SIDSDOCK SMALL ISLAND DEVELOPING STATES
ISLAND ENERGY FOR ISLAND LIFE

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SIDS DOCK WORK PROGRAMME

DRAFT CONCEPT NOTE
SIDS DOCK HEADS OF STATE & GOVERNMENT OTEC INITIATIVE 2023: BRING DOMINIQUE HOME

1. INTRODUCTION

Heads of State and Government that are members of the SIDS DOCK Organization and the Alliance of Small Island States (AOSIS), mandated the SIDS DOCK Secretariat to achieve, in the shortest timeframe, the commercial-scale deployment of ocean-based energy technologies that are appropriate to the demands in Small Island Developing States (SIDS) for the development of a low carbon economy, with emphasis on generating sustainable blue-green gender-equity employment to replace those that will be lost due to the negative impacts of climate change. The rate of deployment has been significantly slower than anticipated by some investors and policymakers.

To meet this goal, financial resources in the amount of USD 300,000 is being sought to complete the development and implementation of: *The 2023 Strategy for the Commercial-scale Deployment of Ocean-based SIDS-Appropriate Energy Technologies.* The 2023 OTEC Strategy is also in support of achieving the SIDS DOCK Goal of *25-50-25 by 2033: Island Energy for Island Life*; the Sustainable Development Goals (SDGs), and in particular, *SDG 14 - Conserve and sustainably use the oceans, seas and marine resources for sustainable development*, as well as the commitments under the United Nations Framework Convention on Climate Change (UNFCCC) Paris Agreement, which cites, "Increasing the ability to adapt to the adverse impacts of climate change and foster climate resilience…" as a priority for strengthening the global response to the threat of climate change.

Small Island Developing States (SIDS) are blessed with an abundance of renewable energy resources and recognise that a diverse range of renewable power systems, including ocean, hydro, wind and solar, can provide a reliable, flexible infrastructure that more than meets our needs. **An Ocean Thermal Energy Conversion (OTEC) plant produces electricity all the time and that we can rely on**. That's baseload power, provided by reliable sources such as an OTEC power plant. Baseload stations supply electricity around the clock - electricity cannot be stored, and must therefore be used as it is generated. The ocean is SIDS largest renewable resource and SIDS play major roles as custodies of the oceans and seas. While relatively small in landmass, SIDS govern over and serve as the "Blue Guardians" of their Exclusive Economic Zones (EEZs), vast ocean territories extending up to 200 nautical miles from their coastlines. As such, oceans and coasts play a disproportionately large role in the lives and livelihoods of island populations. Together, the SIDS have rights to govern ocean areas more than 15 times the size of the European Union land mass and represents their largest natural resource endowment.

Figure 1: THE BEAUTIFUL POTENTIAL OF "DOMINIQUE": A magnificent 100 KW Ocean Thermal Energy Conversion Pilot Plant located on Kumejima Island, Japan

An OTEC plant produces electricity all the time and that we can rely on. That's baseload power, provided by reliable sources such as an OTEC power plant.

The 100 Kw Pilot Plant in Kumejima, Japan, a converted former cold water, fisheries research facility, provides validation of OTEC's potential on a small island with limited land-based natural resources. The cold water from the plant now supports an industrial estate employing more than 200 people on 20 hectares of land. OTEC is an "innovative" technology in which the Japanese is a leader. OTEC harnesses the temperature difference between the solar heated surface water and the colder bottom water of the tropical oceans to generate sustainable electric power. In addition to providing sustainable electric power, OTEC also produces two valuable by-products: (a) large quantities of cold, nutrient-rich water that can be used for aquaculture, and (b) significant volumes of potable water. Additionally, the cold waste nutrient rich water leaving the plant is used for mari-culture (shrimp, scallops and other high value seafood), vegetable production as well as cosmetics, important industries that have significant potential for high female employment.

Eight (8) countries are developing a work programme for OTEC: Japan, China, Korea, India, France, The Netherlands, Singapore and Monaco. Fourteen (14) SIDS have been waiting on next steps in the execution of pre-feasibility studies conducted by the Japanese SIDS DOCK partners: Antigua & Barbuda, Barbados, Bahamas (Commonwealth of the), Belize, Dominican Republic, Grenada, Fiji, Jamaica, Maldives (Republic of), Marshall Islands (Republic of), Mauritius, Samoa (Independent State of), the Seychelles (Republic of), and St. Lucia.

The Science of OTEC has-been ongoing since the 1880s, and a first proof of concept plant was built in Cuba, in the 1930s, operated until it was disabled due to failure of the cold water pipe during a hurricane. Ocean energy resources comes in kinetic and thermal; wave tidal and currents are all kinetic. Each kind of kinetic or thermal resource has unique site requirements, characteristics, and challenges. Some forms are available for periods of time during the day, while others are continuously available. Ocean thermal energy, which is based on converting incoming solar radiation into electricity, is continuously available in almost all ocean locations between the tropics, and therefore represents an unlimited source of baseload electricity for the blue-green economy. Since the United Nations Second International Meeting on Small Island Developing States, in Mauritius in 2005, SIDS institutions have worked with Japanese colleagues and developed pre-feasibility study papers for 14 SIDS. This provides a significant body of information to work on the preparation of the request for funding to prepare the strategy document.

