once primary data and statistics become available.

4. Suitable activities or programs to address *transfer of* SIDS-appropriate SET needs

The following activities are considered the most critical required activities and/or programs to achieve an effective transfer of SIDS-appropriate SET to SIDS DOCK members.

Component 1 – Baseline assessment

This component focuses on performing a comprehensive baseline assessment of the annual energy conditions in each respective SIDS DOCK Member State as per the year 2005 on forward. Activities during this phase will specifically focus on gathering primary or first-hand data and statistics from the respective entities, agencies and ministries in charge of collecting and monitoring data. The data will be properly processed in a database, the data interpreted, analyzed, verified and prepared for publication. A proper energy analysis will be executed to properly establish the reference conditions to enable SIDS DOCK to monitor the development, progress and effectiveness of activities by SIDS DOCK in achieving the set SIDS DOCK objectives.

Component 2 – SIDS-appropriate sustainable energy technology assessment

Following the baseline assessment SIDS DOCK will perform a comprehensive quantitative assessment of the renewable energy resources and energy technology assessment. An assessment will be performed to identify all commercially available energy technologies around the globe and assessed based on the criteria developed by ASDF/SIDS DOCK to identify SIDS-appropriate sustainable energy technologies. The pre-selected energy technologies will be categorized by their potential and ability to satisfy specific needs of SIDS DOCK Member States.

Component 3a – Deployment of commercial SIDS-appropriate sustainable energy technologies

A listing will be created of the technology developers and suppliers of the energy technologies that are categorized as SIDS-appropriate. This information will be processed in a database accessible to SIDS DOCK Membership at all times. SIDS DOCK Secretariat will engage with Member States in identifying specific prioritized and endorsed projects and rank them by order of technology needs resemblance, scale, potential output, and timeline. SIDS DOCK will dedicate efforts in establishing strategic partnerships in all the major SIDS regions to secure additional financial and technical support to deliver

[96] See for an elaborate explanation, Contreras, R., and de Cuba, K., SIDS-appropriate Sustainable Energy Technology Assessment, Aruba Sustainable Development Foundation, Draft of November 2012, available upon request.

results. The objective of this component of the Strategic Plan is to invest in low-hanging fruit opportunities to showcase short term results and build further momentum around the image and capacity of SIDS DOCK to deliver upon the set objectives. The results will be used as input to the SIDS DOCK public education and awareness program, and other instruments to showcase SIDS DOCK's performance to leverage and secure more financing.

Component 3b – Assessment of RD&D needs and potential in SIDS

In parallel to phase 3a, SIDS DOCK will perform a comprehensive assessment of the research, development, and deployment capacity in the SIDS around the globe and identify the potential and need for investing in creating or improving the capabilities to perform RD&D activities with specific focus on SIDS-appropriate energy technologies. Strategic partners will be identified for the creation or fortifying of R&D capacity and facilities in SIDS.

Component 4a – Expand the commercial deployment of SIDS-appropriate sustainable energy technologies

After the first generation of "low hanging fruit" projects, SIDS DOCK will dedicate additional efforts in establishing long term strategic partnerships in all the major SIDS regions and transition its focus on becoming the principle mechanism for SIDS to secure international financing for investment in SIDS-appropriate energy technologies to address specific SIDS energy needs. The strategic alliance with other entities will enable SIDS DOCK to reduce its involvement in specific technical assistance themes that can be better or more effectively covered by specialized technical partner agencies as e.g. IRENA, UN-agencies, and other specialized international and regional organizations. SIDS DOCK as the principle financing mechanisms by and for SIDS will dedicate significant efforts and resources on establishing the proper fiduciary standards and processes to increase its capacity to source, secure, manage and invest financing from donor countries and other financiers. The targeted focus on being the financing mechanism for investment in sustainable energy development in SIDS will allow SIDS DOCK to carve out its niche in the international development assistance community and bring significant added value to SIDS around the globe.

Component 4b – Creation, establishment and investment in R&D facilities in SIDS

This phase focuses on creating and/or furthering the R&D capabilities in SIDS. Financial and technical support will be provided for the design, construction and testing of prototypes that comply with the SIDS-appropriate energy technology criteria. The commercial potential of these prototypes will be assessed and support provided for the up-scaling and further testing of promising technologies. Support will be provided to strengthen research facilities (both in infrastructure and human capacity), and additional test facilities will be developed. SIDS DOCK will continuously promote the creation of public-private-partnerships (PPPs) to attract co-financing from the private sector and the involvement of technology developers and providers.

As an example, ocean energy technologies comprise a number of specialized technologies including wave, ocean thermal, tidal, current, among other. Each specific technology has its own set of challenges and issues that need to be addressed. For instance in the case of wave technology, the key issues highlighted in reviewed literature is that (1) wave technologies have to increase their survival rates in very hostile maritime environments, this means balancing the requirement of designing and building more robust structure/equipment vs. costs, (2) even though the energy forecasting for wave technologies is highly linked to the wind forecasting modeling there is need for further research, development and adaptation of standards and system designs, (3) wave energy is categorized as an intermittent energy source, meaning that some form of back-up or storage technology is required to guarantee 100% power supply. On the other hand tidal energy, due to the nature of its energy resource, is more predictable, consistent, and therefore reliable, reducing the need for energy storage options.[97]

The general technology transfer process involves many stages, including from basic research, applied research and development through incubation, demonstration, (niche) market creation, and ultimately the widespread commercial scale up, diffusion and deployment. The interaction and feedback between these stages is essential for making innovation breakthroughs and requires a long-term financial commitment and wide-scale involvement of different actors and stakeholders.

