Climate Investment Funds

SREP/SC.8/5
October 12, 2012

Meeting of the SREP Sub Committee
Istanbul, Turkey
October 31, 2012

Agenda Item 6

INVESTMENT PLAN FOR MALDIVES

PROPOSED DECISION

The SREP Sub-Committee, having reviewed the document SREP/SC.8/5, *Investment Plan for Maldives,*

a) endorses the Investment Plan as a basis for the further development of the projects foreseen in the plan and takes note of the request for USD 30 million in SREP funding from the initial allocation to Maldives. The Sub-Committee requests the Government of Maldives, in the further development of the proposed projects, to take into account comments submitted by Sub-Committee members by November 21, 2012.

b) reconfirms its decision on the allocation of resources, adopted at its meeting in November 2010, that all allocation amounts are indicative for planning purposes and that approval of funding will be on the basis of high quality investment plans and projects. The indicative allocation agreed for Maldives is up to USD 30 million in SREP resources.

c) approves a total of USD 1,700, 000 in SREP funding as preparation grants for the following projects to be developed under the investment plan:

   i. USD 700,000 for the project entitled *"Preparing Outer Islands for Sustainable Energy Development Program (POISED)"* (ADB); and

   ii. USD 1,000,000 for the project entitled, *"Accelerating Sustainable Private Investments in Renewable Energy Program (ASPIRE)"* (World Bank).

d) takes note of the estimated budget for MDB project preparation and supervision services for the project entitled *"Accelerating Sustainable Private Investments in Renewable Energy Programme (ASPIRE)"* (World Bank) included in the investment plan, and approves USD 214,000 as a first tranche of funding for such services.

MALDIVES SREP INVESTMENT PLAN

2013 - 2017

Ministry of Environment and Energy
Republic of Maldives

MALDIVES SREP INVESTMENT PLAN

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FOREWORD

H.E. Dr. Mohamed Waheed
President of the Republic of Maldives

To the people of the Maldives, global climate change and the resulting rise in sea levels are a serious challenge to the prospect of life and the well-being of our current and future generations. This is why more than 20 years ago the Maldives raised its voice on this impending threat to the survival of our nation. Since then, we are striving to improve the quality of life of the people of the Maldives and to provide environmental quality for those who visit our country for holidays and business. Climate change associated with greenhouse gas emissions coupled with the realization that the world oil reserves will run out, has given strong impetus for the Government to explore alternative energy sources not only for energy security but also for meeting the sustainable development aspirations of the people of our nation.

The Government of Maldives has committed the country to become carbon neutral by 2020. Thus, this Scaling-up Renewable Energy (SREP) Investment Plan will guide us in this endeavour for the years ahead as we strive to achieve energy independence, setting our sights on the ultimate policy goal of carbon neutrality. This Investment Plan outlines the activities that we must implement to mitigate against climate change and it establishes specific goals, objectives and targets that the government, businesses and community must achieve together. Special attention is given to energy security as one of the key challenges for an import dependent nation and to creation of an environment that makes investing in the Maldives renewable energy sector as straightforward and risk free as possible. Affordable access to sustainable electricity for all our citizens is another deliverable. SREP will support the Government in reaching its target towards transforming the economics of the energy sector and moving renewable energy from niche to mainstream.

I note, with satisfaction, that the SREP Investment Plan was developed through extensive consultations and with wide stakeholder participation. The plan also benefited from the experiences and inputs of our development partners, the ADB and the WBG. I would like to express my gratitude to both institutions for the critical role they have played in developing the SREP Investment Plan for the Maldives and I look forward to their support in the implementation of this ambitious and transformative program.

Male', October 2012

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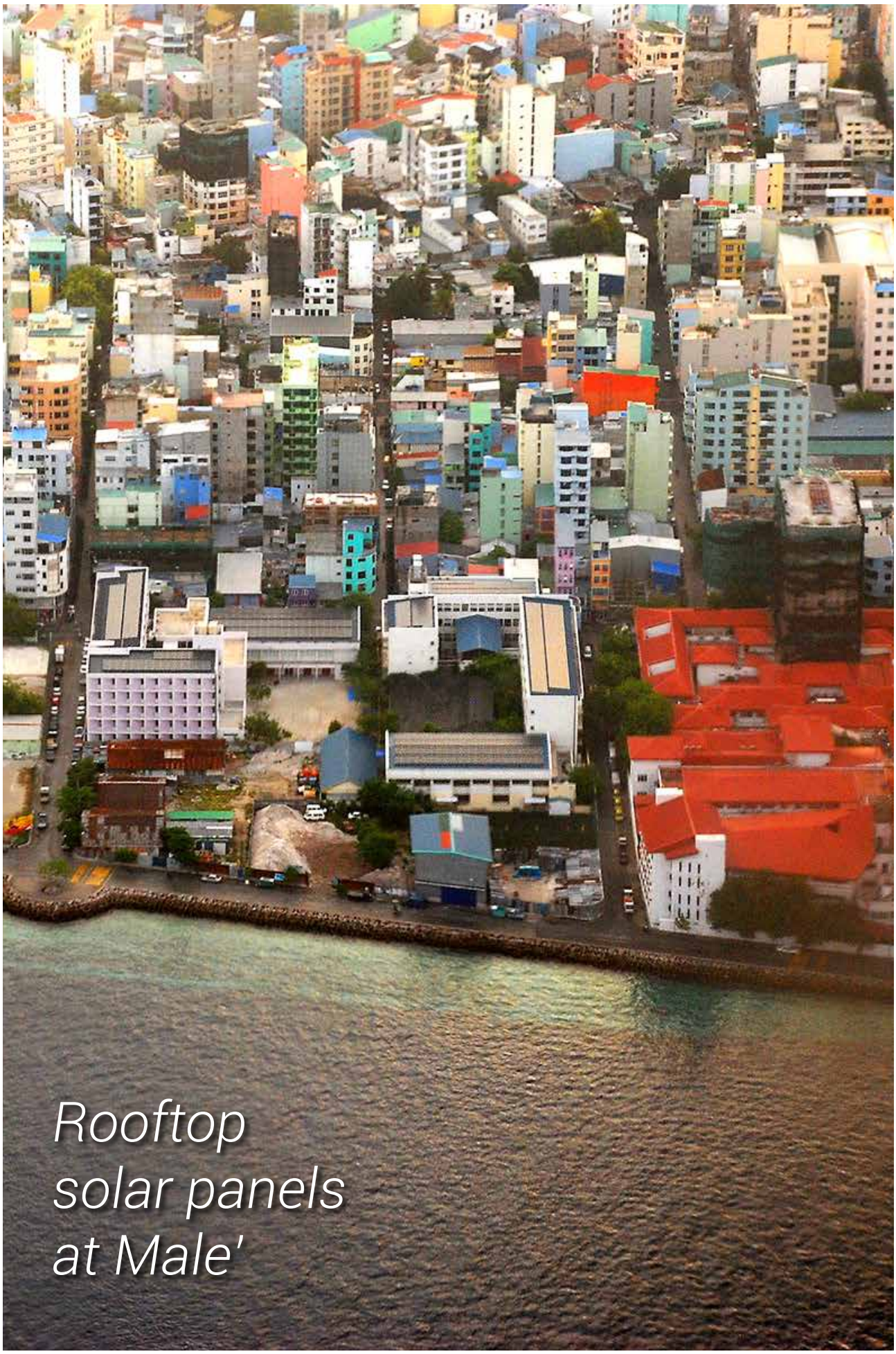
ACRONYMS AND ABBREVIATIONS

ADB	ADB
ASPIRE	Accelerating Sustainable Private Investments in Renewable Energy
CCAC	Climate Change Advisory Council
CCTF	Climate Change Trust Fund
CECM	Clean Energy for Climate Mitigation Project
EE	Energy Efficiency
ESMF	Environment and Social Management Framework
EPA	Environmental Protection Agency
EPC	Engineering Procurement and Construction
FENAKA	FENAKA Corporation Limited
FIT	Feed-In Tariff
GDP	Gross Domestic Product
GEF	Global Environment Facility
GHG	Greenhouse Gas
GIZ	German Gesellschaft fuer Internationale Zusammenarbeit
GoM	Government of Maldives
GST	Goods and Services Tax
GWh	Gigawatt Hour
IDA	International Development Association
IDB	Islamic Development Bank
IFC	International Finance Corporation
IP	Investment Plan
JICA	Japanese International Cooperation Agency
kWh	Kilowatt Hour
LCE	Low Carbon Energy
MEA	Maldives Energy Authority
MED	Ministry of Economic Development
MEE	Ministry of Environment and Energy
MDB	Multilateral Development Banks
MoFT	Ministry of Finance and Treasury
MGF	Maldives Green Fund
MMS	Maldives Meteorological Service
$MtCO_2$	Millions of tons of CO_2
MVR	Maldivian Rufiyaa
MW	Megawatt
NDP	National Development Plan
NEAP	National Environment Action Plan
NSDS	National Sustainable Development Strategy
OTEC	Ocean thermal energy conversion
POISED	Preparing Outer Islands for Sustainable Energy Development
PPA	Power Purchase Agreement
PMU	Project Management Unit
PPP	Public–private partnership

PSOD	Private Sector Operations Department
PV	Solar Photo Voltaic
RE	Renewable Energy
RET	Renewable Energy Technologies
RWMF	Regional Waste Management Facility
SAP	Strategic Action Plan
SREP	Scaling Up Renewable Energy Program in Low Income Countries
STELCO	State Electric Company Ltd
TA	Technical Assistance
TGST	Tourism Goods and Services Tax
toe	Tonne of Oil Equivalent
tCO_2	Tons of CO_2
TPD	Tons Per Day
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNIDO	United Nations Industrial Development Organization
USD	United States Dollar
WBG	World Bank Group
WTE	Waste-To-Energy



Rooftop solar panels at Male'

EXECUTIVE SUMMARY

The Republic of Maldives is one of the lowest lying countries in the world making the country particularly vulnerable to the effects of climate change due to rising sea levels. In addition, the country is entirely dependent on imported oil as the primary source of energy making it exposed to fluctuations and increases in oil prices. This is further exacerbated by the lack of adequate oil storage facilities.

The Maldives is one of the six pilot countries participating in the Scaling Up Renewable Energy Program in Low Income Countries (SREP). As a requirement of the SREP an Investment Plan (IP) was prepared demonstrating how SREP resources together with leveraging by co-financiers will be used to support scaling up renewable energy (RE) development in the Maldives. The IP was developed by the Government of Maldives (GoM) under the leadership of the Ministry of Environment and Energy. It identifies opportunities and presents a plan for achieving the objectives of SREP.

The IP has been prepared in line with the Maldives Vision 2020, Strategic Action Plan (SAP, 2008-2013), National Sustainable Development Strategy (NSDS, 2009), Maldives Energy Policy 2010, 3rd Environment Action Plan (3rd NEAP, 2008), as well as different Climate Change Policies especially with the objective of becoming a carbon neutral country based on a zero carbon electricity sector. Thus, this IP is an integral part of the Maldivian Governments RE and climate change policies, programmes and initiatives.

Throughout the IP preparation process, a wide array of public stakeholders, private sector institutions and development partners were consulted extensively. The IP was presented and discussed at the Cabinet and it officially endorsed the investments proposed in the Plan. The IP also benefited from the experiences and inputs of the Asian Development Bank (ADB) and the World Bank Group (WBG). In addition, the independent reviewer provided valuable comments and suggestions during the final stages of the preparation of the IP. Through this IP, Maldives is seeking USD 30 million SREP funding together with leveraging from other sources of a total investment of over USD 138 million to design and implement projects, and to support the transformation of the energy sector by scaling up RE in the country. All public and private stakeholders are in agreement on the need to focus the Maldives SREP on the sustainable and socioeconomic development while highlighting the need to further develop and use RE technologies to support the overall objective of becoming a carbon neutral nation. Thus, common goals exist to reach the set targets.

OBJECTIVES FOR SCALING UP RENEWABLE ENERGY PROGRAMME

The main objective of Maldives SREP IP is to transform the electricity sector and to develop renewable energies on a large scale. Achieving this objective will support the socioeconomic development by generating new economic opportunities and widening the access to sustainable, clean and reliable energy; it will effectively contribute to poverty reduction and sustainable development - and thus benefiting the Maldives and its people as a whole. Investing in RETs has significant economic and financial benefits as it will not only displace the high fuel costs for diesel, but also contribute to lowering the amount of subsidies that go along with the diesel based electricity generation. The underlying principles guiding the Maldives SREP IP are in line with the 2010 National Energy Policy and Strategy, centred on the following strategic objectives:

- Create an enabling environment for the growth of a reliable and sustainable energy sector and meet the constitutional obligation of the Government in the provision of electricity to every inhabited island at reasonable standards commensurate to the island;
- reduce over reliance of the energy sector and the national economy on fossil fuels through the diversification of energy supplies;
- improve energy efficiency and conservation of energy use;
- encourage the adoption of low-carbon technologies in production, distribution and energy consumption through promotion of a healthy lifestyle;
- exploit local energy resources and renewable technologies; and
- engage private sector participation in the development of the energy sector, energy services and quality assurance mechanisms.

MALDIVES SREP INTERVENTIONS

The Maldives SREP objectives are consistent with Government policies and priorities. The SREP investments were screened and prioritised taking into account technical, financial, economic and environmental criteria and are appropriate to Maldivian electricity use, population distribution, and socioeconomic aspects. The following components for SREP interventions have been identified:

Renewable Energy for Greater Male' Region

This component consists of greater Male' region's solar PV, a Waste-to-Energy (WTE) programme in Thilafushi and the region's renewable power system integration study. The projects under the component are expected to require financing of about USD 69.5 million. Of this amount, the private sector will contribute about USD 31.5 million as equity and debt to finance about 19MW of RE (this includes 11MW solar PV for the capital Male', 4MW solar PV for surrounding islands that are part of the greater Male' region and another 4MW WTE in Thilafushi). SREP and WBG financing will be used to provide risk mitigation facilities and/or incentives to private investors to implement these initiatives on a Feed-In Tariff (FIT) scheme.

Renewable Energy for Outer Islands

This component targeting the outer islands would finance full RE in about 10 small electricity consuming islands, power system upgrades in about 15 islands to be ready for large scale RE deployment, and increase the share of renewable electricity up to 30% of total generation in

about 30[1] islands. Renewable electricity supply in these 30 islands would be through private sector investments in RE through the FIT, and WTE supported by other incentive mechanisms. The projects under this component will require financing of about USD 62 million of which USD 16 million is expected to be financed by the private sector. SREP funding will be used in conjunction with ADB, IDB, GoM and WBG for these investments.

Technical Assistance and Capacity Building[2]

This component will support the creation of an enabling environment for RE investments and human capacity building. It will also provide funding for project preparation and improved access to better quality and more comprehensive renewable resource data. The total resource allocation for the activities under this component is about USD 7 million. About USD 2.1 million will be used from SREP for preparing the projects and for supporting the Government and relevant stakeholders with capacity building activities. WBG, ADB, GIZ and other bilateral donors will be providing additional TA funds to supplement SREP's contributions. Although SREP resources have been allocated for TA and capacity building, consideration will be made to attract other bilateral and multilateral resources to fund this entire component with the view to reallocate released funds from this component to investments.

FINANCING PLAN

This IP envisages investments of around USD 139 million of which USD 30 million is from SREP funds while USD 109 million is from other sources with a leveraging ratio of about 1:4. The largest share of investments is expected to come from the private sector amounting to about USD 47.5 million (34%). A summary of financing sources for the components under the IP and associated technical assistances is shown in Table 1.