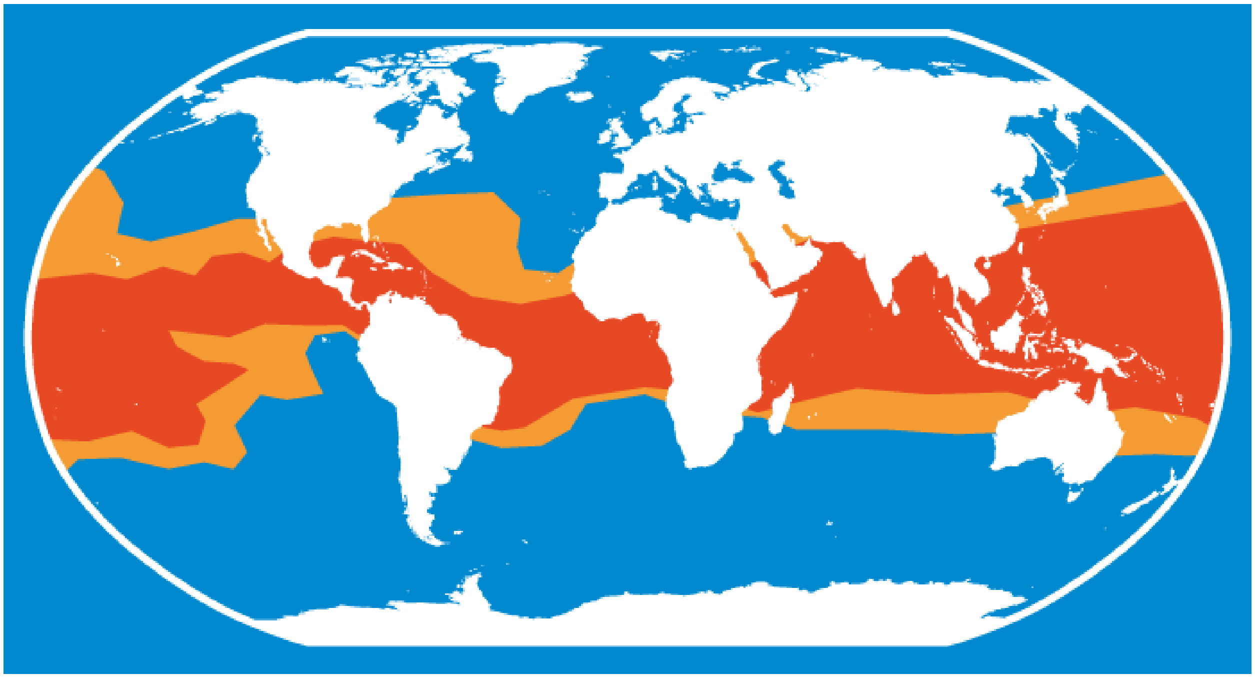
The oceans cover more than 70% of Earth's surface and capture a large part of the sun's heat in the upper layers, making them the world's largest solar collectors and energy storage system. Utilizing just a small portion of this energy, can cover the global energy need. The energy source of OTEC is free, available abundantly and is continually being replenished as long as the sun shines and the natural ocean currents exist. Various renowned parties estimate the amount of energy that can be practically harvested to be in the order of 3 to 5 terawatts (1 terawatt is 1012 watts) of baseload power generation, without affecting the temperature of the ocean or the world's environment. That's about twice the global electricity demand. The oceans are thus a vast renewable resource, with the potential to contribute to the future energy mix offering a sustainable electricity production method[1].

Because the oceans contain a huge amount of energy, changes in salinity, thermal gradients, tidal currents or ocean waves can be used to generate electricity using a range of different technologies. These could provide reliable, sustainable and cost-competitive energy. The OTEC resource covers an area exceeding 100 million km^2 across tropical oceans[2]. Unlike most renewable energy conversion systems, OTEC could deliver power at very high capacity factors and offer baseload capabilities. OTEC is a marine renewable energy technology that harnesses the solar energy absorbed by the oceans to generate electric power. The sun's heat warms the surface water a lot more than the deep ocean water, which creates the ocean's naturally available temperature gradient, or thermal energy.