Component 5 – Monitoring, evaluation and increased deployment of commercial SIDS-appropriate SETs

The results of SIDS DOCK efforts and evolution of R&D of energy technologies is a dynamic process where SIDS DOCK will have to continuously monitor and evaluate the progress made regarding the SIDS DOCK targets, in addition determine the stage of development of energy technologies and assess which ones are in testing/demonstration phase, pre-commercial, or commercially applicable and suitable to SIDS.

In collaboration with strategic partners, SIDS DOCK will allocate significant efforts on assisting the SIDS DOCK members in establishing clear EE, RE and fuel transition policies and action plans to outline how each respective SIDS aims to achieve the set SIDS DOCK targets. Also significant resources will be allocated to developing guidelines, data processing tools, and primary data gathering capacity in each respective SIDS DOCK member in order to properly measure in-country progress made towards achieving the SIDS DOCK targets.

The learning curve of energy technologies is among other determined by the cumulative successful application and commercial deployment and the continuous investment in improving the energy yield that leads to reduction of capital investment costs. SIDS DOCK will invest in its in-house capacity to properly assess, evaluate, make adjustments, promote and invest in promising pre-commercial SIDS-appropriate energy technologies for making them deployable and available in SIDS in the mid- to long term period. In addition SIDS DOCK will invest in measures to guarantee the continued growth in the deployment of SIDS-appropriate sustainable energy technologies.

[97] Ocean Energy in Ireland, An Ocean Strategy for Ireland submitted to the Department of Communications, Marine and Natural Resources, October 2005, see: http://www.marine.ie/NR/rdonlyres/86491414-3E7E-48E5-A0E1-287CA9191C61/0/OceanEnergyStrategy.pdf (visited October, 2012)

In summary, it is recommended to consider SIDS DOCK principally as a financing mechanism with additional or complementary technical assistance capacity or features to support this central mission, and in particular focus on two key issues, (1) allocate resources to deploying commercially viable, but SIDS-appropriate sustainable energy technologies to satisfy the current energy needs, and (2) allocate resources and efforts on building the research, development and deployment capacity and infrastructure in SIDS to further develop future or new energy technologies that are suitable to SIDS to address the future energy needs of island communities.

5. Establishment of the governance or institutional structure of SIDS DOCK Secretariat[98]

A possible configuration of SIDS DOCK as a *SIDS international financing and technical assistance mechanism* is proposed in this section.

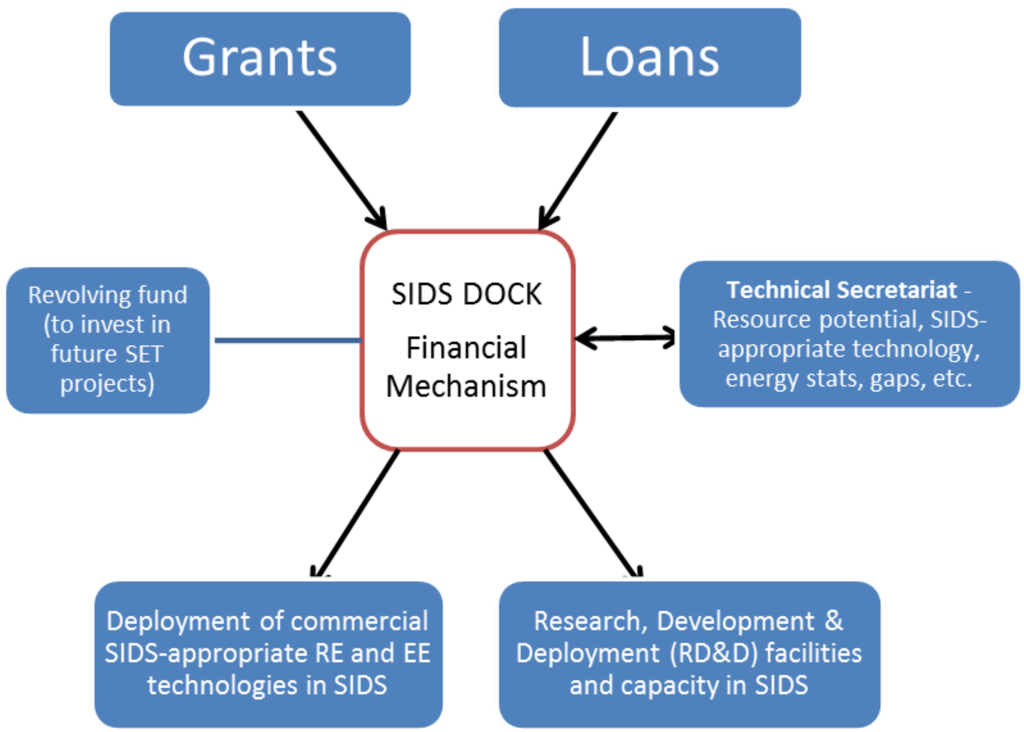

Figure 7 Suggested SIDS DOCK institutional configuration as financing mechanism

The suggested business model of SIDS DOCK is to register SIDS DOCK as an international energy services company that may be able receive donor funding from the public and private sector in the form as grants, donations, or upon delivered services, while having simultaneously an advisory role to investors or large financing institutions aiming to invest or provide loans for specific lower-hanging fruit projects (more profitable projects) but that need to recognize the requirement to be more flexible regarding their return-on-investment and willing to abide the conditions determined by SIDS DOCK, since the conditions will not be as favorable as elsewhere in the global market. Here is where a SIDS DOCK public