Table 1: Financing Summary (in USD '000)

	SOURCES OF FUNDING (USD 000)											
Components	**SREP**	**GoM**	**WB IDA**	**WBG Guara--ntee**	**ADB**	**IFC/ ADB (PSOD)**	**GIZ**	**JICA**	**Private**	**Others**	**IDB**	**TOTAL**
IP Preparation Grant	315											315
Renewable Energy for Greater Male' Region												
Sub Total	11,500	2,500	3,000	12,000	0	10,000	0	11,000	31,500	0	0	69,500
Renewable Energy for Outer Islands												
Sub Total	16,000	8,000	2,000	8,000	6,000	0	960	0	16,000	3,000	10,000	61,960
Technical Assistance and Capacity Building												
Sub Total	2,185	1,500	0	0	400	0	2,300	0	0	800	0	7,185
GRAND TOTAL	30,000	12,000	5,000	20,000	6,400	10,000	3,260	11,000	47,500	3,800	10,000	138,960

1 These 30 islands include 15 that are already efficient and ready for RE with some minor adjustments + 15 islands which will be rehabilitated as mentioned.
2 In the subsequent sections this component has been further divided under four different programmes as appropriate.

PACKAGING THE COMPONENTS

The Maldives SREP IP is taking into consideration the unique geographical and demographical characteristics of the Maldives, having a densely populated greater Male' region surrounded by a large number of outer islands differing in size and population. Due to the inherent challenges associated with small populations, remoteness and high transaction costs for project development and implementation, the interventions are designed and packaged in such a way to address these challenges:

- **Accelerating Sustainable Private Investments in Renewable Energy Programme (ASPIRE):** All projects under this programme will be based on a FIT with the use of appropriate WBG guarantee instruments as a risk mitigation tool for leveraging private investments. It will also target a number of WTE initiatives. This programme consists of greater Male' region solar PV, solar PV/wind for 30 medium and large electricity consuming islands (about 15 islands will be made RE ready under the POISED programme), and WTE for outer islands. The WBG will be the lead agency.

- **Preparing Outer Islands for Sustainable Energy Development Programme (POISED):** Electricity generation from solar PV, and wind in some locations, is less expensive than energy generation from diesel based on avoided cost of fuel. This programme will support achieving full RE systems on 10 small electricity consuming islands and make the power systems ready to accept a 20-30% share of intermittent RE on 15 large and medium electricity consuming islands through rehabilitating inefficient generators and other necessary adjustments. The ADB will be the lead agency.

- **Waste-to-Energy (Thilafushi) Programme:** The programme will provide an up to 4 MW WTE power generation facility to replace the existing diesel-based power generator on the island. It is part of the broader Governments National Solid Waste Management Policy adopted in 2008. IFC/PSOD supports the development of an integrated waste management project for the Male' catchment area as a public-private partnership (PPP). Under Maldives SREP IP, only the implementation of the WTE facility is considered, even though this is part of the larger scale waste management solution that includes the collection, processing and disposal of waste in the Greater Male region. IFC/PSOD will take the lead on this programme.

- **Technical Assistance for Renewable Energy Scale up Programme (TA):** These activities will support the strengthening of the enabling environment, strengthen human resource capacities and identify additional RE investment opportunities and resource data collection. The WBG and the ADB will each lead TA activities as appropriate.

Financing by programmes is shown in Table 2.

Table 2: Financing by programmes

	SOURCES OF FUNDING (US$ 000)											
Components	SREP	GoM	WB IDA	WBG Guara--ntee	ADB	IFC/ ADB (PSOD)	GIZ	JICA	Private	Others	IDB	TOTAL
ASPIRE	10,750	2,600	5,000	20,000	0	0	1,160	11,000	42,500	0	0	73,010
POISED	12,750	8,000	0	0	6,000	0	400	0	0	3,000	10,000	40,150
WASTE-TO-ENERGY THILAFUSHI	5,000	0	0	0	0	10,000	0	0	5,000	0	0	20.000
TECHNICAL ASSISTANCE	1,185	1,400	0	0	400	0	1,700	0	0	800	0	5,485

MODALITIES OF THE PROGRAMME

In accordance with SREP programming modalities, the IP will be implemented through an integrated approach that is led by the Government through policy interventions and incentive schemes to attract the private sector, and supported by technical assistance, financial instruments and physical investments from the MDBs with SREP funding playing a catalytic role in achieving the IP objectives.

The IP envisages implementation modalities that are tailored to the comparative advantage of each stakeholder. Where small-scale public investments may not attract additional private capital, the public utilities will assume responsibility for the design and implementation of the identified solutions. On the other hand, the private sector – both investors and developers – will have an important role to play in the supply of RE through a FIT. In addition, as significant investments will be undertaken by the state owned utilities and private sector, the MDBs will support the government on project preparation, implementation support, financing, tendering and awarding, and through innovative guarantee schemes to address prevailing risks and barriers to scaling up RE investments in the Maldives. Regarding a timetable for the implementation of the projects, it is expected that the Maldives SREP IP work will be spread over a 5 to 6 year period.

TRANSFORMATIVE OUTCOMES AND OUTPUTS

The main outcome of the Maldives SREP IP will be to transform the energy sector and increase energy security in the country. Maldives SREP IP will aim to improve the regulatory environment for investors supported by a strong legal framework to reduce risks and transaction costs and encourage investment in RE; support the strengthening of the capacity of Government institutions and other relevant stakeholders and create new employment and business opportunities in the RE industry. This can lead to more gender and social inclusiveness, climate change mitigation, and ensure sustainable operations.

Investments under Maldives SREP IP will result in the installation of 26MW of RE generation, a reduction in GHG emissions by approximately 56,000 tCO_2/year and about 22 million litres of diesel avoided per year.

SUPPORT TO PRIVATE INVESTMENTS

The IP for the Maldives has been designed to generate strong interest from private investors making this a unique aspect. Out of the total USD 139 million the Plan envisages USD 47.5 million from private investments through various financial incentives and risk mitigation tools. This innovative aspect of the IP is expected to set a positive example for other countries. In order to attract relatively large financing from the private sector, a number of enabling policy measures have already been implemented and others are being planned. These include the elimination of the import duty on RE products as well as the introduction of a FIT. These positive measures coupled with strong commitment from the Government to realize the 2020 carbon neutral target are expected to send a strong signal to those wishing to invest and to develop a strong RE sector. Introducing appropriate policies and regulations to encourage the use of RETs over diesel is expected to mitigate the negative impacts that may arise during the phasing out of the FIT and guarantee instruments in the future. It is important to note that at today's diesel prices, the FIT which would be introduced by the Government would still be lower than the avoided cost of diesel.

In order to make the investment environment even more favourable, a number of attractive instruments and measures have been proposed to be undertaken under the Maldives SREP IP. For projects under the FIT regime favourable tariffs and standard power purchase agreements (PPA) will be in place, taking into account perceived levels of risks and returns that are appropriate to this type of investments. The Maldives SREP IP will have a strong emphasis on utilizing guarantee instruments to cover payment, currency depreciation and related risks that may be of concerns to potential investors. The introduction of a FIT combined with incentives and guarantee facilities and strong regulatory framework is envisaged to encourage private investors to venture into the RE market. In addition, adequate resources have been allocated in the Financing Plan of the Maldives SREP IP for possible capital injection to make debt financing more attractive for private investor even at commercial rates. After the approval of the Maldives SREP IP, the Government, with support from the MDBs, will carry out an investment conference/road show to solicit feedback from investors on the level of guarantees needed as well as on the design of risk mitigation instruments to attract investment in the sector.

During the process of selecting the companies, suitable credibility criteria, substantial financial backing and appropriate experience will be considered.

CORE INDICATORS AND CO-BENEFITS

While the current share of RE in the electricity mix in the inhabited islands is estimated to be less than 1%, RE investments planned under the Maldives SREP IP are expected to generate 70GWh/year of electricity, therefore increasing the share of RE by approximately 16%. Currently contributions from the electricity sector on the national CO_2 emissions are estimated to be 0.25MtCO_2/year. With the full implementation of the Maldives SREP IP, 27% of CO_2 emission reduction is expected compared to 2009 levels for electricity generation in inhabited islands.

Significant co-benefits are expected from the projects planned under the Maldives SREP IP including an increased energy security for small and vulnerable communities to enhance the socioeconomic conditions. Furthermore, WTE projects will improve local environment in the islands by better management of waste and by reducing the extent of land needed for waste disposal. This is also expected to bring significant health and tourism benefits to the local communities.

Reducing the operational costs of power systems, improving the country's balance of trade due to reduction of diesel imports and potential tariff reductions as a result of lower power generation costs as well as building private sector capacities and creating more employment opportunities are considered as significant fiscal co-benefits of the Maldives SREP IP.

The successful implementation of full RE in 10 small electricity consuming islands is expected to generate a strong demonstration effect which in turn can be translated for both other small islands in the Maldives and other countries learning from this experience and applying it to their own context to meet the energy needs of isolated populations.

THE MALDIVES SREP IP PROCESS

To identify the priorities, programmes and projects under the Maldives SREP IP and their investment potential, a strategic development approach was adopted:

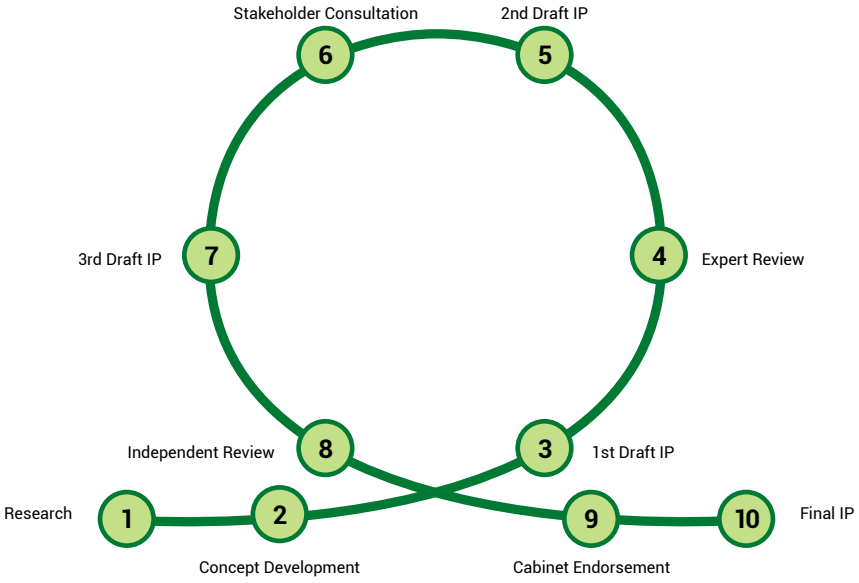


Figure 1: Schematic diagram for various stages of IP formulation

The multi-phase approach as shown in Figure 1 started with extensive research and analysis of existing data by national and international energy sector experts to assess the energy demand and supply for the greater Male' region and the inhabited islands that led into the preparation of the first draft of the IP. This first draft also included benefits and costs related to promising programmes and projects, the identification of incentive schemes and methods to attract, blend and leverage private sector finance for implementation, the selection of RETs best suited for the country's needs as well the identification of programmes and projects for implementation under Maldives SREP IP.

Based on extensive stakeholder consultations the second draft of the IP was prepared and shared with MDBs for extensive discussions and comments. To guarantee the most effective and efficient implementation the identified programmes and projects were packaged according to their potential to attract private investors. For RE ready islands, instruments such as the FIT and the guarantee facility would provide the necessary security for private investors (ASPIRE), island in need of power system upgrades or complete generator set replacement were packaged under POISED with the goal of making them RE ready to attract private investors under FIT and guarantee mechanism.

The resulting updated IP was published for review and after including comments from public and private stakeholders as well as sector experts referred to the independent reviewer for further comments, questions and suggestions. After the final round of including additional information into the IP, it was presented and discussed with the cabinet and given endorsement as part of the overall RE strategy of the country.

1. COUNTRY BACKGROUND

Figure 2: Map Of The Maldives

1.1 GEOGRAPHY

The Republic of Maldives is located 750 km South West of Sri Lanka and is made up of 26 natural atolls stretching 115,300 km^2 North to South across the equator (Figure 2). Made up exclusively of corals and sand, no single point is higher than 2.3m above mean sea level. The total land area is around 300 km^2 and the average size of the islands is 25 hectares. The Maldivian islands experience a monsoonal climate, with little variation in temperature throughout the year. Daily temperatures range from 31^{o}C in the daytime, to 23^{o}C during night time. The Maldives on average receives over 2,700 hours of sunshine each year[3].

Of the total 1192 islands, 194 are inhabited and 105 are self-contained tourist resorts. The total estimated population[4] in 2012 is 330,652 with an average annual population growth rate[5] of 1.69%. The largest urban centre is the greater Male' region, which includes Male', Hulhumale'', Villingili, Thilafushi, Hulhulé and Gulheefalhu and has an estimated population of 114,686. Over one third of the nation's population reside in the capital island Male' which has an area of about 2 km^2. Male', Villingili and Hulhumale'' are already inhabited islands and Gulheefalhu will soon be. Thilafushi is a landfill, waste management site and an industrial island, while Hulhule' hosts the international airport.

The second largest population centre is Addu City in the South, with an estimated 19,940 residents. Besides Male', only four islands have a population of over 5,000 and one fourth of the islands has a population less than 500. According to the Population and Housing Census 2006, there are a total of 46,194 households in the Republic, of which approximately one third are located in Male'.

Maldives has been demonstrating progress in various indicators of development. The per capita GDP[6] of Maldives in the year 2010 was USD 5,273. On average, 6.2 persons live in one household, and monthly household income is MVR[7] 28,909 for Male', and MVR 11,200 for the other islands.

The islands of the Maldives are connected via a basic nationwide transportation system and therefore, transport between islands calls for investments to further strengthen and develop

3 Maldives Meteorological Service. Climate of Maldives. [updated 2010; cited 2012 Aug 1]. Available from: http://202.21.178.203/mms//
4 Direct Communication with Department of National Planning, July 2012.
5 Ministry of Planning and National Development. Population and Housing Census of Maldives 2006. Male': Ministry of Planning and National Development; 2007.
6 Department of National Planning. Statistical Yearbook of the Maldives 2011. Male': Department of National Planning; 2011
7 1USD =15.42MVR

Figure 3: A typical island of Maldives

this service. Access to almost all inhabited islands is supported by harbours and jetties (Figure 3). At present, a network of ferries enables affordable travel between the islands and atolls although the frequency remains an issue. Three regional ports have been established, one in the capital island Male', one in the North in HDh.Kulhudhuffishi and a third in Addu City. For air travel, two international airports are in operation; one in greater Male' region and the other in Addu City. Furthermore, three additional airports throughout the country serve domestic flights, and five more airports are currently under development. The Maldives is also home to one of the largest sea plane operations in the world, with sea plane access facilities established in 56 locations throughout the archipelago[8] since 2009. Telecommunications are excellent, with an affordable mobile phone service that covers the entire country.

Despite the many challenges posed by the geographically dispersed nature of the islands and its inhabitants, the Maldivian population enjoys universal access to electricity. In fact, electricity generation is one of the fastest growing sectors in the Maldives, with the annual electricity production in 2011 reaching over 428GWh[9] in inhabited islands. Since it is not possible to install a single national grid to provide electricity to the population, each inhabited island in the Maldives, as well as resorts and other industrial islands are required to install their own power generation and distribution facility and are therefore, self-contained. This results in high costs for installation and maintenance of such systems.