[1] http://www.otecnews.org/what-is-otec/

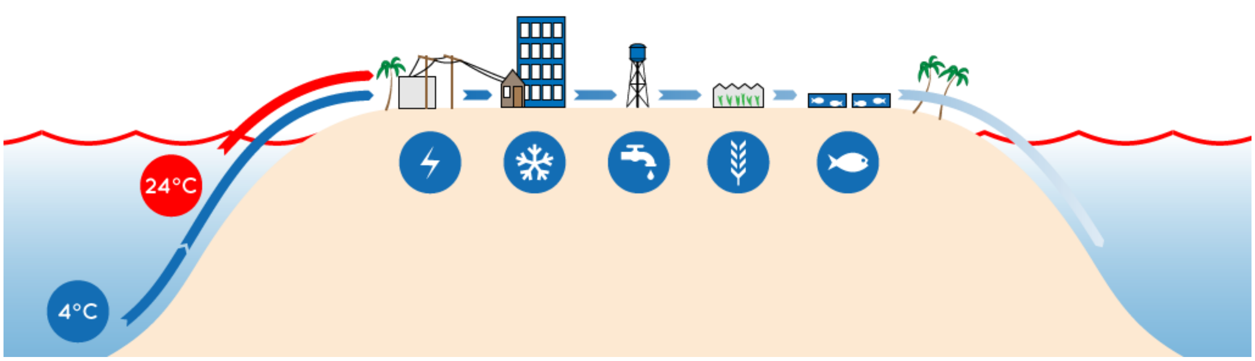
[2] https://www.ocean-energy-systems.org/about-oes/what-is-ocean-energy/ocean-thermal-energy/

Figure 2: OTEC Resource[3]



OTEC uses the ocean's warm surface water with a temperature of around 25°C (77°F) to vaporize a working fluid, which has a low-boiling point, such as ammonia. The vapor expands and spins a turbine coupled to a generator to produce electricity. The vapor is then cooled by seawater that has been pumped from the deeper ocean layer, where the temperature is about 5°C (41°F). That condenses the working fluid back into a liquid, so it can be reused. This is a continuous electricity generating cycle. The efficiency of the cycle is strongly determined by the temperature differential. The bigger the temperature difference, the higher the efficiency. The technology is therefore viable primarily in equatorial areas where the year-round temperature differential is at least 20 degrees Celsius or 36 degrees Fahrenheit.

Figure 3: Cold water applications



OTEC is uniquely fitted to addressing challenges in SIDS, as it is a multi-product technology with potentially economic viable income streams. As noted earlier, OTEC uses the thermal and biological resources of the ocean to generate energy, desalinated water, mari-culture products

[3] http://www.otecnews.org/what-is-otec/resource/

(abalone, lobsters, crabs, fish and high value seaweed), as well as the recovery of Lithium. Based on classification as a renewable energy technology, OTEC is the most unique system and the one most suited to developing the vast potential of SIDS' oceans and seas in a sustainable manner. OTEC, from a socio-economic perspective, has potential to positively impact a number of the SDGs, including water, energy access, hunger, gender empowerment, oceans and climate, and industrialization, directly. It is the most representative example of a technology with direct multiple application, a "Nexus" sustainable SIDS-Appropriate Energy Technology, like no other renewable energy system.

Ocean energy represents the most available, and likely the largest potential source of renewable energy in SIDS. SIDS now import annually, more than 200 million barrels of petroleum, which cost US billions annually, and a major cause of debt in SIDS. SIDS maritime EEZ are very large (especially in the Pacific) and extend to approximately one-sixth of the earth's surface. Collectively, SIDS Oceans (EEZ and extended continental shelves) make them 15 times the physical size of the EU. In this system, the tropical ocean acts as a giant solar energy collector for the estimated 25,000 to 35,000 barrels of oil equivalent that contacts the surface of the ocean. Indeed, SIDS reside amid the largest area of renewable energy on the planet. In addition to providing sustainable electric power, OTEC also produces two valuable by-products: large quantities of cold, nutrient-rich water that can be used for mari-culture, and significant volumes of fresh water, a very limited commodity in most SIDS. Therefore, OTEC, a known technology in development since the 1880s, has unequalled potential to assist SIDS in helping to meet the challenges and obstacles posed by Climate Change and expensive energy and to achieve sustainable development in SIDS. OTEC technology will facilitate the development of island nations' largest undeveloped natural resource - the tropical ocean. OTEC can be the main pillar of sustainable energy and the blue green economy in SIDS, with vast benefits to SIDS and the global population.