[98] This suggested organizational configuration and business model, serves only as food for thought and requires a proper assessment by a multifaceted team of financing, legal, policy, and technical experts.

outreach and awareness program for the general public and potential investors is critical to explain the rationale and the unique investment conditions for doing business in SIDS.

To make an investment decision, SIDS DOCK will use the investment intelligence provided by the *SIDS DOCK Technical Secretariat.* With other words the *SIDS DOCK Technical Secretariat* will in partnership with international technical agencies, create a data base of projects of priority to SIDS; gather available resource assessments done and make these publically available; monitor, analyze and publish energy statics per SIDS; identify the SIDS with similar needs and potential for applications of similar technologies (to assess bundling potential); the legislative framework applicable in the individual SIDS; provide updates regarding current and pre-commercial SIDS-appropriate sustainable energy technologies; provide updates and contacts to technology providers; and all that is required to have the proper project investment intelligence in place.

Revenue is generated by (1) collecting a fraction of the savings generated by off-setting the imported fossil fuels to generate power in SIDS by investing and deploying commercial SIDS-appropriate sustainable energy technologies, and (2) by investing in RD&D activities to allow or support SIDS to develop, patent, and sell new SIDS-appropriate energy technology patents, and target the global market of island communities and coastal zones to sell and deploy the technologies.

This financing and technical assistance mechanism enables SIDS DOCK to optimize its potential and capacity to allocate resources and efforts on two critical instruments that may facilitate the accelerated deployment of SIDS-appropriate sustainable energy technologies in SIDS and other island communities around the globe while carving its niche within the international development assistance community and bring added value.

Institutional organogram of the SIDS DOCK Technical Secretariat[99]

The SIDS DOCK Technical Secretariat (SDTS) will have the principle role of providing investment intelligence to potential investors, project developers and other clients to SIDS DOCK. This service includes providing updated data and information regarding resource assessments, energy statistics and the energy sectors conditions in a SIDS of interest, be the one-stop-shop for updates regarding the existing regulatory regime, the permitting process, and other issues to allow a developer or investor gain the necessary data and info to perform a proper assessment of the investment potential in one or more SIDS of interest.

[99] This suggested institutional configuration of the SIDS DOCK Technical Secretariat serves only as food for thought and requires a proper assessment by a multifaceted team of financing, legal, policy, and technical experts.

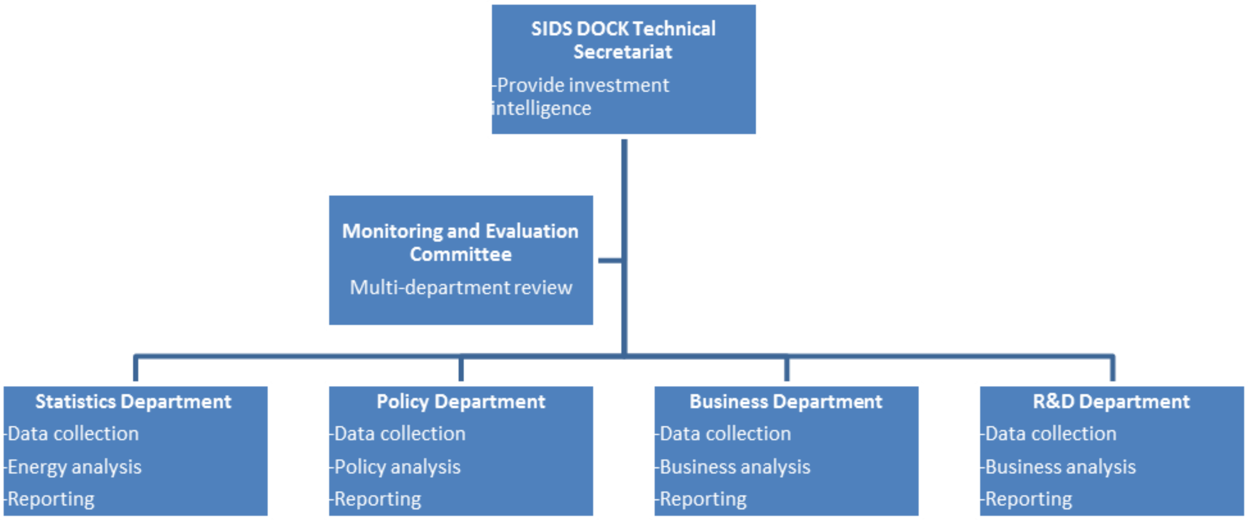

Figure 8 Suggested institutional configuration of the SIDS DOCK Technical Secretariat