Almost half of the population in the country resides in the greater Male' region and Addu city. These two regions account for half of the installed electrical capacity in inhabited islands. In the year 2011, Male' consumed roughly 217GWh of electricity which accounts for nearly half of the total electricity generated for inhabited islands. The power demand increases at a rate of 11% per year for Male'[10]. Tourist resorts produce and consume 60% of the national electricity production.

The Maldives relies almost exclusively on imported petroleum to meet its energy demands, and the cost of importing fossil fuels for the year 2011 accounted for roughly 20% of the national GDP.

8 The President's Office."Aneh Dhivehiraajje" - The Strategic Action Plan 2009 - 2013, Male': Government of Maldives; 2009
9 Based on data from utilities
10 Male', being the capital of the country, has a lot of on-going developmental activities such as new buildings, businesses etc.

1.2 ENVIRONMENTAL POLICY BACKGROUND

Article 22 of the Constitution of the Republic of Maldives provides the basis for the environmental policy formulation. The Constitution stipulates the fundamental duty of the State to protect the environment for present and future generations, and to ensure that the pursuance of economic and social development goals is not at the cost of the natural environment. The Environment Protection and Preservation Act (Law No. 4/93) further reiterates the need for the protection of the natural environment for present and future generations. The Third National Environment Action Plan (2009-2013) highlights goals towards carbon neutrality, advancement of energy security and establishment of an efficient transport network. The National Sustainable Development Strategy adopted in 2009 sets out the targets for achieving carbon neutrality for the energy sector.

As one of the most low-lying countries in the world, Maldives is exceptionally vulnerable to the impacts of climate change. Although the contribution of the Maldives to global climate change is negligible, the government wants to demonstrate international leadership. It has declared a policy commitment to become a carbon neutral country by 2020. This carbon neutral objective is supported by a number of policy decisions, including the National Energy Policy (2009-2013) and the National Energy Action Plan (2009-2013) that have been adopted to guide the development of the energy sector in the Maldives. In addition, a number of policies have been developed to encourage private investments in the energy sector - including a zero import duty for RE related merchandise and the introduction of FIT regulations.

1.3 ECONOMIC POLICY BACKGROUND

Tourism and fisheries are the mainstays of the Maldivian economy. These two sectors directly account for approximately 40% of the national GDP and are the main sources of foreign exchange earnings[11] . The Government, recognizing the role of the private sector in the development of these two vital industries, encourages its greater involvement in all development activities[12].

Foreign direct investment in the Maldives employs very simple procedures, whereby prospective investors may be granted permission to commence operations within a very short period of time from submission of necessary documentation[13] . Furthermore, transfer of profits through foreign investment is not subject to restriction.

As part of the Government tax reforms, the Goods and Services Tax Act was introduced in 2011. The Goods and Services Tax (GST) became operational in October 2011, and the Tourism Goods and Services Tax (TGST) was raised from 3.5 % to 6 % from January 2012 and to 8% from January 2013.

Maldives has an open economy and is highly dependent on imports. In the past five years, imports have averaged 61% of the GDP while exports ranged between 11-15 %, resulting in a large trade deficit.

11 Maldives Monetary Authority. Overview of the Maldivian Economy [homepage on the Internet]. Male', Maldives: Maldives Monetary Authority. [updated 2011 May 24; cited 2012 Aug 1]. Available from: http://www.mma.gov.mv/stat.php

12 Shareef F, Sodique H. Baseline Study on Corporate Social Responsibility Practices in Maldives, Male': UNDP.

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In 2011, the Maldives spent USD 340 million on oil based imports (excluding bunker fuels) and in 2012 this is expected to reach USD 450-500 million, which would be approximately 33-36% of GDP. If the oil price rises to USD150/bbl by 2020, and consumption grows by 8% per annum, oil imports are expected to reach around USD 700 million – or almost USD 2,000 per capita by 2020. This is clearly unsustainable. Therefore, the twin objective of the carbon neutral policy, other than being a flagship for climate change, is to make the economy largely independent of oil. Decarbonisation is as much a matter of national economic security and social welfare as it is a matter of environmental concern.

Figure 4 below shows the price comparison of 4 major fossil fuel imports to the Maldives in the past decade (2001 to 2010). In 2011, Maldives spent USD 261 million to import 316 thousand toe of diesel which is about 20% of the GDP of the country. Approximately 81% of the fuel import is diesel and more than 44% of the diesel imported is used for electricity generation.

Figure 4: Price comparison of four major fossil fuel imports to Maldives over the past decade

1.4 ENERGY POLICY BACKGROUND

The Government has formulated and adopted policies to provide affordable and reliable electricity to its citizens while at the same time introduced some necessary interventions to diversify its energy mix by focusing on other alternate sources. This includes measures to diversify the energy mix by introducing RE and by concentrating on the feasibility of installing solar, wind, WTE and ocean energy generation based projects across the country.

RE resources will be developed to optimum levels to minimize dependence on fossil fuel, subject to resolving economic, environmental and social constraints. In order to minimize the vulnerability of energy supplies to external factors such as international socio-political problems, the use of indigenously available RE resources will be maximized. In addition, the use of RE resources in energy generation will reduce the pressure on the country's balance of payments.
The Energy Action Plan (2009-2013) includes a series of actions, measures, programmes and targets to be met over five years to achieve greater energy efficiency and conservation awareness,

together with reductions in CO_2 emissions. The Plan intends to persuade private organizations and individual citizens that energy conservation is the responsibility of all. The key strategies that have been envisaged in the action plan are as follows:

- Provide all citizens with access to affordable and reliable supply of electricity through:
  - Developing utilities to upgrade and manage power infrastructure on the islands and improve the efficiency and quality of services;
  - encouraging private sector participation to develop, manage and sustain electric services;
  - encouraging national and international investments to develop and sustain energy; and
  - introducing incentives to power sector developers to ensure affordability of energy supply by facilitating access to grants and concessional finance.

- Achieve carbon neutrality by year 2020 through:
  - Developing plans for energy sector to include forecast of energy usage by different sources, GHG emissions and assessing status of carbon neutrality;
  - setting and monitoring targets to track energy sources, composition, efficiency and losses to achieve carbon neutrality and sustaining it;
  - adopting standards for exhaust emission for power plants, vehicles and vessels that use fossil fuel in order to improve air quality; and
  - promoting carbon capture and sequestration.

- Promote energy conservation and energy efficiency to reduce costs through:
  - Promoting energy efficiency and energy conservation to achieve economic use of energy without lowering the quality of service rendered;
  - promoting energy efficiency in electricity production, distribution and usage via workshops involving necessary stakeholders;
  - promoting demand side management with focus on large energy users;
  - identifying all areas of improvement and provide technical advice in fuel conservation and efficiency in different modes of transport; and
  - introducing incentives to encourage greater use of electric vehicles by establishing charging stations using RE sources.

- Promote RE technologies through:
  - Introducing and demonstrating new renewable technologies application;
  - facilitating and promoting research opportunities for locals and international parties by informing about potential of RE sources within the country;
  - developing human resource capacity for RE throughout the country by introducing RE related courses in college curriculum;
  - encouraging and promote bio fuels; and
  - encouraging the development of power generation capability by utilizing the household waste and bio fuels.

1.5 ELECTRICITY SECTOR BACKGROUND

Provision of electricity as a service in the Maldives started 63 years ago. In 1949, a generator set of 6kW was installed in the capital Male' to produce electricity for the first time. Initially, electricity was supplied to presidential palace and a few Government office buildings; this was later extended to the entire population of Male'. Recognizing the importance of providing electricity to the outer islands for social and economic development and poverty eradication, a state-owned company (STELCO) with a mandate to provide electricity was formed in 1997.

STELCO developed electricity facilities on 32 of the most populated islands and developed human resource capacities to an acceptable level. Although most power systems are set up, operated and managed by state owned utilities, a few were developed and are being operated by either the community or private parties.

Due to the geographic formation of the archipelago, each island has its own infrastructure including power generating facilities with several diesel generators of varying ages and capacities. Some of these systems were not properly designed and continue to be manually controlled with each island having only one supplier. In addition, where there are industrial facilities such as ice-making plants for the fishing industry, private generation is the norm. The physical dispersion of the islands makes it virtually impossible to connect the entire country on a single grid.

Diesel generators have been chosen as the primary mode of power generation as the initial investment required is less and these systems provide a relatively reliable source of energy. On the other hand, this makes the nation completely dependent on fossil fuel imports, as the country does not have proven fossil fuel reserves. Limited demand and storage capacity does not allow the importing of large quantities of fuel which makes the import of diesel relatively expensive. As a result, the country purchases its fuel requirements at the prevailing market rates.

In 2009, six new utility companies were formed to provide affordable and quality utility services to the respective populations in six regions of the Maldives. In addition, STELCO's mandate was expanded to include the islands in the North Central Region. The idea behind this change was to develop and manage utility services by qualified and trained personal to avoid inefficiencies and losses caused due to lack of knowledge and necessary skills. On formation, these utility companies took over most of the power systems operated by the island councils and private parties.

With the recent changes in the Government's administration structure, the former regional utility companies have been merged into one company; FENAKA Corporation Limited. FENAKA provides electricity to 115 out of 194 inhabited islands, STELCO currently operates and manages power systems on 10 islands, the island councils provide electricity to 63 islands and private parties provide electricity to 6 islands. It is expected that FENAKA will take over all power systems that are currently managed by councils or private parties as this would make the management more efficient and effective and save operational as well as maintenance costs by pooling resources.

1.6 ISLAND CLASSIFICATION BASED ON ELECTRICITY DEMAND

Energy consumption in the Maldives increased from 224,000 in 2002 to 396,000 toe in 2011 due to a rise in the demand for electricity and transportation. Electricity generation is by far the single largest consumer of imported fuels. Diesel accounts for 81% of the total primary energy demand in the country. In 2011, 316,000 toe of diesel was consumed of which 44% was utilized for electricity generation.

The production of electricity is the fastest growing energy consumption sector led by increased electrification of inhabited islands and growth in the tourism industry. Electricity generation for the capital Male' and the islands in its vicinity (collectively called as greater Male' region) accounts for approximately 51% of the total electricity generated for all inhabited islands in the country.

Electricity demand in the Maldives is expected to continue to grow at more than 8.5%/year, with this growth rate being influenced most significantly by the increase in electricity demand for the greater Male' region.

Rising fuel prices prompted the Government to subsidize the operational cost of electricity generation to maintain the stability of the price of electricity which in turn has imposed a significant burden on the Government's budget in 2011, USD 25 million was spent on electricity subsidy.

Today Maldives has a total installed capacity of approximately 245MW of diesel generators to cater for electricity demand. Electricity generation in the Maldives is in three main types of Islands: inhabited islands, tourist resort and industrial islands. Table 3 below shows the installed capacity for the different types.

Table 3: Installed capacities by types

Types	Installed Capacity (MW)
Inhabited Islands	120
Tourism Resorts (estimated)	105
Industrial Islands	20
Total	**245**

Male' accounts for 48 MW which is approximately 20% of the total installed capacity of the country or one third of the installed capacity on inhabited and industrial islands combined.

Since Maldives SREP IP will be targeted towards transforming the electricity sector of the inhabited islands only, the current situation of the electricity sector was analysed and the inhabited islands have been divided into two main categories: the greater Male' region and the outer islands.

Greater Male' region:

Greater Male' region consists of the capital island Male', Thilafushi (Industrial and waste management island), Gulheefalhu (newly reclaimed island), Villingili, Hulhule (airport) and Hulhumale'' (Figure 5). The greater Male' region is the largest consumer of electricity with an consumption of about 225 GWh/year (excluding Hulhule). Of this, Male' with approximately one third of the entire population has an electricity demand of 217GWh/year with an installed capacity of 48 MW. The electricity demand in Male' is increasing at an average rate of 11% annually.

However, Male' does not have enough space to expand the power generating capacity and hence, it is important to find alternative options to supply electricity to Male' to meet this demand. STELCO, does not have enough capacity to provide electricity to all its customers, some businesses in Male' operate standby generators, and some have their own private full time power supply. Since the lack of any interconnection between islands means there is no opportunity to generate electricity on one island and supply to another.

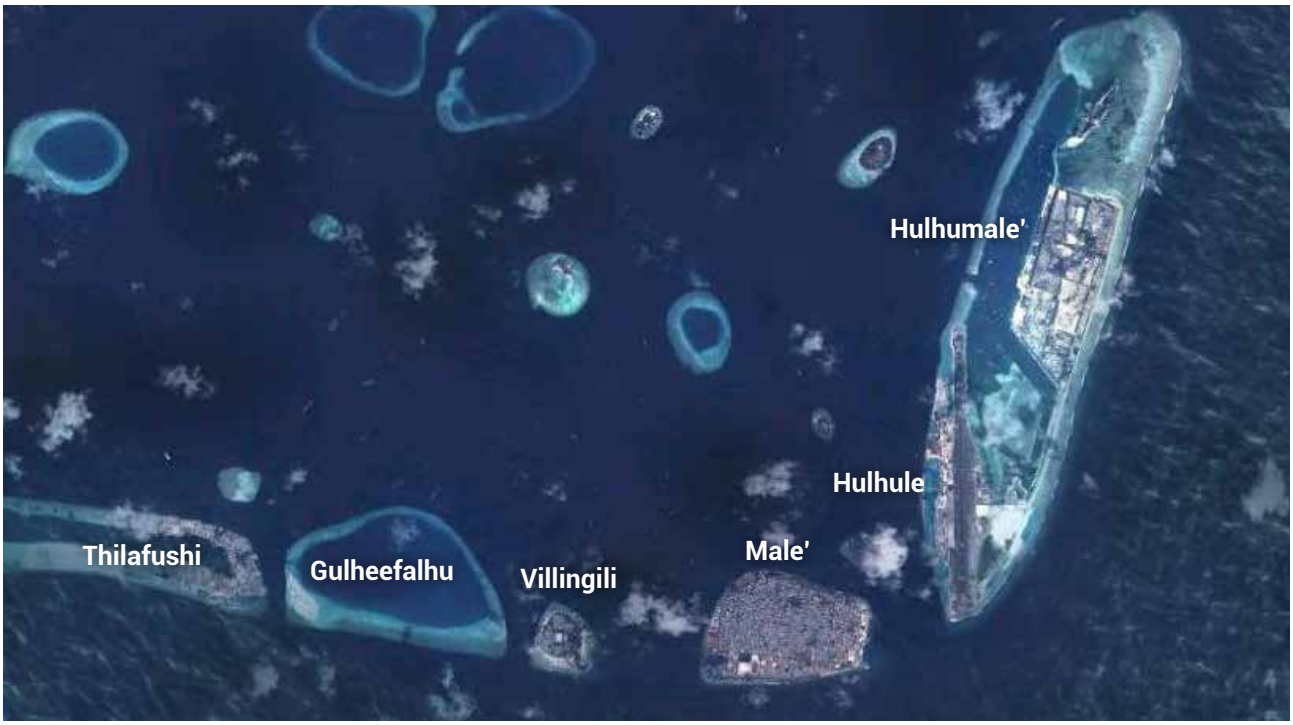


Figure 5: Greater Male' region

Outer islands:

For the purpose of this IP, the islands outside greater Male' region are referred to as outer islands. Out of a total of the 194 inhabited islands, power systems on 113 islands were analysed on an island-by-island basis, regarding their electricity production/consumption, installed capacities, and associated costs. Annual electricity consumption varies significantly, ranging from 8,000MWh to less than 95MWh. Similarly, the fuel efficiency varies from 0.68l/kWh to 0.26l/kWh. The average population[14] among the island groups ranges from 5700 people to less than 550 people (Figure 6). Based on these factors, the outer islands have been divided into four sub-categories: large electricity consuming islands, medium electricity consuming islands, small electricity consuming islands and very small electricity consuming islands as shown in Figures 7 and 8.