2. BACKGROUND

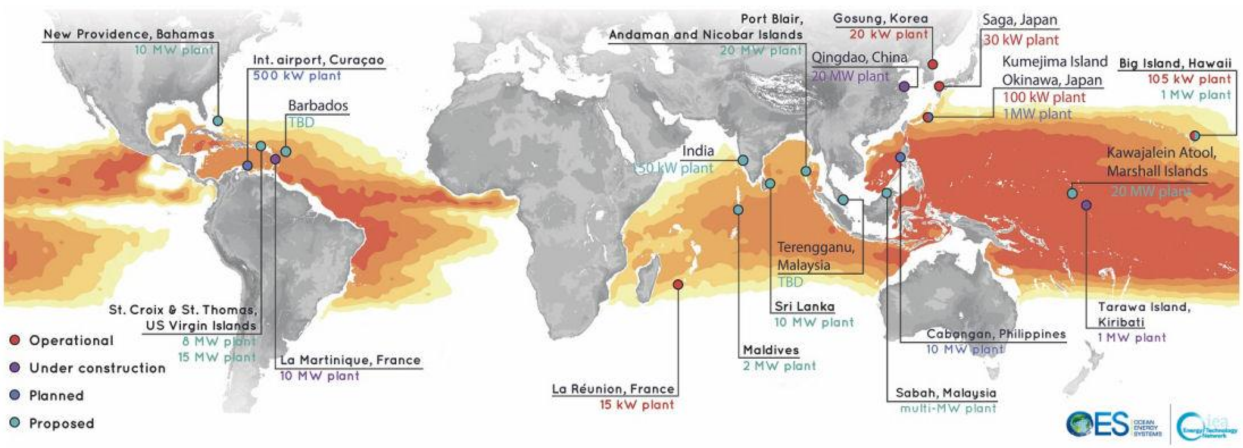
Based on a presentation to the United Nations Economic and Social Council (ECOSOC) meeting in June 2004, by the researchers from the Institute of Ocean Energy Research (IOER) at Saga University, Saga, Japan, and The University of the West Indies Centre for Environment and Development (UWICED), AOSIS decided that deployment of OTEC technology in SIDS should be a priority for collective action. Since the Second United Nations International Meeting on Small Island Developing States, in 2005, in Mauritius, the SIDS have advocated for the further development and deployment of Ocean Thermal Energy Conversion technology starting with the Technology Fair in Port Louis, Mauritius, where a model system was displayed using cold water from commercial water to simulate the cold ocean water at temperature of about 4 degrees Celsius; and tap water simulated the water from the ocean surface at a temperature of about 25 degrees Celsius. The display staged by IOES Saga University and the AOSIS, was visited by the then UN Secretary-General, who gave it his full endorsement for transfer to the islands.

Since 2012, when grant funding to the tune of USD 14.5 million and USD 15 million from Denmark and Japan, respectively, raised solely by AOSIS and SIDS DOCK, Member states of the SIDS DOCK and the SIDS DOCK Secretariat have been advocating for OTEC research and development and recruiting partners for the preparation of studies and formation of a special interest group among SIDS. Utilizing funds under the SIDS DOCK Support Program, the interim SIDS DOCK Secretariat reached an agreement to set aside US 2.9 million from the First Tranche of Funding from the Government of Japan, to support a full feasibility study for the Marshall

Islands, which the research done by Saga University, Institute of Ocean Energy, indicated had almost ideal conditions for an OTEC systems. In April 2014, the request was denied by World Bank Energy Sector Management Programme ESMAP, which has responsibility for the administration of the SIDS DOCK Support Program funded by Denmark and Japan. *The Word Bank concluded that a pre-feasibility study is required prior to funding a large feasibility study. Grant size represents exposure risk to the ESMAP SIDS DOCK portfolio and a pre-feasibility study is needed to address this.* The decision was made despite the Japanese having conducted and submitted a pre-feasibility study in 2012.

Years of frustration followed the Mauritius Conference, but with the establishment of SIDS DOCK, and after the Samoa meeting, new energy has been pumped into OTEC and it is now a priority in the SIDS DOCK Work Programme (2016 to 2021), and advocacy has increased. The SIDS DOCK Secretariat used the opportunity to advocate for OTEC, on May 31, 2016, at the Sustainable Energy for All Forum, sponsored by the UN ECOSOC and the Government of Kazakhstan, to promote Island Nations' interest in OTEC. In cooperation with the Global Environmental Facility (GEF) and SIDS DOCK, an education tour was conducted of the Kumejima OTEC Research Facility, in Kumejima, Japan, in June 2016, aimed at strengthening and further building relationships and partnerships for advocacy. The Caribbean Community (CARICOM) Secretariat, Energy Unit, and the Secretariat of the Pacific Environment Programme (SPREP), are the leading advocates in the Caribbean and Pacific.

Figure 4: Status of OTEC Power Plants (May 2017)[4]



The SIDS DOCK Island Women Open Network (IWON), the energy-gender-nexus empowerment arm of the Organization, included their voice as a major advocate for OTEC, recognizing the myriad livelihood opportunities available to women. On 26 October 2016, the Chair of the IWON, Her Excellency Ms. I. Rhonda King, Ambassador of Saint Vincent and the Grenadines to the UN, delivered a powerful presentation: **"Ocean Energy Development Unique to Small Island Developing States (SIDS),"** to the United Nations Department of Economic and Social Affairs (UNDESA) and Global Energy Interconnection Development and Cooperation Organization (GEIDCO) High-level Luncheon and Discussion, "Building Global Energy Interconnection and Achieving Worldwide Sustainable Development of Energy," calling for the immediate development and deployment of OTEC in SIDS.