The Statistics Department has a very critical function as to collect, analyze, verify and publish energy statistics of the SIDS DOCK Membership. All data collected is at the outset linked to the goals of SIDS DOCK of increasing renewable energy supply; increase the rational and efficient use of energy; and offsetting the use of imported fossil fuels for transportation. The continuous update and buildup of a statistical data base enables the SIDS DOCK Secretariat to keep track of the progress made due to SIDS DOCK interventions in partnership with its membership on achieving the set SIDS DOCK goals. Furthermore the gathering of data regarding the energy sector (power generation and use, and transportation) performance per SIDS member enables the country to assess its national performance and allow SIDS DOCK Secretariat to benchmark the SIDS regarding the rate of deployment and use of SIDS-appropriate sustainable energy technologies and achieving SIDS DOCK goals.

The Policy Department is responsible for tracking the energy policy development in the SIDS DOCK Membership. The gathered information regarding existing policies and details about the regulatory regime serve to provide potential investors/donors an initial overview of investment opportunities and challenges. The Department will perform policy analysis, assist and enable SIDS members to develop specific national EE, RE and fuel transition policies and access information regarding the performance or effectiveness of their implemented energy policies.

The Business Department is in charge of collecting and analyzing data from the SIDS DOCK Membership regarding the investment climate and continuously (annually) rates the SIDS members based on annual performance (e.g. creation and registration of new sustainable energy related businesses) and monitors the level of investments made in SIDS-appropriate energy technologies in member states. Furthermore the Department is in charge of identifying, evaluating, and maintaining a directory of technology providers, vendors, manufacturers, brokers, and other service providers that have passed a due diligence process and are shortlisted to provide services to SIDS DOCK members.

The Research & Development Department is in charge of identifying, assessing and categorizing energy technologies as SIDS-appropriate technologies and monitors the evolution of non-commercial energy technologies that may be suitable for SIDS in the future. The Department collaborates directly with the establish RD&D facilities/laboratories in SIDS Members for the development of SIDS-appropriate energy technologies and gathers latest updates and intelligence to share with the SIDS DOCK Technical Secretariat regarding the status of SIDS-appropriate sustainable energy technologies.

The Monitoring and Evaluation Committee is a multi-departmental committee with the purpose of reviewing the overall progress of SIDS DOCK Members in achieving set national and SIDS DOCK goals to increase the deployment of SIDS-appropriate sustainable energy technologies for renewable energy supply; increase the rational and efficient use of energy; and offset the use of imported fossil fuels for transport. This commission has an advisory role to the SIDS DOCK Secretariat by providing annual performance reports and recommendations regarding activities and responsibilities of the Technical Secretariat and its Departments.

6. Detailed Strategic Implementation Plan

Table 21 summarizes the set of activities and programs to be developed under the different strategic components explained under point 4 of the strategy. This set of activities and programs are considered the key elements of the strategic implementation plan to achieve the set SIDS DOCK targets by 2033.

Table 21 Detailed Strategic Implementation Plan

Program category	Activity Description	Time frame	Cost (US$)	Notes
1 Baseline assessment				
Technology assessment	Gather and verify annual energy sector performance data from 2005 on forward in each respective SDMS	2013 - 2014	3,000 – 4,500k	Estimated at 100-150k per SDMS. This will enable SD to assess the energy sector conditions in each resp. SDMS to id energy needs and assess suitability of RETs.
	Perform energy analysis and present annual energy sector performance data from 2005 on forward in each respective SDMS			This enables SD to establish and verify the 2005 reference conditions to assess future progress regarding SD's EE, RE, and fuel transition targets by 2033
Creating strategic/collaborative partnerships	Perform SIDS national and regional stakeholder analyses	2013 - 2014	450 – 750k	Estimated at 15-25k per mission/multi-stakeholder meeting in each respective SDMS. This enables SD to establish strategic partnerships in all the SDMS and major SIDS regions to assist SD in gathering data and prepare detailed energy analyses per SDMS. Critical partners include IRENA, and UN-agencies/IO/RO operating in each respective SIDS major regions.
			3,450 – 8,700k	
2 SIDS-appropriate sustainable energy technology assessment				
Technology assessment	Verify existing RES assessment studies	2013 - 2014	2,000 – 5,000k	Estimated at 200 – 500k per (quantitative) RES due diligence assessment up to a total of 10 RET projects, depending on RET proposed. By performing due diligence, existing RES assessment studies can be used to prepare bankable RET projects on short-term
	Perform detailed and quantitative RES assessments in SIDS (where needed)	2013 - 2014	2,500 – 7,500k	Estimated at 500 – 1,500k per (quantitative) RES assessment, of up to 5 RET projects, depending on RET proposed. Some RETs require more intensive and higher level of RES potential details to allow for ID SIDS-appropriate SETs and securing investment.
	Perform quantitative energy technology assessment	2013 - 2014	500 – 1,000k	Estimated at 25-50k per RET, using case-studies of implemented RET projects in SIDS, including site-visits and processing first-hand data, up to 20 RETs. This enables SD to ID and categorize SIDS-appropriate SETs upon deployment potential