14 Based on population and housing census of Maldives 2006

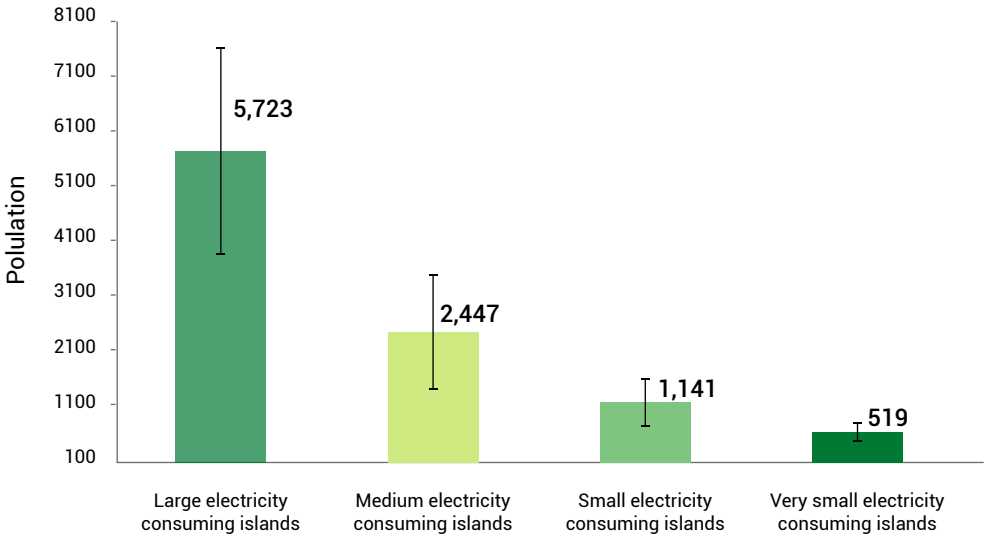


Figure 6: Average population size among the outer island groups

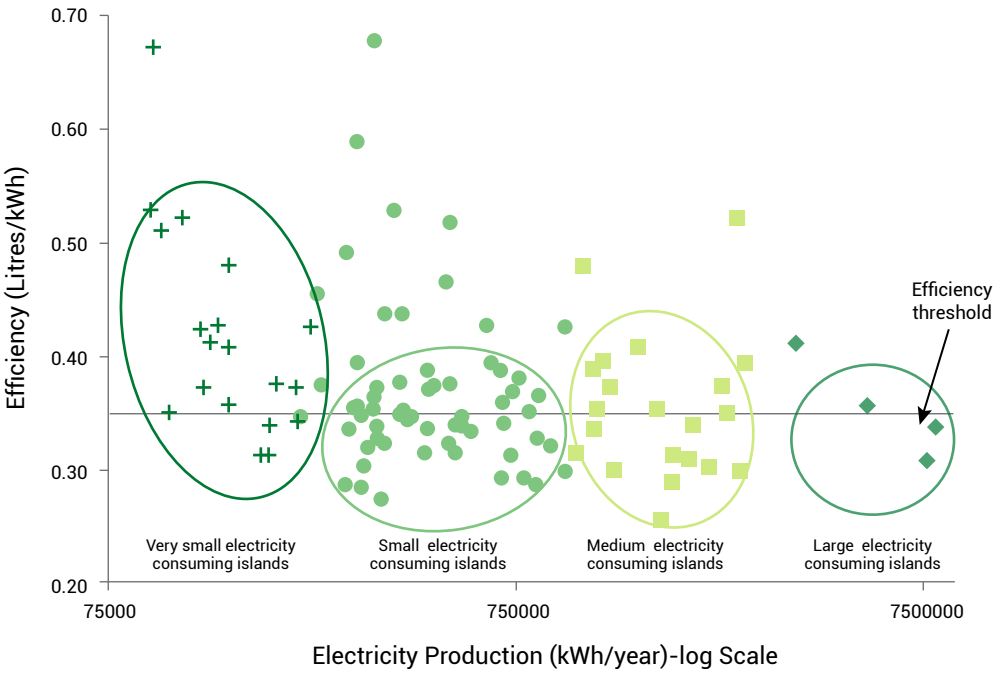


Figure 7: Island categories based on electricity production and efficiency

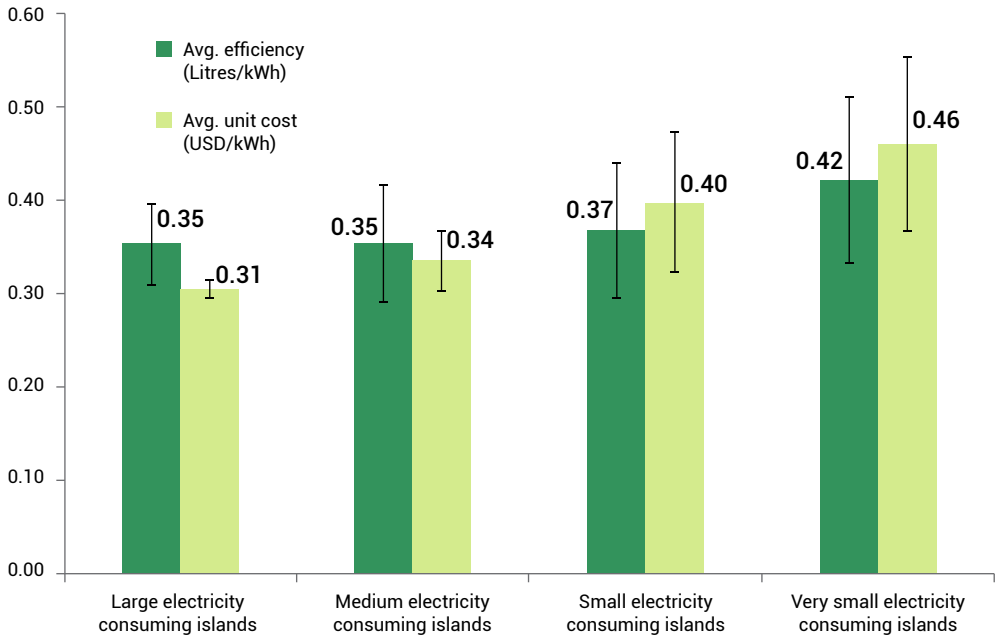


Figure 8: Comparison of average fuel efficiency and unit cost of generation for the different categories of outer islands[15]

Large electricity consuming islands:

Outer islands that consume electricity exceeding 3GWh/year have been classified as large electricity consuming islands. Power systems operating on these islands have been properly designed and are considered reasonably efficient with an average fuel efficiency of 0.35l/kWh. In addition, the average cost of electricity production on these islands is considered to be lowest at USD 0.31/kWh while the cost varies between USD 0.30/kWh and USD 0.32/kWh. Even though these islands have the lowest average electricity tariff among all outer island clusters, the unit cost of diesel electricity is still higher than that of solar/wind generated electricity. The islands under this category have an average population of 5,723 people. All nine islands that fall under this category are considered as RE ready under the FIT with some possible system upgrading (See Appendix 5 for more details).

Medium electricity consuming islands:

Medium electricity consuming islands have electricity consumption between 1GWh/year to 3GWh/year. This category includes 21 islands with a fuel efficiency between 0.26l/kWh to 0.52l/kWh. In addition, the average cost of electricity production on these islands is considered to be USD 0.34/kWh while the cost varies between USD 0.28/kWh and USD 0.43/kWh. Power systems on some of these islands have been upgraded in the past and are considered efficient and RE ready for FIT. Also several islands can be identified where the power houses and the distribution systems would need to be upgraded to reduce the diesel usage per unit of electricity consumed and to make the islands ready for RE through the FIT. The islands under this category have an average population of 2,447 people (Appendix 5).

Small electricity consuming islands:

Electricity consumption in these 62 islands is in the range of 250MWh/year to 1GWh/year with a fuel efficiency between 0.27l/kWh to 0.68l/kWh. In addition, the average cost of electricity production on these islands is considered to be USD 0.40/kWh while the cost varies between

15 Displays error bar for selected series with standard deviation.

USD 0.31/kWh and USD 0.49/kWh. Even though there are efficient power systems on some of the islands in the category, on most of these islands power systems are considered inefficient. In addition, the electricity demand as well as the electricity growth rate are relatively small. Due to small size, low return on investment, small population coupled with small growth in electricity demands these islands are not very attractive for private investors. This makes them potential candidates for complete RE transformation including necessary power system upgrading[16]. The complete RE transformation will have a strong demonstration effect that would potentially inspire others to follow the model both on other Maldives islands, but also on a global scale. The islands under this category have an average population of 1,141 people (Appendix 5).

Very small electricity consuming islands:

All islands that have a consumption of less than 250MWh/year are considered as very small electricity consuming islands. The fuel efficiency on those islands ranges between 0.311/kWh to 0.671/kWh which indicates extremely inefficient power systems. The 20 plus islands under this category all have a very small demand and have virtually no potential for further growth. Investments in these islands are not considered to be economical and will therefore not be considered under Maldives SREP IP. The Government is considering promoting voluntary relocation programmes for these small populations to islands where development potential and other opportunities are greater. The islands have an average population of 519 people (Appendix 5). Based on the above assessments, Table 4 summarizes those outer islands selected under the Maldives SREP IP for RE investments.

Table 4: Island categories and SREP interventions

Category	Total No. of Islands studied	No. of islands selected under Maldives SREP IP	Mechanism of intervention	Additional comments
Greater Male' region	6	3 (Male', Thilafushi & Hulhumale'')	FIT	Some minor adjustments to the power systems
Large electricity consuming islands	4	4	FIT	Some minor adjustments to the power systems
Medium electricity consuming islands	21	26	FIT	Power system of 15 islands may need complete replacement or major upgrading
Small electricity consuming islands	62	10	Complete power system transformation to full RE with storage	Power distribution systems upgrading is needed.
Very small electricity consuming islands	20			Not considered under Maldives SREP IP
Total	113[17]	43		

16 These islands would have solar PV installed with batteries at a generation cost of around USD 0.35/kWh, whereas the current cost of generation for the diesel systems is at around USD 0.40/kWh. Based on the difference a decrease in subsidies for the fuel surcharge might occur, even though there might be the need for keeping diesel generators as backup which as a result would lower the cost reductions .

17 Greater Male' region is counted as 6 islands, Addu central power station provides electricity to 4 inhabited islands that are interconnected and therefore, counted as one island (107 outer islands and 6 islands in the greater Male' region)

Tourism sector:
All 105 islands that are operated as tourist resorts (one island one resort exclusively) have their own private generating facilities. Although there is no accurate record of the installed capacity at these resorts, a reasonable working estimate is 1 MW per island, making the tourism sector as big as the state sector. The tourism sector was not considered under Maldives SREP IP due to the fact that grant finance allocated for the Maldives should benefit the local populations as a priority as opposed to lucrative businesses that can afford to invest own finance to run similar programmes. Maldives SREP IP will however share lessons learnt to tourist islands to motivate and encourage them to follow a similar path. This may be important to deepen the opportunities for PV sales, providing an additional attraction for investment when there is a clearer path to an increase in the scale of the market.

1.7 ELECTRICITY PRICING AND SUBSIDY

The tariff methodology and structure currently applied by the regulator, Maldives Energy Authority (MEA) was introduced in 2009. Electricity tariffs are determined based on average tariff, dividing customers into three categories: residential, business and governmental (see Figure 9).

Tariffs for each group are fixed by using an ad-hoc method (trying to produce small adjustments to previously existing tariffs) and a reconciliation test (assuring that with the approved tariffs each region is capable to collect the allowed revenues). Tariffs are single part (only energy) and increase with consumption.

With the current tariff a correction mechanism was introduced in order to adjust end-user tariffs to the variation in fuel prices (the latter currently represents above 80% of total costs in the Maldives). This adjustment is carried out monthly through a fuel surcharge mechanism which is added to the monthly invoices. The fuel surcharge is calculated according to a formula, which assumes an average efficiency of the generation sets of USD 0.35l/kWh of fuel.

When the tariff was first introduced the price for a litre of diesel was around USD 0.5. Today, this price has almost doubled to about USD 1 per litre. As a result of this increase, the fuel surcharge amounts to about 45% of the final bills.

With the current tariff, the Government also introduced a subsidy scheme for domestic consumers. This is part of the social welfare protection, to make access to electricity affordable to average households. The tariffs actually paid by end-users are reduced by the application of subsidies. Two types of subsidies exist as shown in Figure 9.

Cross subsidies (among customers or customer categories): Governmental and business tariffs are higher than residential ones, although the costs imposed by these customers are roughly similar than domestic consumers.

Direct subsidies are paid for domestic customers as Fuel Surcharge Subsidies and Usage Subsidies. Fuel surcharge for domestic customers (although reflected in the customer's bill) is paid in full by the Government. Customers have to claim (individually) to receive this subsidy. In addition to

this, as a Usage Subsidy, lower energy blocks up to 400 units are subsidized for those customers who claim it under the social welfare scheme. On average, 57% of the domestic customer's bill is written off as subsides and paid to the service providers.

Figure 9 depicts the average tariff and fuel surcharge compared with the generation costs using diesel and solar PV. The average cost of generating a unit of electricity in the greater Male' region is around USD 0.30 using diesel compared with USD 0.23 using solar PV.

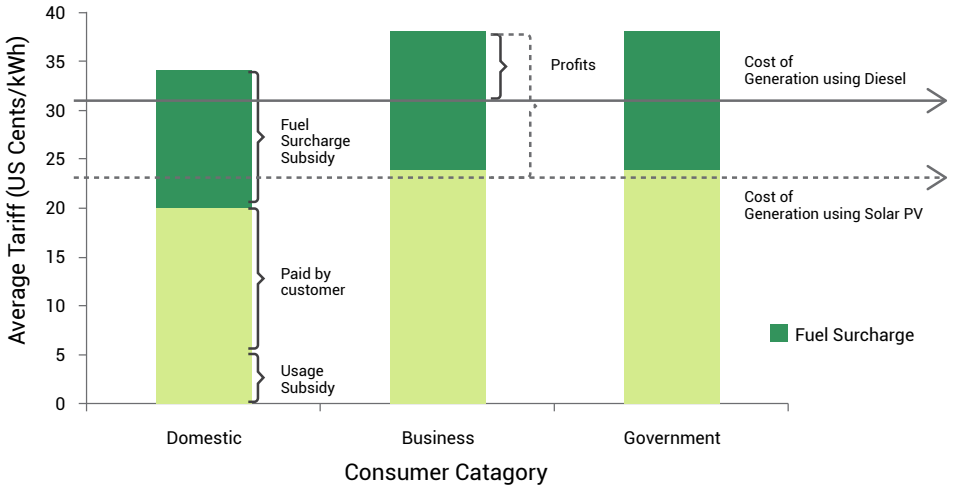


Figure 9: Fuel surcharge compared with generation costs and subsidy for Male'

Current tariffs are based on existing (historical) costs rather than expected (future) ones: Several important investments are currently being evaluated which, if materialize, may lead to a further increase in electricity costs making future overall costs even higher than the historic ones and therefore RE even more favourable[18].

The requirements of important investments in the short term (islands interconnection, replacement of old, inefficient generators etc.): As investments (capital costs) are not a factor explicitly incorporated into the current tariff methodology, it is not possible to guarantee that these costs will be properly recovered, which challenges the overall sustainability.