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[4] https://www.ocean-energy-systems.org/oes-projects/task-11-status-of-otec-and-its-resource-assessment/#tab-results

At the 3-9 June 2017, UN Oceans Conference, held in New York, during the SIDS Ministerial, the SIDS DOCK Secretariat echoed the importance of this technology to the future battle with climate changes impacts. This was followed by a similar call from the IWON Chair, who announced an IWON Campaign to be launched in September 2017, on the margins of the 72nd UN General Assembly, to, **"Bring Dominique Home."** *Dominique* is the magnificent 100 KW Ocean Thermal Energy Conversion Pilot Plant located on Kumejima Island, Japan. The feminization of OTEC through Dominique, is in line with the characteristics of Mother Earth's resources. "Despite our gender-blind naming of diseases, hurricanes, storms and other forces of nature, we still bestow on our planetary home and the very core of our existence names of the ultimate symbols of life-giving femininity: Mother Earth and Mother Nature." She's called *Dominique* by the Japanese, in honour of the island of Dominica, and with special reference to the first Chair of the SIDS DOCK Executive Council, and former Chair of the SIDS DOCK Steering Committee, His Excellency Dr. Vince Henderson, LPD, Ambassador of the Commonwealth of Dominica to the U.S and the Permanent Representative to the Organization of American States (OAS), and the first Chairman of the SIDS DOCK Executive Council and Patron of the SIDS DOCK IWON.

The SIDS DOCK Secretariat also advocated for OTEC development as a viable option for SIDS in addressing trade deficits and reducing vulnerability of island states to projected climate change impacts at the Bloomberg Asia and Pacific Renewable Energy Summit, in Shanghai, China, in November 2016. In May 2017, at the 2017 Vienna Energy Forum (VEF), His Excellency Mr. Enele Sosene Sopoaga, OBE, Prime Minister and Minister for Public Utilities of Tuvalu, and President of the second SIDS DOCK Assembly, in his keynote address, informed the Forum of the importance of OTEC technology to SIDS. Based on the statement delivered by the Prime Minister from Tuvalu, along with discussions during the VEF panels, the OTEC system is best seen as a "NEXUS" technology as it addresses many issues negatively impacting the sustainable development aspirations of SIDS in achieving the SDGs and the Paris Agreement. It was further accepted that OTEC systems should not be evaluated solely for its energy generation, as the established least cost energy option index (LCOE) does not capture other income streams generated by the technology, and therefore, comparison to wind and photovoltaics (PV) which have no co-products, is not valid economics. Wind and PV are both intermittent sources of energy versus OTEC which is a baseload source of energy.

2.1 Fostering Public-Private Partnerships - Private Sector Involvement in OTEC

Given the geography that is most suited to OTEC is the tropical islands, and in these countries, that have very small economies and hence very small energy demand, there is not a significant market to drive OTEC technology deployment. In some countries, a single 10 MW OTEC plant would provide all the power and water needed for the country for generations, however, the private sector does not see a market that resembles the solar PV or wind market. While a number of private sector companies are involved in OTEC, as shown in Figure 5, the level of effort needs significant scale-up as all systems are below 1MW to get OTEC as an integral part of the small islands energy mix. It should be noted that none of the players have really proved themselves to date (all operational projects are less than 1MW). Most of the companies are small and therefore do not have the financial balance sheet to mobilize for scale up and to do research. A strong case could be made that for OTEC, there is market failure, scale is being a stubborn obstacle to a badly needed technology.

Among the private sector, based on the balance sheet of the French Company, DCNS, they indicate they would be the best potential company. Regarding which would be the best partner? There is no clear answer, but if a choice is to be made then, DCNS, just because they are a large company and are most likely to have the balance sheet and resources to build a first commercial scale plant in a public-private partnership with island governments, and philanthropy. DCNS have an existing project funded by the EU for Martinique, but reports are that they are not making particularly fast progress, so, it could be argued that they don't see OTEC as a core part of their activity. Next in line would be the Japanese, and also Bardot.

Figure 5: OTEC Market Players[5]