Program category	Activity Description	Time frame	Cost (US$)	Notes
Institutional capacity building	ID or establish a dedicated public national agency for coordinating national energy development efforts	2013 - 2033	100 – 200k (2013) + 1,000k (until 2033)	Estimated at 100 – 200k for the establishment of a virtual platform, data base, outreach material, procedures, and 50k annually for maintenance to facilitate exchange and interaction between SD and SDMS regarding national performance and activities to achieve SD targets
			6,100 – 14,700k	
3a Deployment of commercial SIDS-appropriate sustainable energy technologies				
Technology assessment	Perform review of low-hanging fruit SIDS-appropriate SET projects in SDMS	2014	100 – 150k	Estimated at 10 – 15k per fact finding mission (up to 10 SIDS RET projects) to ID specific prioritized and endorsed projects and rank them by order of technology needs resemblance, scale, potential output, applicability of SIDS-appropriate SETs, timeline, and investment needs
Institutional capacity building	Develop a SIDS-appropriate technology developers and suppliers data base accessible to all SDMS	2013 - 2033	50 – 100 k (2013) + 1,000k (until 2033)	Estimated at 50 – 100k to establish a database accessible to SDMS with a continuously updated (50k annually) short-listing of pre-qualified and attested technology providers and developers to enable SDMS to streamline activities
Creating strategic/collaborative partnerships	Perform SIDS national and regional stakeholder analyses	2013 - 2015	400 – 600k	Estimated at 50 – 75k per regional stakeholder meetings per major SIDS region, up to 2 events in each of the 4 major regions. This enables SD to establish strategic partnerships in all the major SIDS regions to secure additional financial and technical support to deliver short-term deployment results
Human capacity building	Develop public education and awareness program(s)	2014 - 2015	3,000 – 4,500k (by 2015) + 30,000k (until 2033)	Estimated at 100 - 150k per SDMS for the establishment of a SIDS DOCK-wide public education and awareness program. And about 50k annually per SDMS to provide support to national developed and endorsed education and awareness programs. By incorporating early success projects and their results in public awareness programs public support can be leveraged to facilitate securing further financing for future activities
			34,550 – 36,350k	

Program category	Activity Description	Time frame	Cost (US$)	Notes
3b Assessment of RD&D needs and potential in SIDS				
Technology assessment	Perform a comprehensive assessment of the research, development, and deployment capacity in the SIDS	2014 - 2015	750 – 1,500k	Estimated at 25 – 50k per SDMS for literature assessments, field visits, attending/participate at regional/international R&D related events, to enable SD to determine most suitable SIDS to function as incubators for R&D activities to develop SIDS-appropriate SETs
Financing mechanism	Assess the R&D capacity and infrastructure in SIDS	2015 - 2016	300 – 600k	Estimated at 50 – 100k per technical assessment mission in up to 6 pre-selected SDMS with potential to serve as incubator/host for R&D facility. This enables SD to ID the potential and need for investing in creating or improving the capabilities in selected SIDS to perform RD&D activities with specific focus on SIDS-appropriate energy technologies
Creating strategic/collaborative partnerships	Perform SIDS-wide R&D capacity and stakeholder assessment	2015 - 2016	200 – 300k	Estimated at 50 – 75k per regional R&D capacity building workshop in each of the 4 major SIDS regions. This enables SD to ID strategic partners to invest in the creation or fortifying of R&D capacity and facilities in SIDS with specific focus on SIDS-appropriate energy technologies
			1,250 – 2,400k	
4a Expand the commercial deployment of SIDS-appropriate sustainable energy technologies				
Financing mechanism	Perform review of existing mechanisms, develop and implement suitable financing mechanism(s) for transfer of SIDS-appropriate SETs to SIDS	2013 - 2014	2,000 – 3,000k	Estimated at 100 - 150k per SDMS to enable SD to dedicate significant efforts and resources on establishing the proper fiduciary standards and processes to increase its capacity to source, secure, manage and invest financing from donor countries and other financiers
Creating strategic/collaborative partnerships	Establishing long term strategic partnerships in all the major SIDS regions	2013 - 2016	240 – 320k	Estimated at 15 – 20k per strategic visits/meetings with key partners (up to 4 meetings annually). This enables SD to establish formal partnerships and allow SD to transition towards becoming the principle mechanism for SIDS to secure international financing for investment and coordinated support in the transfer of SIDS-appropriate energy technologies