To find a balance between the right incentives for sector investors and the appropriate level of subsidies, major structural change to the system are required. Recognising this, the Government has initiated several programmes, with the assistance of the WBG's economic stabilization and recovery credit programme, to stabilize the economy and to put in place some key elements needed for a sound recovery including laying the foundations for a harmonized national social protection system to better target subsidies prevalent in the current electricity structure.

In parallel, and to remedy the challenges identified above, a comprehensive new tariff structure for both conventional and RE will be introduced under ongoing technical assistance from ADB. The proposed FIT structure is provided in Appendix 6.

18 The current tariff is based only on one variable which is the cost of fuel. It does not take into account other variables such as staff costs, inflation, etc. In addition, the on-going Fourth Power Development Project is being carried out under a loan scheme of up to USD 30 million. When these costs are considered in the tariff setting, the true costs could increase significantly.

2. INSTITUTIONAL FRAMEWORK FOR MALDIVES SREP IP IMPLEMENTATION

In order to improve governance and sector management, the Government has restructured the former Ministry of Housing and Environment, which had a mandate for energy amongst other sectors, and created a new Ministry of Environment and Energy (MEE). The new Ministry has a more focused mandate on energy, climate change, environment and water resources. Within MEE, a dedicated Energy Department is responsible for development and implementation of policies, legislation, and project/programmes including Maldives SREP IP. In addition, the Ministry coordinates directly with other stakeholders and government agencies on cross-sectoral initiatives. The government through its existing institutions has devised a mechanism to design, develop and implement investments in the energy sector and specifically for Maldives SREP IP. The proposed institutional relationships are described in Figure 10.

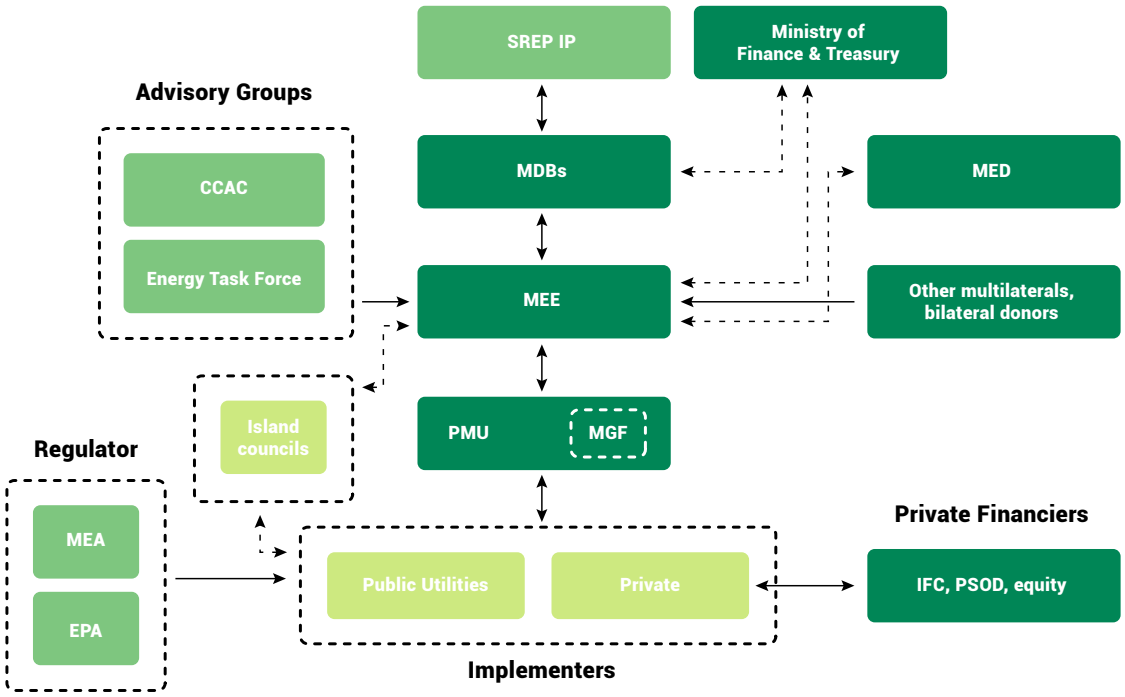


Figure 10: Institutional framework for SREP implementation

2.1 MINISTRY OF ENVIRONMENT AND ENERGY

The Minister of Environment and Energy represents the energy sector in the President's Cabinet of Ministers. A Minister of State solely dedicated to the energy sector has also been appointed to help the Maldives bolster its energy security and create important RE and energy efficiency policies and reduce greenhouse gas emissions. The Government has appointed the Permanent Secretary of MEE as the Focal Point for SREP coordination.

The key priorities of the Ministry with regard to energy sector development are to:

- Promote energy security by increasing the use of RE and diversifying the fuel mix;
- devise innovative financing for the development of the energy sector;
- advocate policies for efficient energy use by households, private and public sector;
- reform the energy market to ensure a diverse, safe, secure and affordable energy system; and
- tackle climate change internationally through ambitious international agreements.

MEE will be advised by Climate Change Advisory Council (CCAC) which is a high-level body setup under a Presidential decree and chaired by the Vice President of the Maldives. This council will advise, facilitate and enhance inter-agency cooperation and strategic guidance on climate change related issues. It will also play a strategic role in ensuring the timely implementation of Maldives SREP IP.

Within MEE, the Energy Department is responsible for overall coordination, management and implementation of Maldives SREP IP activities and projects. The Energy Department will also draw on expertise and technical inputs from proposed Energy Task Force comprising of experts from key Maldivian institutions as well as necessary experts from the public sector and internationally.

2.2 MALDIVES SREP IP IMPLEMENTATION

Day to day implementation of the Maldives SREP IP within the Energy Department will be handled by the PMU. The PMU is currently operational within the Department and is responsible for managing a number of externally-funded projects and programmes including four ongoing WBG operations. The existing PMU will be strengthened through Maldives SREP IP to handle the increased workload especially in the early years during the preparatory activities. Eventually, lead responsibility for RE and energy efficiency projects and programmes will be transferred to the Maldives Green Fund (MGF) which is being established. Once operational, it is expected to become a key element of the environmental management system of the Republic of the Maldives. MGF is expected to become the Maldives Government's dedicated institution for financing and enabling a wide range of priority projects/investments in the areas of climate change, environment and energy.

Project implementation will be led by the public sector utilities, private sector and other national agencies as outlined below:

- ***State Electric Company (STELCO):*** provides electricity service to the greater Male' region. The company has a comparatively long history of existence and technical capacity to handle projects in the region. The role of STELCO in Maldives SREP IP implementation would be to purchase electricity from private suppliers as well as public sector investments in the power sector.

- ***FENAKA Corporation:*** is mandated with providing electricity and other utility services to all inhabited islands in the Maldives, with the exception of the greater Male' region. The role of FENAKA in Maldives SREP IP implementation is similar to that of STELCO but for the outer islands. Presently, the company lacks sufficient technical and financial capacity to implement large scale RET projects. Therefore, in the initial phases of Maldives SREP IP, the PMU will be supporting FENAKA in implementing the relevant Maldives SREP IP programmes and projects, while simultaneously strengthening FENAKA's capacities. Eventually FENAKA will assume full responsibility for Maldives SREP IP implementation and RE expansion in the outer islands.

- ***Private Sector:*** domestic and international private investments are central for achieving Maldives SREP IP and national goals. They bring financing, advanced technologies, strong technical and professional business management expertise. Recognizing their importance, the government of Maldives through its own initiatives and Maldives SREP IP will be addressing investment barriers and risks of concern to these investors and pro-actively reaching out to them through road shows and investor conferences. Domestic commercial banks are currently not financing RE investments, but may do so as experience in the sector builds up.

- ***Other National Stakeholders:*** The Government through the Ministry of Finance and Treasury will support the programme through contributions from the national budget as well as structuring Overseas Development Assistance guarantees through MDBs to cover commercial and non-commercial risks. The Ministry of Economic Development will support and assist local and foreign investors and provide incentives for private sector engagement. The Central Procurement Agency will carry out tender processes for larger procurement packages. The Maldives Meteorological Service (MMS) will lead RE resource data collection and management required for Maldives SREP IP funded projects and beyond. At island levels the projects will be implemented with the consent of the Island Councils who will play a major role in implantation of the projects.

2.3 REGULATING FUNCTIONS

Maldives Energy Authority (MEA): as the regulator, will have a critical role to play in establishing tariffs, issuing guidelines and regulations to ensure the reliability, security of the grids, and that the rights and obligations of consumers and service providers are safeguarded. MEAs role is crucial for the success of Maldives SREP IP implementation as the programme envisages significant private investment in delivering renewable electricity. In this regard, MEA is developing a comprehensive energy sector regulatory framework with technical assistance from WBG and ADB. Through this support, regulations on licensing, standards of performance, energy efficiency labelling, investment approvals and technical regulations are being developed.

Environmental Protection Agency (EPA): will be responsible for implementation of the Maldives Environment Act and the Environmental Impact Assessment Regulation. This will ensure that investments under Maldives SREP IP are compliant with Maldivian Law as well as applicable MDB safeguards requirements.

3. MALDIVES SREP IP AS A KEY STRATEGIC TOOL

3.1 MALDIVES SREP IP CONTRIBUTION TO CARBON NEUTRAL STRATEGY

The carbon neutral policy has multiple benefits in terms of CO_2 emission reduction, energy security, electricity cost reduction and ecosystem conservation. According to the Carbon Audit 2009[19] the present status of emissions is at 1.3 $MtCO_2$ equivalents which, by 2020 will increase up to 2.5 $MtCO_2$ equivalents under a usual business scenario (Figure 11). Maldives SREP IP is targeting the electricity sector which contributes 19% of the total CO_2 emissions. Maldives SREP IP also has a very significant demonstrative effect to the tourism sector which is one of the largest emitters of CO_2 in the country. There are number of Government led programmes targeting various sectors (see Appendix 3 and 4 for details). Therefore, the Maldives SREP IP is part of a larger programme tackling the climate change agenda.

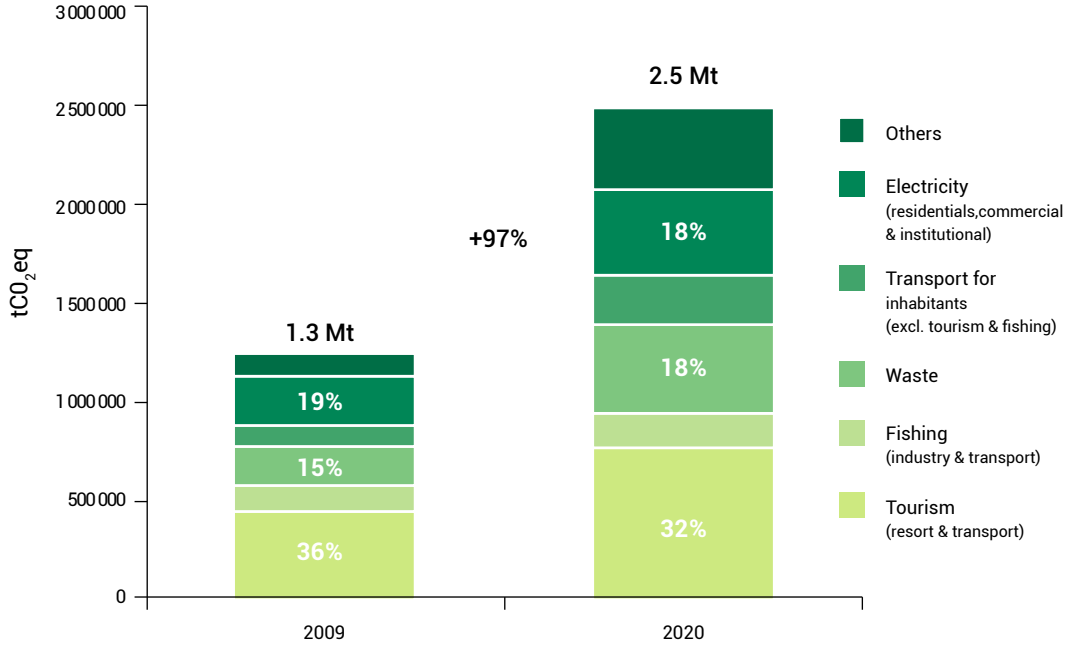


Figure 11: Emissions by the major sectors in the country

Reaching the target of a carbon neutral energy sector by the year 2020 is of high priority to the Government. Even though there is universal access to electricity in the Maldives, it is based entirely on diesel generators. Maldives SREP IP will complement the overall RET development programme stated in the National Sustainable Development Strategy from 2009 that sets out the targets for achieving carbon neutrality for the energy sector.

Maldives SREP IP will support the RE development in the greater Male' region and the outer islands with a strong focus on solar PV, wind and WTE, including public and private investment as well as related capacity building of government bodies, utilities and other stakeholders.

MEE is in the process of formulating a Renewable Energy Law with a long term perspective for the RET development including a functioning FIT system. The Government is also supporting the establishment of a coherent and efficient structure for the electricity market through the following actions and policies:

19 BeCitizen, 2009 Carbon Audit, November 2010

- Establishment of an enabling legal framework and policies to alleviate barriers to RE and mitigate associated risks;
- development of an institutional framework to support RE development by the private and public sectors;
- strengthening of MEE and related institutions and instruments such as the MGF; and
- development of a financing mechanism, including risk mitigation instruments, to address the needs of project developers and banks.

Maldives SREP IP will further strengthen the above actions and policies through appropriate interventions.

3.2 USING MALDIVES SREP IP TO OVERCOME THE BARRIERS AND CHALLENGES IN THE SECTOR

Table 5 outlines the key barriers and challenges which will be addressed through Maldives SREP IP interventions.

Table 5: Key barriers and challenges

Barriers and Challenges	Maldives SREP IP interventions
Inadequate information on the availability of RE resource – Presently with the exception of solar and apart from some data on wind speed, there is limited information on the magnitude of RE resource potentials in the country, which could be utilized in designing and developing RE-based projects either for electricity and non-electricity purposes.	By collecting and supplying quality resource data to the RE community.
People in the country, particularly in the outer islands are not aware of the various aspects of the installation and operation of RE systems. In addition, many perceive RE as a free resource and therefore may not have to pay for electricity service.	As a complementary activity to Maldives SREP IP the government plans to introduce an RE module in training programmes conducted for the island counsellors at the Institute of Local Governance and Development to sensitise them of the socio-economic and environmental aspects of RE technologies. MEE will also carry out media campaigns using mass media to raise awareness of the public on RE benefits.
Inadequate policies on the utilization of RE – Although the GoM has committed itself to pursue the development of RE resources as a means to sustainable development, inadequate policies are in place to support efforts to engage in RE-based projects in the country. There is a need for policies and regulations regarding financial and economic incentives to undertake RET applications.	Through Maldives SREP IP technical assistance the RE policy and the regulatory framework will be strengthened by developing and implementing policies, laws, regulations, rules, standards and incentive schemes to integrate RE in the energy sector. Electricity FIT and tariff mechanisms, standardized PPAs, guidelines for investment approval, licensing of electricity operators, etc. to support RE development have been carried out and will continue to be supported under Maldives SREP IP.