Company name	Company info	Technology concept overview	Progress to date	Target price (10MW)	Target LCOE ($/kWh)
Technology developers					
Bardot	HQ in France, group has 80 employees	Closed loop system. Focus on offshore. Modular concept allowing scalability.	No operational plants. Commercial contract agreed for 0.5MW project in the Maldives with aggressive deployment target of end 2018. Undertaking feasibility studies for several other projects.		
Bluerise	Dutch company (university spin-out) with office in Aruba, <10 staff.	Closed loop system. Suggest some IP in working fluid used. Working on <10MW onshore and >10MW offshore concepts.	Have a small prototype used for laboratory testing. Contract for 500kW OTEC plus SWAC in Curacao but delayed due to change in government. Undertaking feasibility studies for several other sites.		
DCNS Energies	HQ in France, 250 employees working on various ocean energy projects, 55% owned by DCNS Group.	Closed loop system, component selection based on real tests of various options. Offshore is preferred solution.	15kW onshore demonstrator since 2009. 10MW net NEMO offshore project for Martinique due to be completed by end 2022. Feasibility studies for numerous other sites.		
KRISO	Ship and ocean engineering research institute with 342 staff. Started work on OTEC in 2010.	Research is focused on closed loop and offshore systems.	20kW demonstration completed in 2013. Working on 1MW (gross) offshore demonstration to be installed by 2020 in Kiribati. Design has approval in principal from Bureau Veritas. 10MW floating concept detailed design to start in 2018.		
Lockheed Martin	Large OEM with HQ in the US. Previously heavily involved with OTEC but no action at present.	-	Much activity through 1980s and 1990s. Most recent activity was 2013 agreement to build 10MW project in China which appears to have been subsequently cancelled.		
Makai Ocean Engineering	Hawaii based engineering company with long experience in SWAC and OTEC sector with particular expertise in subsea pipelines	-	Designed and operate 100kW closed cycle OTEC plant at the National Energy Laboratory of Hawaii Authority (NELHA). Undertaken feasibility for several large projects.		
Xenesys	HQ in Japan. Heat exchanger manufacturer with 23 staff.	Closed loop onshore or offshore	Supplier to 50kW onshore OTEC plant in Okinawa operational since 2013. Supplier to 15kW and 30kW OTEC at Saga University. Undertaken feasibility for several projects up to 10MW.		
Project developers					
OTE Corporation	US based OTEC and SWAC project developer with 5 full-time staff.	Not tech developer but state they would use a closed cycle system and believe that onshore is the best option for the first large projects.	Contracted to operate SWAC system for the Baha Mar resort in the Bahamas- project stalled due to bankruptcy of resort developer. Working with DCNS on a 15MW OTEC project in the US Virgin Islands. Undertaken feasibility for several other projects.		
Bell Pirie*	Project developer for OTEC project in the Philippines	-	Agreement for DCNS to provide 10MW plant. Project appears to have stalled.		

If ocean energy technologies are to make a significant contribution to the development of low carbon economies in SIDS, in a timely manner to play a major role in climate change adaptation,

[5] Need reference

it is essential that predictable financial resources (public, private and philanthropic) be available to support a five-year programme that results in the deployment of the first commercial facility by the end of the period, based on an approach that facilitates establishment of four other plants over the next five years. It is a critical time for OTEC, it needs additional push to complement what is happening to avoid losing momentum and that is what the Heads of State and Government OTEC Initiative is intended to do.

3. PROPOSED STRATEGY: THE 2023 STRATEGY FOR THE COMMERCIAL-SCALE DEPLOYMENT OF OCEAN-BASED SIDS-APPROPRIATE ENERGY TECHNOLOGIES

The major bottleneck to the deployment of OTEC systems has been the high capital costs, which overshadow operational characteristics of low maintenance, high availability, multiple products streams to generate revenue, and, which at scale of 10 MW and above becomes competitive with diesel plants, and employment generation potential[6].

Many promising technologies have died a slow death because the vested interest parties could not organize and effectively advocate for support or make the convincing case. Island Nations cannot allow this. SIDS outsourced OTEC development since the Second UN Conference in Mauritius, and nothing happened. The urgency of the need was revived at the Third UN Conference in Samoa, and with the establishment of SIDS DOCK. Since Samoa, there is much more visibility about OTEC and ocean energy in general; feasibility studies are on the way in one SIDS, but that should be seen as additional, not our main effort or adequate effort. For SIDS struggling to address issues of debt along with lingering social and environmental problems and now experiencing the debilitating impacts of a changing climate, OTEC represents the best known option for long-term viability and the SIDS have made it known that it is a high priority.

While we embrace the support for PV, SIDS are aware of their limited land resources and the requirement to keep land for the housing and food production for future generations. Three major challenges to the deployment of OTEC at its current stage of development have been identified by the SIDS DOCK organization:

- Risk of technology failure;
- Perceived risk of investment in SIDS, and;
- Policy enabling framework.

3.1 Risk of Technology Failure

The commercialization of OTEC is an engineering process integration exercise in which the following advanced technologies are integrated and optimized:

a. Flash Evaporation – this technology is used in the agro-industry for making concentrated fruit juices. In the OTEC systems its role is to remove dissolved gas from the warm ocean water, the energy source, so that the transfer of heat from the warm ocean water to the Ammonia is very efficient.
b. Heat Exchangers – a standard requirement in industries with thermal processes. Exchangers, as the name implies, is where the heat in the warm ocean water is transferred

[6] More detailed information will be forthcoming from the InterAmerican Development Bank on the Barbados Full Feasibility Study, when it is released later this year.

to liquid Ammonia under pressure. Ammonia is one of the possible fluids that transfer the heat between components of the OTEC system.