Program category	Activity Description	Time frame	Cost (US$)	Notes
			2,240 – 3,320k	
4b Creation, establishment and investment in R&D facilities in SIDS				
Financing mechanism(s)	Develop business plans for creating and/or furthering the R&D capabilities and facilities in SIDS	2015	300 – 600k	Estimated at 50 – 100k per SDMS pre-selected as R&D host/incubator (up to 6). To provide financial and technical support for the design and construction of laboratories/testing facilities to develop pre-commercial SET that comply with the SIDS-appropriate energy technology criteria
Institutional capacity building	Develop MSc/PhD programs in required fields of specializations or facilitate access to existing programs by SIDS citizens	2015 - 2033	120,000 – 180,000k	Estimated at 2x students per SDMS per year at 100 – 150k per student to attend MSc/PhD programs. This is minimally required to build up a critical human capacity mass to manage and perform research in R&D facilities in SIDS
Creating strategic/collaborative partnerships	Promote the creation of public-private-partnerships (PPPs)	2015 - 2021	800 – 1,000k	Estimated at 200 - 250k per technology fair or global conferences for/related to SIDS-appropriate SET (every 2 years up to 4 global events in each major SIDS region). To attract co-financing from the private sector and the involvement of technology developers and providers in SIDS R&D facilities
	Establish university and research agency partnerships	2014 - 2016	200 – 300k	Estimated at 50 -75k per regional event regarding university/research partnership build up. To attract and develop human capacity in R&D activities in SIDS-appropriate SETs
			121,300 – 181,900k	
5 Monitoring, evaluation and increased deployment of commercial SIDS-appropriate SETs				
Policy harmonization	Assist SDMS in establishing clear EE, RE and fuel transition policies and action plans	2013 - 2016	3,000 – 4,500k	Estimated at 100 – 150k per SDMS. To outline how each respective SIDS aims to achieve the set SIDS DOCK targets by 2033
Institutional capacity building	Develop a SIDS energy data base and present annual energy outlooks	2014 - 2033	100 – 150k (by 2014) + 2,000 – 3,000k (until 2033)	Estimated at 100 – 150k for the establishment of a data base, and 100 – 150k annually for update and maintenance of data base and release of annual energy outlooks. This enables SD to present the annual collective performance of the SDMS

Program category	Activity Description	Time frame	Cost (US$)	Notes
	Develop guidelines and tools to gather energy data	2013 - 2014	100 - 200k	Estimated at 100 – 200k for the development of data gathering guidelines and the data processing tools. This allows for the systematic sampling, collection and processing of primary energy data in each respective SDMS
Human capacity building	Provide training to staff of respective entities, agencies and ministries in charge of collecting and monitoring data	2014 - 2017	1,500 – 2,250k	Estimated at 50 – 75k per training in each SDMS. The proper training regarding data gathering guidelines and management of data processing tools enables SDMS to proper manage and monitor energy sector performance
			6,700 – 10,100k	
Total Cost Strategic Plan		**2013 - 2033**	**175,590 – 257,470k**	

Summary of findings

Based on a very superficial and initial estimation of costs for the implementation of the strategic implementation plan, a cost range of US$175.6 – 257.5 million is estimated to be required for the transfer of SIDS-appropriate SET to SIDS DOCK member states. This is based from the perspective of identified critical activities and programs. This is an initial effort to identify the potential resources required to enable SIDS DOCK to facilitate and assist its membership to achieve the set SIDS DOCK targets of (*1) increasing energy efficiency by 25 percent (2005 baseline) by 2033; (2) generating a minimum of 50 percent of electric power from renewable sources by 2033; and (3) achieving 25 percent decrease in conventional transportation fuel use by 2033.*

8. General conclusions and recommendations

- As is repeatedly highlighted in this report, access to adequate financing is considered the most critical barrier to the wide-scale deployment and use of sustainable energy technologies in SIDS.

- There is a need to clarify the difference between *Technology Deployment* and *Technology Transfer*. This clarification helps senior policy makers to better use these two different concepts and avoid misinterpretations. ***Technology deployment*** is defined as the installation, set-up, testing and running of a technology.[100] While ***technology transfer*** as defined earlier, entails a *set of processes covering the flows of know-how, experience, and equipment amongst different stakeholders such as governments, private sector entities, financial institutions, non-governmental organizations (NGOs), and research/education institution*'.[101]

- In order to be able rationalize and structure a proper strategy to identify, assess, deploy, and transfer SIDS-appropriate sustainable energy technologies to the SIDS DOCK member states, several specific elements to be incorporated in the strategy are elaborated in detail and explained, definitions used are clarified, and specific activities are recommended for the effective deployment and transfer of SIDS-appropriate SETs. Please see chapter 7 for details.

- As any other financing and technical assistance mechanism a proper business model is required to clearly specify how this mechanism will raise or secure funding and how this funding is used or allocated to facilitate the effective transfer of SIDS-appropriate sustainable energy technologies to SIDS. For the global SIDS community a critical issue is using the limited resources wisely and effectively, this includes among other (1) the identification, assessment, selection and prioritization of SIDS-appropriate sustainable energy technologies and (2) investing in these technologies to facilitate their deployment and use, (3) invest in the RD&D capacity to further develop suitable energy technologies for SIDS.

- Although beyond the scope of this study, the authors of this report shared some ideas as food for thought, regarding the possible institutional configuration of the SIDS DOCK Secretariat to enhance its capacity to provide targeted assistance to assist its membership in achieving the set SIDS DOCK targets by 2033.

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[100] PC Mag, Encyclopedia of IT terms, http://www.pcmag.com/encyclopedia_term/0,1237,t=deployment&i=41136,00.asp (visited November 2012)

[101] Ibid.

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Annex I

Please find here the Terms of Reference as background for the preparation of this SIDS-appropriate sustainable energy technology assessment report.