Inadequate capability of the key players in the government sector in the development, design, implementation and management of RE technology application activities – Because of the complete dependence on fossil fuels, capacity among policy makers and technical people in RE development is very limited. Presently, there is very limited trained manpower in the country to assess, plan, implement and monitor RE technology development and implementation on a significant scale. In addition, limited institutional mechanism exist to support the dissemination of RE technologies, as well as in the diffusion of knowledge and skills in the operation and maintenance of RE.	By building the technical and commercial capacity to enable utilities to enter into and manage good contracts. In addition, skill development for the public sector will be developed for better planning, implementation and operation of RE systems. In addition to training, international expertise will be sought to supplement local capabilities for example on advisory services on technical design, procurement, packaging projects, bidding & awarding contracts, legal and commercial aspects, etc. for Maldives SREP IP. Furthermore, MEE is considering introducing a degree level programme at Maldives National University to build long term capacity and develop/retain a cadre of energy professionals that become the future catalysts of change and can help sustain these transformative investments. Funding will be sought from other sources.
Limited involvement of entrepreneurs in producing and servicing RE systems – Except for a few entrepreneurs that are interested in engaging in RE business, there is a general perception that the private sector is not interested in investing in RE business.	By reducing commercial and sovereign risks through guarantees, capital injection (where needed) and by marketing RE projects in the Maldives and overseas this would make investments in the sector more attractive.
Lack of significant field demonstration of RE technology applications – only few individuals have some knowledge about RE technologies, plenty are still doubtful if such technologies will work in Maldives. There is a need for successful demonstration of actual applications of the appropriate RETs in order to convince potential users.	Although a few pilot projects have been implemented, they are often too small and do not demonstrate the needed scale to bring transformative change to the sector.
Lack of financing available for RE applications as well as for RE-based livelihoods projects.	The introduction of the FIT, incentives and guarantee facilities and strong regulatory framework will encourage investor to venture into this market. Maldives SREP IP provides the opportunity to target vulnerable island communities where cost of financing is usually prohibitive.
Small scale and high complexity of transactions.	By aggregating projects, providing regulatory clarity, and by providing technical information and support to developers to reduce pre-investment costs.
Power station readiness- a sizable group of islands currently requires significant upgrading of the diesel generators, grid system and controls. This is prerequisite to transitioning to increased share of solar/wind.	By adapting power stations to accept high levels of intermittent RE on a 'plug and play' basis. This will be done in conjunction with a major power station upgrade programme to reduce fuel use.

3.3 RENEWABLE ENERGY RESOURCES IN THE MALDIVES

3.3.1 SOLAR ENERGY

Solar energy will play a crucial role for the RET development in the Maldives. There are already some successful installations of solar PV and solar heating applications in the Maldives[20].

Maldives is blessed with an abundance of sunshine year round. As it is located on the equator, solar declination is not an issue throughout the year. As shown in Figures 12-14, there is a constant level of sunshine throughout the year taken from a sample of three islands in the north, central and south of Maldives, respectively.

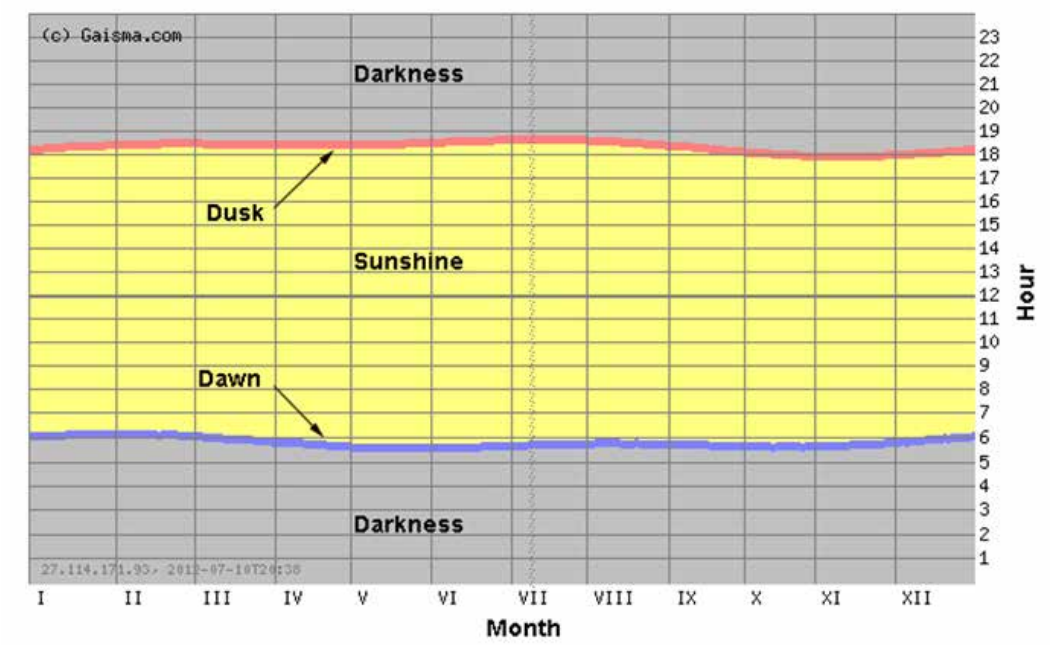


Figure 12: Solar insolation in HA.Dhidhoo Island (source: www.gaisma.com)

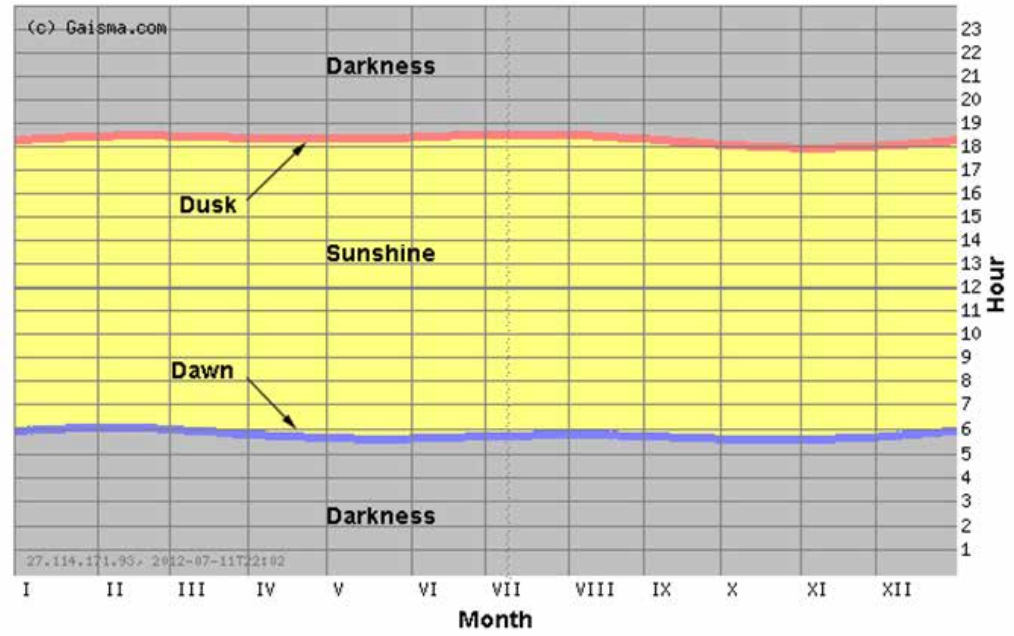


Figure 13: Solar insolation in Male' (source: www.gaisma.com)

20 Such as the STELCO Six Island Solar PV Project - the first project that has been completed under a PPA signed between STELCO and Renewable Energy Maldives (REM).

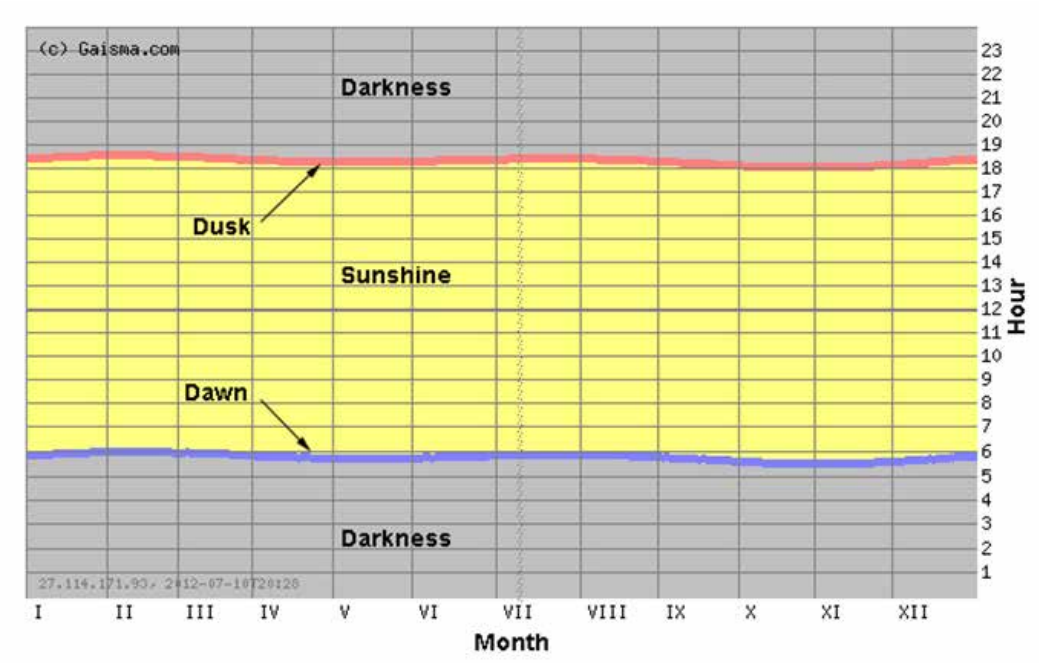


Figure 14: Solar insolation in Gn.Fuvahmulah Island (source: www.gaisma.com)

The spatial distribution shows little variation of sunshine, indicating that solar declination is not an issue when the geographic span of the islands is considered. Therefore installation of the solar PV units would be easier compared to other parts of the globe where the units have to be south or north facing to get the maximum output from the units.

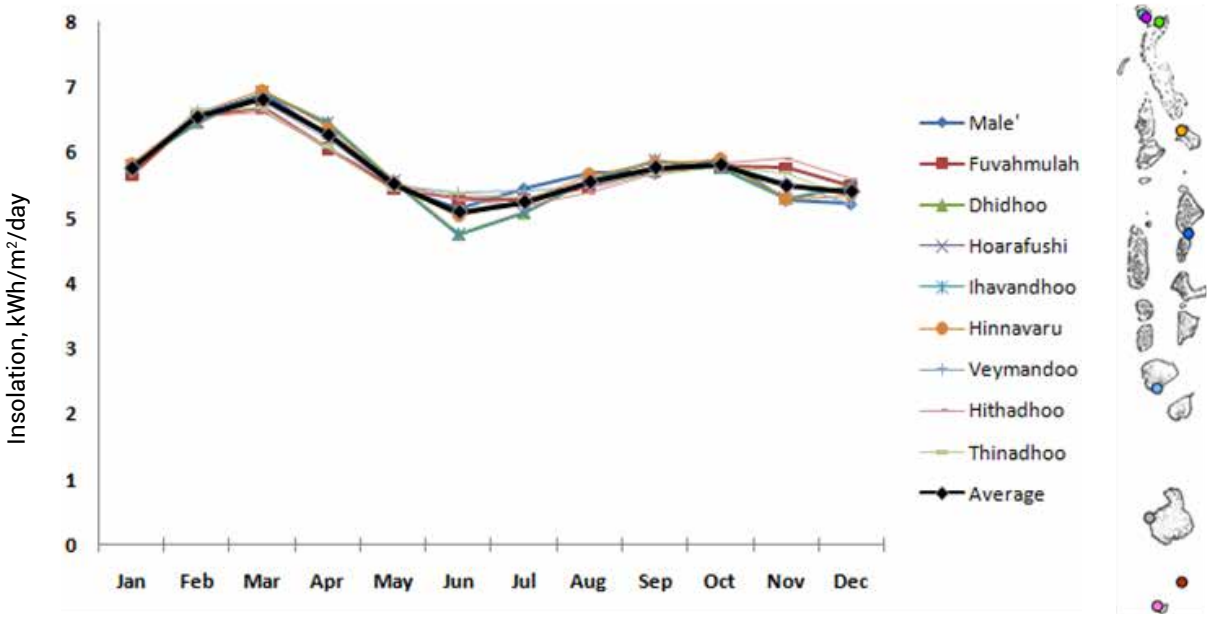


Figure 15: Spatial variation in solar power insolation

Figure 15 shows the spatial variation in solar power insolation in Maldives. It shows maximum of approximately 7kWh/m^2/day and a minimum of 4.5kWh/m^2/day. This shows that there is little spatial variation of the sunshine received throughout the country.

Rooftop areas of randomly selected islands were considered to seek the availability of rooftop space of individual households and public buildings for solar panel installation. The calculation shows roof space availability to meet 30% of the electricity demand in some islands while it reaches 80% in some other islands. Further surveys are likely to identify additional suitable roof space for solar PV installations.

Solar photovoltaic: Photovoltaic technology is generally used for power generation as an alternative to conventional methods. The technology was introduced to the Maldives as a power generation technology fairly recently in 2005. Since then, popularity of the technology rose with multiple private companies providing PV solutions and increased number of utility projects embracing this technology. This was driven mainly by the high cost of generation from diesel coupled with falling solar PV prices. For instance in the case of large electricity consuming islands the unit cost of diesel based electricity production is USD 0.35/kWh while the cost of electricity generation from solar PV is USD 0.23/kWh. Even with battery storage, in the case of small electricity consuming islands, the cost of electricity generation using solar PV is found to be USD 0.35/kWh which is lower than diesel based electricity generation (USD 0.40/kWh) making this a viable technology for consideration under Maldives SREP IP.

Solar heating technologies: Solar heating technologies are a commonly used technology in the world and well known in the Maldives. Solar energy is used for water heating as an alternative to electric heaters and even air conditioners to increase its efficiency. Although the technology is widely available, lack of awareness, limited service providers competent in dealing with the technology and quality assurance is still an issue. The technology is currently used in tourism industry for water heating and has little or no application in local islands due to limited demand. Further, since Maldives SREP IP projects are mainly targeting local inhabited islands and solar water heating is currently serving a niche market this technology has not been selected under the Maldives SREP IP.

3.3.2 WIND ENERGY

According to preliminary assessments based on satellite data (Figure 16), the wind resource in Maldives is found between 4.5° N Lat. and approximately 6.5° N Lat. Covering the following atolls: North Maalhosmadulu, South Maalhosmadulu, North Miladhunmadulu, South Miladhunmadulu, and Faadhippolhu. This information would to be verified through meso-scale mapping to improve the quality and accuracy of the data throughout the country.