c. Vapour Turbines – turbines are mechanical devices that rotate at very high speeds – most know are those on airplanes; in the OTEC systems, it is where the heated Ammonia is released resulting in the generation of shaft power – shaft spinning at very high speeds.
d. Electric Generators – connected to the turbine shaft the generators power for export to the grid.
e. Cooling, Refrigeration and Desalination – the Ammonia leaving the Turbine exhaust is cooled in a heat exchanger using cold sea water from the deep ocean about 1000 meters where the water temperature is about 4-6 degrees Celsius. The cold water is used to remove heat from the Ammonia vapour leaving the turbine so it can be converted to a liquid. Additional heat from the Ammonia vapour is removed by refrigeration. The cooled Ammonia vapour is then compressed into a liquid, and starts the heat exchange, cooling and compression cycle again, making for continuous operations. The gases leaving the Flash Evaporator are a mixture of Nitrogen, Oxygen, Carbon Dioxide and water vapour; the cooling of these gases with cold water produces desalinated water – a 10 MW OTEC plant is estimated at generating 12 million litres per day.

There are two inflows into the OTEC system, hot and cold ocean water, and two outflows, the surface water whose temperature is now reduced and cold water that is now warmer. The cold water is used to generate desalinated water. The cold water is used for Mari-culture; Hawaii and Japan have commercial operations based on the use of this nutrient rich and very clean resource, among the products. The cold water can also be used as a source of commercial cooling. There are growing applications in the Pacific, and feasibilities studies are proposed and ongoing in the Caribbean, for hotel and airports. In Japan and Hawaii, it is used to cool greenhouses, which results in better yields and crop quality. This cold water is also a major source of Lithium. Unused cold water is returned to the Ocean at the correct depth corresponding to its temperature.

3.2 Perceived Risk of Investment in SIDS

External investment flows into SIDS are primarily in two areas, tourism and mineral extraction, primarily a result of economic factors related to scale and size of domestic markets, as well as the high cost of energy and related services. A majority of SIDS are highly indebted, a result of borrowing to finance infrastructure, and social investment and recovery from natural disasters, thus, their poor balance sheets make SIDS risky locations for investment. Given this context, dependence on the private sector to drive OTEC deployment is highly questionable. The governments and population of the SIDS, who live in 10 of the 14 most indebted countries, with limited scope for employment and new forms of livelihoods need this technology and they should not have to sacrifice, as they did for petroleum fuel which has left them in socio-economic distress and facing an uncertain future. The significant impact of risks and the cost in economic terms is recognized by the SIDS DOCK, and mechanisms are being designed to address this obstacle.

3.2.1 Project Risk Financing Mechanism[7]

[7] As a catalyst for sustainable development, SIDS DOCK is developing a Risk Mitigation Platform Proposal to submit to the Green Climate Fund to address sustainable energy and climate change challenges and mobilize private investment for renewable energy and efficiency projects. The Platform will be built on three pillars, including a Risk Mitigation Facility aimed at providing credit enhancement and risk mitigation instruments to enable bankability of renewable energy and efficiency projects.

Addressing the risk to private sector requires partnership with Government to create the enabling environment, and technical and financial resource partnerships to provide the confidence necessary to make national commitment. The availability of technical resources will help the government fill any institutional capacity gaps necessary to help the government identify, educate the population and commit to putting in place the necessary policies and regulations.

As noted earlier, high initial cost is the major financing challenge and it is unrealistic to expect the private sector to engage in any venture that at first, is seen as risky, and whose profitability, which appears quite attractive, is however only partially proven. Through a project financing agreement for the construction of a first commercial OTEC facility in SIDS, it is proposed that the project financing facility be comprised of resources for co-financing of the project with the selected private sector company. The funds into the OTEC project from the Financing Facility would go via the Government as a contingent recoverable loan. Mobilizing resources for the OTEC facility and support of the process will be the responsibility of the proposed OTEC Consortium, and would represent cost of project and funds for financing the activities of the Initiative (travel, meetings, document preparation, retaining services of consultants when necessary, provision of technical assistance to governments, capacity building, public education and awareness, and research.

3.3 Policy Enabling Framework

SIDS, despite the recognition since the1994 First UN Conference on SIDS, planning for and governance of national development continues to be dominated by sector silos. Seldom do national development policies seek to address development challenges through integrated sectoral approaches. Deriving maximum benefits from OTEC systems requires significant coordination between the following key sectors: Agriculture and Fisheries; Water and Sewage; Tourism and Industry; and Energy, which have more than likely and seldom at best worked on a single project. A key requirement in qualifying countries for the Initiative will be the extent of inter-sectorial cooperation, the policy environment, and most important, commitment to putting in place the necessary policies and regulation. From the perspective of the private sector partner, the major requirement is payment upon successful commissioning of the plant. A set of key project milestones will be established for the countries, as part of the qualification process.