Terms of References

SIDS DOCK Support Programme - Development and Implementation of the SIDS DOCK Platform Building Component – Activity 2.1 (c) and (e): Development of a Strategic Plan to Identify, Assess and Transfer Technologies that are SIDS-Appropriate

1.0 Introduction

SIDS DOCK is a SIDS–SIDS institutional mechanism established to facilitate the development of a sustainable energy economy within the small island developing states. Transforming the energy sector away from petroleum dependency is the pathway for SIDS to generate the significant levels of financial resources that will be needed for adaptation to the impacts of climate change. It is estimated that SIDS consume in excess of 220 million barrels of fuels, annually, and emit some 38 million tons of carbon. The ultimate goal of SIDS DOCK is to increase energy efficiency by 25 percent (2005 baseline) and to generate a minimum of 50 percent of electric power from renewable sources and a 20-30 percent decrease in conventional transportation fuel use by 2033.

Some SIDS governments have announced more ambitious goals for the reduction of fossil fuel use in order to reduce greenhouse gas (GHG) emissions. An energy sector focused on promoting sustainable development rather than just providing energy to meet economic needs is essential to the SIDS addressing critical long-term development challenges, particularly in the areas of global climate change, food security, waste management and fresh water resources. SIDS DOCK provides a model mechanism with the objective of transforming the current fossil fueled-based economy to a low carbon economy in SIDS, with the ultimate goal of improved livelihoods through access to affordable energy services. By providing SIDS with a dedicated and flexible mechanism to pursue sustainable energy, SIDS DOCK will make it easier for SIDS Development Partners to invest across multiple island States, and to more frequently reach investment scale that can be of interest to commercial global financing.

SIDS DOCK will serve as a “DOCKing station” to increase SIDS access to international financing, technical expertise and technology, as well as a link to the multi-billion dollar European and United States carbon markets – within which the potential value of trading avoided GHG emissions is estimated to be between USD 100-400 billion, annually. The funds generated will help countries develop and implement long-term adaptation measures. SIDS DOCK has four principal functions:

1. Assist SIDS transition to a sustainable energy sector, by increasing energy efficiency and development of renewable energy;
2. Providing a vehicle for mobilizing financial and technical resources to catalyze clean economic growth;
3. Provide SIDS with a mechanism for connecting with the global carbon market and taking advantage of the resource transfer possibilities that will be afforded, and;
4. A mechanism to help SIDS generate the financial resources to invest in climate change adaptation.

In December 2010, in Cancun, Mexico, SIDS DOCK was launched with four Partners: the Alliance of Small Island States (AOSIS), the United Nations Development Programme (UNDP), the World Bank, and the Government of Denmark, which announced a grant of USD14.5 million in start-up contributions for the *SIDS DOCK Support Programme*. Over the period July 2011 to September 2011, the SIDS DOCK Organizational structure was finalized in a series of meetings between the Partners. On December 8, 2011, the SIDS DOCK Steering Committee designated Belize as the Host Country for the SIDS DOCK Secretariat. On 13 February 2012, the SIDS DOCK Steering Committee held its first meeting for 2012. The committee approved a number of decisions relevant to the timely implementation of the SIDS DOCK Support Program, and in particular the SIDS DOCK Program Platform Building Component. Key decisions include the formal recording of Belize as Host Country of the SIDS DOCK, and agreement for the registration of the SIDS DOCK as an international organization in keeping with *Article VII of the SIDS DOCK Memorandum of Agreement (MoA),* which, as of July 2012, has been signed by 30 SIDS Governments. Under the SIDS DOCK Support Program supported by the Government of Denmark, the Caribbean Community Climate Change Centre is responsible for developing the SIDS DOCK Platform in 2012, and includes *Supporting Technical Assistance Services SIDS DOCK* and *Institutional Design and Strengthening*. These items are listed as Activities 2.1-2.6 in the Program proposal. This Terms of Reference (ToR) is for preparation of *Activity 2.1 – Country energy planning capacities strengthened, focus on policy-makers*, *(e) Development of* a *Strategic Plan to Identify, Assess and Transfer Technologies that are SIDS-Appropriate*. SIDS DOCK is focused on developing deep expertise around specific types of low-carbon energy projects that can be deployed across states, but at the same time allow close cooperation and relationship building with government officials and private sector participants in individual countries. One initial focus is on SIDS-Appropriate Technologies where more research and/or demonstration, survey work and trials are needed before commercial-scale SIDS projects can be initiated. These include OTEC, lingo-cellulosic biofuels, geothermal, and energy storage. SIDS DOCK would seek to forge alliances with major research institutions, non-profits, and private sector entities to facilitate SIDS-specific research and in-situ technology trials.

Two key characteristics of the energy technologies to provide services to a low carbon economy are for the production of base load and peak electric power from sources other than petroleum, and for its efficient use in the production of goods and services. While PV and wind energy technologies are making and will make significant contribution, these generation of current technology does not provide competitive base load power which is critical for sustainable economic growth. The renewable energy resources that have potential to directly provide base load and/or peak power are hydro, geothermal, biomass and ocean thermal energy. Of these sources, only geothermal, hydro, and ocean thermal has this capability – of these sources only ocean thermal is applicable to the vast majority of SIDS. Ocean thermal also addresses other critical inputs into a sustainable low carbon economy such as increasing freshwater availability and improving food security.