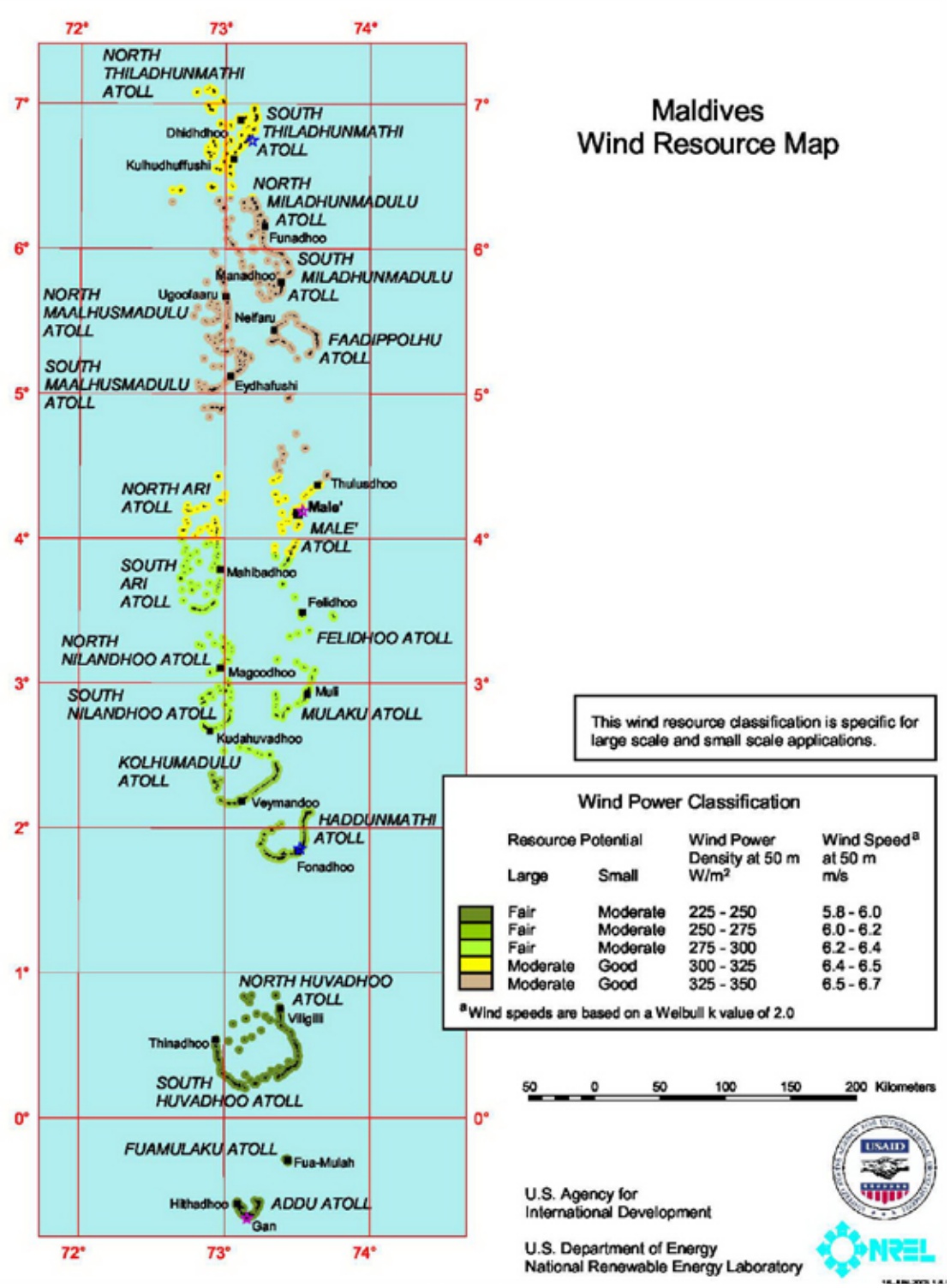


Figure 16: Wind resource map and the atoll names for the Maldives

Figure 17 shows that wind has a particular advantage and that the resource is most plentiful for the period of the year when the solar resource is at its weakest. Thus, wind power may be important to maximize diesel savings in the short term, and minimize the cost of energy storage in the longer term. Wind will therefore be supported under the Maldives SREP IP when used in conjunction with solar PV to provide a more consistent RE supply over the year.

Although predominantly focused on solar PV investments, where the conditions allow, Maldives SREP IP can support a material proportion of small scale wind to be used to supplement solar PV during the windy and cloudy months of the year.

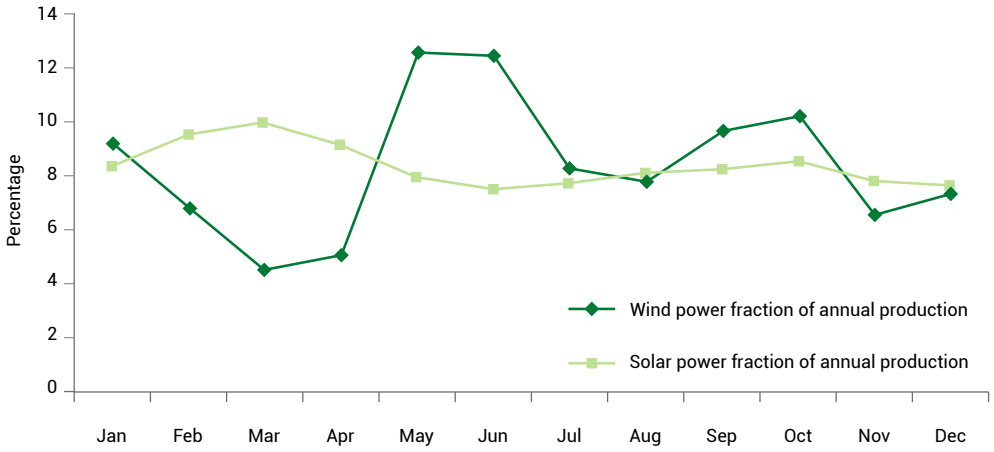


Figure 17: Complementary solar and wind resource patterns throughout the year

3.3.3 WASTE TO ENERGY

Waste management in the Maldives, just as with energy, is an unequivocal environmental issue which requires immediate and sustained investment to resolve. The National Solid Waste Management Policy (2008) and the Government's Strategic Action Plan identify that in order to overcome the lack of economy of scale for investment in waste management, up to 7 Regional Waste Management Facilities (RWMF) should be established within the Maldives. Such facilities are expected to promote integrated waste management in the Maldives and demonstrate waste as a resource that can benefit both economically and environmentally. The waste management policy encourages use of waste to generate electricity using sound technologies. There are considerable potential synergies between waste technology solutions and energy generation which are mutually beneficial.

A pre-feasibility study supported by UNDP and undertaken by IT Power India in 2007 identified that the incineration of waste to generate electricity is a suitable waste treatment technology for the Maldives. The pre-feasibility study considered that WTE technologies are viable for regional incineration facilities with a throughput of 15 ton/day or more. Principally waste heat extracted in the flue gas cooling process is captured and used for power production as well as in commercial enterprises such as desalinated water plants. The heat extracted from incinerator flue gas cleaning represents equivalence to the imported fossil fuel which would otherwise be required to produce the same quantity of water. Heat produced in the flue gas cooling process is an intermediate by-product of the incineration process and if it is not utilized for some other purpose it is simply vented to the atmosphere.

Currently the GoM is investing USD 4.5 million in R.Vandhoo RWMF. The waste treatment technology under consideration is incineration with a heat exchanger for flue gas cooling. The waste throughput is approximately 40 tons/day.

The IT Power India study identified that conversion of low pressure steam heated by the waste incineration process into electricity is technically feasible for RWMF with a throughput of 40tons/day or more. The technological options for developing WTE incineration facilities are more complex and come at a cost. Unlike waste for energy where heat is extracted from a heat exchanger which is an integral part of the flu gas cleaning technology, additional technology is required to produce low pressure steam and to produce electricity through a low pressure

steam generator. In addition, given the air quality constraints with locating incineration facilities near populations, additional investment may be required to transfer electricity produced from the incineration facility to potential users. Such investment would reasonably involve undersea cabling. Given the cost constraints potential for WTE incineration is likely to be limited to population centres where the demand is likely to be greatest such as in Male' and Addu.

Another technical WTE solution that may have potential in the Maldives is the syn gas technology. Rather than convert steam into electricity through a low pressure steam generator, syn gas technology uses pyrolysis to produce combustible gasses which are captured and introduced into a syn gas generator. Air emissions from such technology are generally more acceptable, and such technology can be provided in modules potentially making it more accessible to smaller regional populations. The constraints with such technology are that the capital cost is proportionally higher than more conventional technology, besides the complexity of the technology.

While it has limited potential, appropriate WTE technology is found to be technically and financially feasible in the Maldives and is the only technology which is not intermittent. Cost is highly competitive, much lower than diesel and hence has been selected under Maldives SREP IP.

3.3.4 BIOGAS

Biogas can provide a clean, easily controlled source of RE from organic waste materials, replacing firewood or fossil fuels. Since small scale units can be built and operated relatively simply, biogas can be used directly for cooking, heating or lighting. On the other side, both electricity generation and the compression of the gas (for storage or for use in vehicles) needs large amounts of energy compared to a relatively small output of useful energy. Therefore, biogas might only be an option when it can be used directly at the source, i.e. where waste is treated, or sludge is reused locally, and will not be considered under Maldives SREP IP.

3.3.5 OCEAN ENERGIES

Deep Sea Water Cooling: This technology utilizes the supply of cold sea water from depths over 1000 meter which can be used for offsetting electricity generated for cooling purposes. Maldives Water and Sewerage Company (MWSC) is studying a potential project at the new International Airport terminal in Hulhule Island.

Tidal and Currents: A preliminary desktop study by Robert Gordon University of Scotland in 2011 concluded that there was limited potential for tidal energy in the Maldives given topographical features. These may be some potential in channels between islands; however this would need to be systematically surveyed.

3.3.6 BIOMASS

There are only very limited biomass resources available in the Maldives. At a smaller scale, biomass gasifiers operate successfully in many countries. However, they require considerable maintenance, the conversion from biomass to electricity can be very low, and they are generally run only for a limited number of hours per day.

Introducing biomass powered electricity at small scale in the outer islands would require considerable investment in fuel preparation equipment, mobile equipment for transport (most

islands have little or no motorized traffic), maintenance facilities, etc. In addition, agricultural residues or wood needed are not available in the Maldives and are not likely to be growing in required quantities. If Maldives is to generate energy by utilizing biomass as fuel source at a large scale, it has to depend on imported biomass. Impacts of importing biomass for large scale energy generation will be studied further as a possible option under the feasibility study for the greater Male' region power integration.

3.4 ENERGY EFFICIENCY

Given the high cost of power generation, energy efficiency will play an important and complementary role to the development of RET in the Maldives. On the supply side, increasing the efficiency of generators and distribution network would offset and defer the requirement for upgrading diesel generation capacity. Similarly, on the demand side there exist several opportunities for efficient air conditioning, lighting, motors, appliances, industrial processes etc.

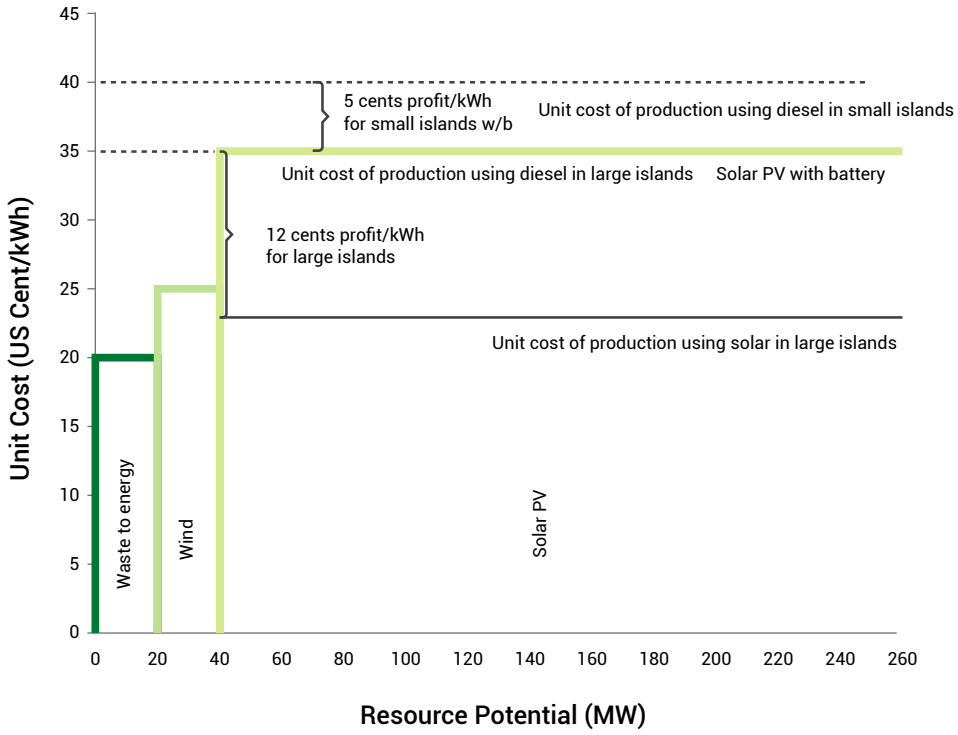


Figure 18: Renewable energy potential capacity and unit cost of generation for outer islands[21]

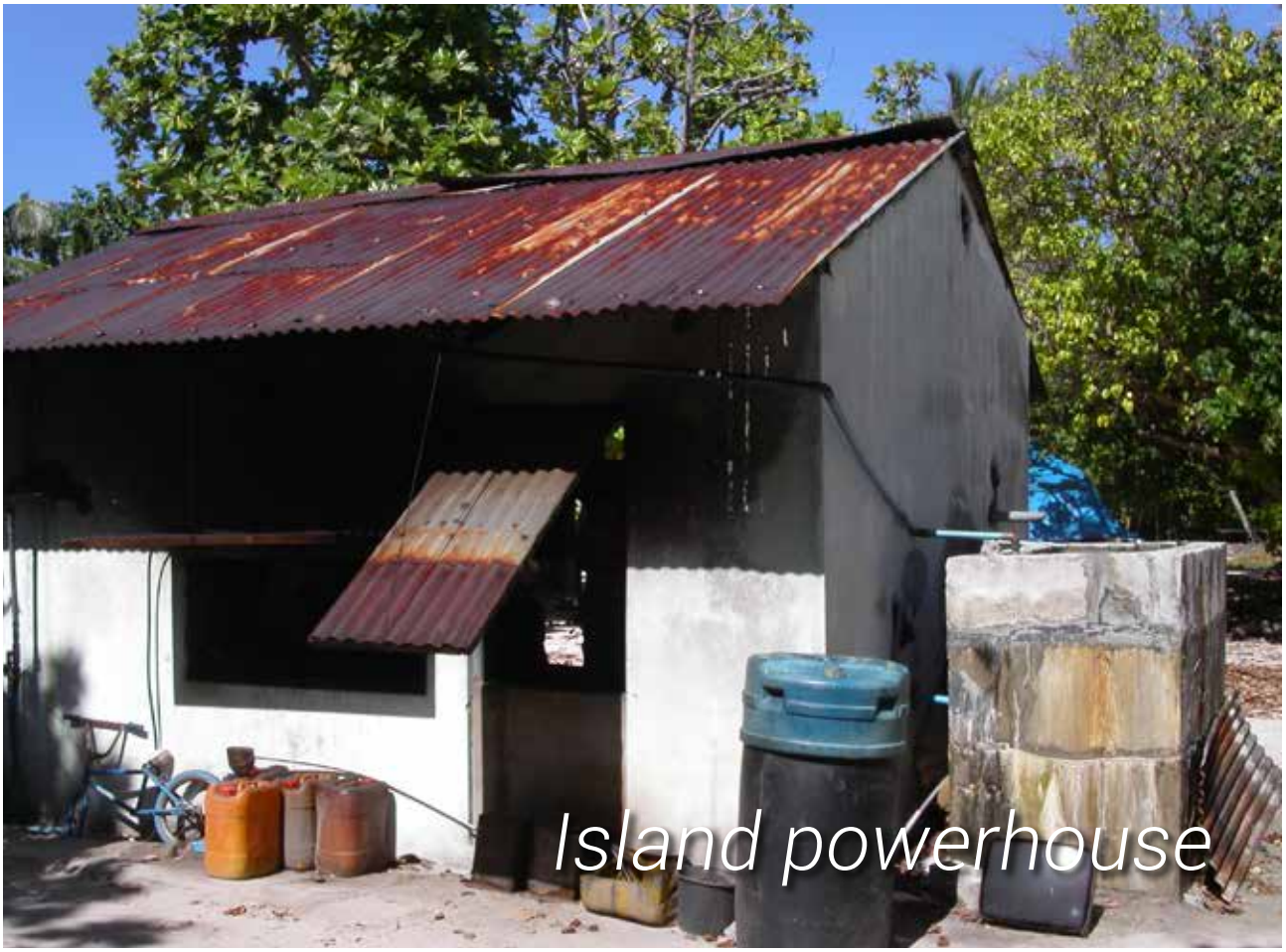
As shown in Figure 18, which presents a comparison of unit generation cost for the various RE sources that have been studied in some level of detail and their potential capacities in the country, WTE is the most cost effective but it has resource limitations followed by wind with similar shortcomings. Solar has immense potential and is economically favourable compared to generation cost using diesel. In small electricity consuming islands solar is found to favour over diesel even with battery storage. Table 6 sets out a summary of technology options considered under Maldives SREP IP and their estimated potential.