3.4 The Proposed Strategy - Building an OTEC Consortium

3.4.1 Functions of the Consortium

a. To advocate on behalf of SIDS the need for this technology and the constraints poised to market as a driver. OTEC is not an engineering scale-up, it is a system integration and optimization scale-up;
b. To provide leadership in dialoguing with potential partners and governments and in resource mobilization;
c. Lend credibility to the initiative and increase private sector confidence in the potential;
d. Identify potential partners;
e. Mobilize resources; and
f. Provide leadership for the initiative.

3.4.2 Composition of the Coalition

Senior level government official at level of Director or higher from the countries; OTEC technical experts, representative of development partners, private sector companies (OTEC, and Legal and Financing); Civil Society leaders (NGO, Philanthropy), and UN agencies.

Identification of the 3-5 Pilot Member countries whose national development policy and plans include OTEC, to act as lead governments.

Criteria for qualification will be prepared for countries to assess degree of readiness by the OTEC Technical team and to make final selection. Countries will be required to provide evidence of commitment at various stages in the process, including submission of a draft project document.

3.4.3 Establishment of a Technical Team of OTEC Experts

Functions:

a. Prepare the overall strategy and provide oversight and mobilize financial and technical resources, and approve documentation as necessary;
b. Selecting initial sites will be critical to the success of the strategy – the existence of market for power, fresh water, the cold water for Mari-culture or fr commercial cooling and refrigeration is the better the economics of the project is. For example, a site that provides for maximum use of desalination potential, uses for cooling, and Mari-culture will have a much better balance sheet compared to one with just baseload power.
c. Provide technical assistance to countries as needed, to participate effectively in the process;
d. Preparation of the methodology to provide verifiable assessment of the various product options from OTEC systems, based on the prevailing local situation;
e. Identify potential suppliers of OTEC systems components and research performance and rank suppliers by category;
f. Conduct evaluation on systems components to identify potential areas for cost reduction and the requisite research and development;
g. Designing capacity building programmes for operations of facilities for power generation, mari-culture, sea water desalination;
h. Preparation of the terms of reference of the Feasibility and engineering design study;
i. Review responses to the Expression of Interest to build the first commercial scale facility in SIDS;
j. Preparation of project budget and Financing Plan and guidelines;
k. Assistance to countries in the preparation and introduction of policies to support private sector participation in the project;
l. Prepare the Criteria for evaluating projects;
m. Assist government in the procurement of the services of the most suited company or consortium to build the plant, and;
n. Assistance to countries in negotiating Power and water purchase agreements.

Composition:

Senior level government officials at level of Director or higher from the lead countries, OTEC experts and representatives from OTEC-related companies, representatives of Development Banks, representatives of institutions with relevant scientific and technical expertise, e.g., IIASA, IEA, IRENA, FAO, representatives from academia, regional energy organizations, UNIDO and other development partners.

4. RESOURCE MOBILIZATION

Based on the indicative budget prepared by the technical team, selected members of the Consortium would take responsibility for mobilizing resources for project components. This approach allows for strategic targeting of private sector vested interests (heat exchange, vapour turbine manufactures, compressors, electricity generators, and flash evaporators).

Preparation and submission of projects by Countries: assistance will be available from the Expert Team to aid in preparation of the project document.

Project review by Technical Team of OTEC Experts: this review will decide the rankings for the submitted projects.

Negotiations with the government of the winning projects on terms and conditions for financing: the amount of funds to be mobilized will be determined by the size of the winning project.

Project Implementation: mobilizing funds for the Project Finance Facility - the amount of funds to be mobilized depends on the size of the project – finalizing of PPA.

5.0 NEXT STEPS

- Review of Concept by the SIDS DOCK Secretariat;
- Finalizing of Concept Note;
- Meeting with Gates Foundation to identify a Champion;
- Begin identifying potential members of the Consortium and the Technical Team;
- Increase advocacy by the SIDS countries;
- Mobilize initial seed funding of USD 50,000.
- Planning for the development and establishment of a small island ocean energy feasibility facility – this would provide support for reasonably sound "pre-feasibility analyses" into detailed feasibility studies and viable business plans, and there be a source of financing for feasible projects. It is proposed to establish a USD 30 million (principal amount) "Facility" to provide "Soft Loans" to members. The Facility would have a lifetime period of 12 years, with loans reimbursed to the Facility upon Financing of a Project's first stage, then converted to a grant upon formal abandonment of the project. The proposed transaction size (assuming a 7% annual percentage rate) for scoping and applications loans is USD 50,000 and between USD 1.5-3 million for feasibility studies and business plan loans. Funds to be raised as part of an international partnership comprised on UNIDO, IIASA, SIDS DOCK, Clinton Foundation, Gates Foundation and other to raise an estimated US 30 Million to provide conditionally recoverable grants for feasibility studies.

SIDS DOCK Secretariat
Belmopan, Belize
July 7, 2017