SIDS need to undertake an assessment of potential sustainable SIDS-appropriate energy technologies based on prioritized needs and the renewable resources and then collectively negotiate for their timely development/deployment as the situation demands. There is need for a plan to identify, assess and transfer technologies that are SIDS-appropriate. SIDS needs to put in place capacity to undertake assessment of these SIDS-appropriate technologies and prioritize their needs and then collectively negotiate for their timely development/deployment as the situation demands. In this regard, the CCCCC is seeking a qualified and highly motivated individual or professional agency to develop the *Strategic Plan to Identify, Assess and Transfer Technologies that are SIDS-Appropriate*.

2.0 Scope of Work

The scope of work under this ToR covers Activities 2.1 (c) and (e) under the SIDS DOCK Support Programme, and will be implemented by the Consultant, supervised by the CCCCC on behalf of the SIDS DOCK Secretariat.

3.0 Deliverables

(a) SIDS-appropriate Renewable Energy Technology Assessment Report
(b) Draft Strategic Plan
(c) Strategic and Implementation Plan

Please find here the **Draft Outline for Concept Paper** that was shared as suggested concept paper outline.

1.1 Draft Outline for Concept Paper

Strategy for the Identification, Assessment, Development and Deployment of SIDS Appropriate Technologies with Potential to Assist SIDS DOCK Member States Transition to Low Carbon Economies by 2033

1.0 Introduction

The purpose of the strategy
1.1 Background Information
- SIDS DOCK and its Purpose – goals: 25-50-25 by 2033
- Energy and Climate Change and Adaptation –the importance of technology transfer in building a low carbon economy

1.2 Overview - State of Sustainable Development in SIDS
1.2.1 Socio-economic Status in SIDS – debt, unemployment, crime and violence, HIV AIDS, off track to achieve MDGs
1.2.2 State of the SIDS Environment – beach erosion, land degradation, coral bleaching, biodiversity threats, fisheries stressed, marine resources diminishing, other CC impacts
1.2.3 Sustainable Energy Situation in SIDS – access, affordability, policies, fossil fuel shocks, institutional capacity

2.0 Need for SIDS-Appropriate Technologies

2.1 State of the Energy Technological Environment in SIDS

2.2 The Technological Needs Necessary to Promote a Low Carbon Energy Sector in SIDS
2.2.1 Power Generation
2.2.2 Energy Service Provision
2.2.3 Institutional Capacity
2.2.4 Financing of priority technological needs

3.0 Objectives of the Strategy

3.1 To identify, assess and compile a list of energy technologies that are SIDS appropriate, technically feasible, consistent with SIDS development objectives, cost-effective, environmentally sustainable, culturally compatible and socially acceptable;

3.2 To create a database and directory of the technologies and the technology vendors, manufacturers, brokers, institutions, academia, civil society organizations, etc.;

3.3 To develop an implementation plan for the transfer, development and deployment of SIDS-appropriate technology;

3.4 To develop a strategy for a collective SIDS-wide policy approach with regards to aggregate purchasing to get better prices, collective approaches to technology developers, collective approaches to seeking investment financing, and in research, development, and demonstration.

3.5 To develop a monitoring and evaluation programme of SIDS-appropriate technologies to continually monitor and evaluate these technologies, allow for adjustments, course corrections, and further innovation and feedback;

3.6 To develop SIDS DOCK Secretariat capacity to coordinate and facilitate the achievement of a low carbon economy in SIDS by 2033.

3.7 To develop a SIDS-wide public education and awareness programme to sensitize and get buy-in from the public about the benefits of SIDS-appropriate energy technologies in a low carbon economy, and to encourage renewable energy use and support for energy efficiency efforts in pursuit of sustainable energy for all and improved livelihoods.

4.0 Methodology

Methodology to achieve outputs mentioned in 3.0 – literature reviews, elite and other interviews with key energy vendors and manufacturers, stakeholder consultations, surveys, site visits, assessment of the needs and priorities of the SIDS DOCK members for meeting energy for sustainable development objectives, assessment of SIDS DOCK member countries renewable energy potential

5.0 Overview of Energy Technologies

5.1 Technical, economic, and social aspects of energy technologies
5.2 Current Systems of Technology Development and Transfer
5.3 Sources of Sustainable Energy Technologies
5.3.1 Renewable Energy
5.3.2 Solar
5.3.3 Wind
5.3.4 Hydro

5.3.5 Geothermal
5.3.6 Biomass
5.3.7 Ocean
5.4 Energy Efficiency and Conservation
5.5 Transportation
5.6 Household

6.0 The Characteristics of Energy Technologies in SIDS
6.1 Power Generation
6.0.1 Thermal
6.0.2 Renewables
6.0.3 Waste to energy
6.1 Provision of Energy Services
6.1.1 Transportation
6.1.1.1 Marine
6.1.1.2 Commercial
6.1.1.3 Passenger Vehicle
6.1.1.4 Aviation
6.1.2 Lighting
6.1.3 Cooling
6.1.4 Refrigeration
6.1.5 Shaft Power

7.0 Recommended Activities and Programmes

8.0 Proposed Timeline and Milestones