21 USD 0.23 is at lower levels of penetration of solar in the system, USD 0.35 cents is based on storage of 1 day using conventional batteries. Depending on days of storage (1 or 2) and storage technology used – cost will be from USD 0.35 to USD 0.50.

Table 6: Summary of technology options considered under Maldives SREP IP and their estimated potential

Technology	Potential in Maldives	Cost (USD)	Focus for Maldives SREP IP	Justification
Solar PV	Unlimited	0.23 w/o batteries 0.35 w/ batteries	Yes	RE technology with the largest potential and scalability. Solar radiation throughout the year with little variation throughout the country. Modular approach would allow gradual roll out. Both small and large investors might find their niche.
Solar heating	Limited application		No	Limited demand mainly focused in the resorts which are not covered in the IP. Technology is mature and does not require major subsidies.
Biogas	<1MW		No	The studies conducted show very little potential for the technology.
Tidal and currents	~10MW		No	Technologies are not commercially available and costs seem to be prohibitive for the time being. Tides and currents have seasonal nature which would not help to address the problem. Still, studies are underway to explore the potential.
Waste-to-energy	20MW	0.20	Yes	While it has limited potential, it is found to be technically and financially feasible in the Maldives and is the only technology which is not intermittent. Cost is highly competitive and is much lower than diesel. It has major environmental benefits in term of utilization of waste which often ends up in the ocean damaging fragile marine ecosystem
Wind (small-medium)	10-20MW	0.25	Yes	The technology has limited potential and significant seasonal variability. Large wind farms are unlikely feasible due to the variability and intermittency. However, small wind turbines can be a good complement to solar PVs in areas with good wind resource reducing the overall costs.
Deep sea water utilization for cooling	Feasible		No	Due to lack of distribution network the technology can currently serve only large industrial users (there is one pilot project under preparation). Expansion of the technology will be analysed as part of the study for Male' generation options.
Heat recovery	0-10MW		No	The technology can be used for desalination of water and some industries but it is not considered RE and will not be qualified for Maldives SREP IP support. Some heat recovery for desalination will be used in WTE projects.
Biomass		0.20	No	No local biomass is available. Feasibility of building a biomass plant for Male' based on imported fuel will be analysed as part of the Male, study on generation options to be supported by Maldives SREP IP.

Rooftop solar panels at STELCO, Male'



Island powerhouse

4. RATIONALE FOR MALDIVES SREP IP INTERVENTIONS

In selecting components for Maldives SREP IP interventions, consideration was given to such initiatives that have the potential to be scaled up, can leverage private investments, have transformational impact, innovation, poverty reduction, gender/social inclusiveness, and contribute to climate change mitigation. The IP takes into consideration the unique geographical and demographical characteristics of the Maldives having a densely populated Male' region surrounded by a large number of outer islands differing in size and population. The Maldives SREP IP will support the following three main components:

4.1 RENEWABLE ENERGY FOR GREATER MALE' REGION

As the national capital, the main industrial and economic growth point and the largest electricity consumer, Male' needs a large and reliable source of power. Current barriers for reaching a higher RET penetration are:

- Lack of awareness and capacity among stakeholders on RETs;
- risk and high costs of appraisal;
- lack of interest among the private sector to invest in RETs;
- inadequate policies, financial and regulatory mechanisms to promote RETs; and
- weaknesses in the overall and financial management capacity of local institutions combined with limitations of capital for accessing loans, along with the incapacity of local financial institutions to analyse RE projects.

This intervention aims to reduce above mentioned barriers. It will support successful portfolio development of the sector and lower risks by means of demonstration and through training and experience gaining and sharing provided to stakeholders in the market such as developers, financial institutions and communities to enable the transformation of the energy sector.

Scope

Greater Male' Region Solar PV: it is possible to feed solar PV generated electricity amounting to 20-30% of the peak day time demand in greater Male' region without significant investment in sophisticated systems upgrading. Considering the respective peak demands for various islands in the region as shown in Table 7, 15 MW of solar PV can be safely fed in to grid systems in the greater Male' region by 2015. Additional solar generation potential exists on rooftops of industrial sites in Thilafushi, Gulheefalhu, Hulhule, Hulhumale' and transmitted to Male' via submarine cable. This will relieve the pressure of providing the capital Male' with a huge standalone power supply, which would be physically impossible to install within the capital. Additional benefits include improved system efficiency and reliability with larger and more diverse power sources.

Table 7: Available PV potential in the islands of greater Male' region

Island	Peak Demand by 2015 (MW)	Existing & Planned PV (MW)	Available PV potential (MW)
Male'	37.2	0.7	13
Hulhumale''[22]	4.9	0.06	5
Villingili	1.1	0.3	1
Thilafushi[22]	1.9	0	1
Hulhule (Airport)	13.7	0	4
MWSC	5.2	0.05	2
Total	18.9	1.11	26

The FIT mechanism will be used in deploying the solar PV on greater Male' region. FIT is already in place and MEA is updating it. The final draft of the standardized PPA is ready and drafts with solar PV - grid connection specifications and guidelines are available at MEA. Off taker is STELCO as mandated by MEA.

Financing requirement of this component is expected to be about USD 49 million, of this the private sector will contribute about USD 26.5 million as equity and debt to finance the installation of about 11MW in Male' and additional 4MW on other islands in the greater Male' region. USD 11 million for investments will come from JICA, SREP and WBG financing will be used to provide risk mitigation facilities and/or incentives to private companies during the early stages of the implementation of the FIT scheme.

Waste-to-energy (Thilafushi): will be considered under the greater Male' region electricity supply. Thilafushi receives more than 200 tons of combustible waste per day, which would allow the installation of a facility to generate up to 4MW. The electricity produced can be used to meet the demand of the island and will generate additional revenue from the sale of water.

The project is part of a larger scale integrated waste management system including waste collection and transportation to Thilafushi and waste processing and disposal on Thilafushi (segregation, recycling, composting, gasification and inert waste disposal in the landfill). Under the Maldives SREP IP, only the construction of an up to 4 MW WTE power generation project to replace the existing diesel-based power generator on the island is considered. It will be developed under a Public-Private Partnership (PPP) arrangement. The investor is expected to self-finance the project. This project is expected to cost around USD 20 million, of this the private sector will contribute about USD 5 million to finance the installation of about 4MW, USD 10 million will be provided by IFC and ADB's PSOD. Maldives SREP IP financing will be used to cover electricity payment risk. SREP funds may be required to meet the financing gap described above or cover the incremental costs or risks of project implementation. ADB and IFC will consider the following options for deploying the SREP funds: (i) parallel concessional loans; (ii) partial credit or risk guarantees or other risk sharing mechanisms; (iii) buying down of fees and/or risk premiums from the commercial political risk insurance market; (iv) covering the risks associated with electricity off-take under a GoM FIT scheme; and (v) other forms of subordinated or mezzanine finance.

Greater Male' Region Renewable Power System Integration: In order to further displace the use of diesel generation, additional RETs are required. A feasibility study will be carried out under Maldives SREP IP to identify RE options to deliver large-scale dispatchable power for greater Male' region and achieve economies of scale through inter-island connectivity. The study will

22 Only STELCO-operated plants are considered; does not include additional private generating plants

recommend further initiatives to be supported by Maldives SREP IP and from other resources. The feasibility of a submarine cable to connect the islands of the greater Male' area will be studied. The region will profit from an improved energy infrastructure, which in turn will support the social and economic development of the region.

Phase 1 (attracting investors for solar PV) and WTE in Thilafushi will serve as learning platforms for RE for outer islands, they will show the effectiveness of the new institutional set-up and can provide the necessary insight for MEE and MGF.

Last but not least, successful implementation will improve the investment climate in general and might lead to more competition between RE producers and a better understanding of the banking sector to strengthen its capability in providing project finance for the RET sector.

4.2 RENEWABLE ENERGY FOR OUTER ISLANDS

Electricity generation from solar PV, and wind in some locations, is less expensive than energy generation from diesel based on avoided cost of fuel in the Maldives. Given that these are intermittent generation technologies these would be supplemented by either energy storage and/or diesel back up.

Based on island classifications as detailed in Section 1.6 the RE development strategy for these islands is summarized below in Table 8. For the small electricity consuming islands installation of solar/wind with battery storage is economically justifiable based on the fact that generation cost of electricity using diesel is found to be USD 0.4/kWh while solar PV with adequate battery storage unit cost of generation is USD 0.35/kWh. This being the case, proper assessments will be necessary in order to identify the best RE mix for each of the selected islands, including potential savings due to energy efficiency measures, additionally considerations will also be given to take the advantage of gradually decreasing world market prices[23] for battery storage and solar PV systems. Hence, a 2-step approach will be adopted in order to optimize the use of the available financial resources. Under this phase-wise approach, 70% of electricity demand of 10 small electricity consuming islands will be converted to RE within the first 2 years and subsequently leading up to 100% RE conversion in the next 3-4 years of the Maldives SREP IP implementation. The lessons gained in the first step would serve the purpose of gaining valuable experience that can be later used to convert remaining 30% to RE more efficiently and effectively and it would also serve as a best practice for other islands, resorts and islands in other islands in SIDS, where RE transformation is possible[24].

For medium to large electricity consuming islands with inefficient energy generation power system, upgrading is a prerequisite to increase the share of solar/wind. On efficient medium and large electricity consuming islands increasing the share of solar/wind can start immediately minor adjustments to existing power systems. The share of solar/wind in the energy mix is dependent on the cost of storage and cost of diesel.

23 Renewable energy technologies: Cost Analysis Series Volume 1: Power Sector Issue 4/5 solar photovoltaic, International Renewable Energy Agency, 2012.
24 Project preparatory studies would assess technology options, cost curves for solar power and storage batteries to arrive at the transition path to implementation of full RE on small electricity consuming islands.

Table 8: Island classification by electricity consumption

Small electricity consuming islands (~10)	1 - Full solar/wind with batteries	
Inefficient medium and large electricity consuming islands (~15)	2a - Upgrade power system with new efficient generators, controls to be 'plug and play' and distribution network compatible with up to 30% of peak demand.	2b - Install sufficient solar PV and/or wind to meet up to 30% of peak demand.
Efficient medium and large electricity consuming islands (~ 15)	3 - Install sufficient solar PV and/or wind to meet up to 30% of peak demand.	

The objective of this is to achieve full RE systems on small electricity consuming islands and upgrade power systems on medium to large electricity consuming islands to make them RE ready and install sufficient solar PV/wind.

Scope

Small electricity consuming islands RE: Approximately 10 power stations (between 250-350MWh/year) will be converted to full RE (approximately 2MW) in two steps, using an optimum mix of wind and solar PV, with batteries to provide energy storage. On average diesel electricity supply costs on those selected islands are high (~USD0.40/kWh). In addition, they have been selected for implementation because they are the most difficult to fund commercially and they involve tight integration - at small scale - of wind, solar, energy storage and generator control. This will be implemented by the state-owned utility, FENAKA, and will support the design of operational systems for the eventual full RE penetration across all islands. In addition, distribution system improvements, energy efficiency measures and productive usage of energy would be explored on these islands.

A 2-step approach for full RE on the identified small electricity consuming islands would be developed during the project preparation phase that will be based on the assessment of demand on the islands, RE resource assessments, potential for energy efficiency, space constraints, environmental and social safeguard aspects etc.

Power system rehabilitation: This is a necessary pre-cursor to the introduction of high levels of RE on the large electricity consuming islands. This is a necessary pre-cursor to the introduction of high levels of RE on the medium electricity consuming islands that have inefficient generators. It involves the refurbishment and/or replacement of inefficient generators in about 15 medium electricity consuming islands (>1GWh/year), with a range of modern, electronically controlled, generators as well as installing improved control systems to enable generators to run efficiently at low loads and to stabilize the grid. Distribution system upgrades and energy efficiency measures would be attempted where appropriate. Once the refurbishment/replacement is done, those islands can attract private investors under the FIT supported by the guarantee schemes. In addition, there are nearly 15 islands with efficient power generation and distribution systems that have been developed in recent years. These systems would be assessed for readiness to integrate RE additions. Necessary investments would be identified and undertaken to attract private investors to meet 30% of peak demand. This will be implemented by FENAKA.

The financing requirements of this component are expected to be about USD 13 million (ADB USD 3 million, IDB USD 5 million and the Government USD 5 million) required for preparing power systems to accept RE. These funds will be on-lend to FENAKA by the government and repayments will be used to replenish MGF which in turn will be used to scale up further RE investments.

RE investments under the FIT: Installation of about 3MW of combined solar and wind is envisaged on medium to large electricity consuming islands (>1GWh/year) under the FIT mechanism to offset up to 30% of peak day time demand. This will be carried out by the private sector on a commercial basis with the electricity sold to FENAKA at the FIT. This is a precursor to investments in a greater share of RE on these islands once storage costs decline. SREP resources may be used to mitigate against payment or currency risk and/or providing initial subsidized capital for the first movers. The exact modalities will be finalized during the project preparation and will be based on feedback received from potential investors collected during the planned investor conference and other consultations.

The financing requirements of this component are expected to be about USD 12.9 million, of this private sector will contribute about USD 9 million as equity and debt to finance the installation of about 3MW. USD 1 million of SREP, USD 0.9 million of GIZ and USD 2 million of WBG financing will be used for guarantee and/or investments, in addition WBG will provide risk mitigation facilities and/or incentives to private companies during the early stages of the implementation of the FIT scheme.

Waste-to-Energy (WTE): Based on technical, financial and economic assessments carried out, there is potential for utilizing waste management solutions on islands where the waste streams exceed 15 tons/day (TPD). Three islands have been identified as candidates for this, namely: HDh Kulhudhufushi, R. Vandhoo and S. Hithadhoo where diesel used for electricity and water production will be displaced by WTE. Table 9 shows the electricity and water production potential on these islands. These private sector projects will sell water and electricity to FENAKA under purchase agreements.

Table 9: Electricity and water production potential

	S. Hithadhoo	Kulhudhufushi	R.Vandhoo
Proposed solution	Combustion based solution to provide electricity and potable water	Combustion based solution to provide potable water	Incineration based solution to provide electricity
Capacity – input waste	50 TPD	20 TPD	40 TPD
Capacity – output electricity + water	1 MWe + 95 TPD	76 TPD	1 MWe
Diesel electricity avoided (kWh/year)	635,000	175,000	613,000

The financing requirements of this component are expected to be about USD 10 million, of this private sector will contribute about USD 7 million as equity and debt to finance the installation of about 2MW. USD 3 million will come from SREP, in addition, WBG financing will be used to provide risk mitigation facilities and/or incentives to private companies.

4.3 TECHNICAL ASSISTANCE AND CAPACITY BUILDING

This is a critical pre-requisite of any significant development of the RE sector. Lack of skills has been a major factor in holding back progress to date, and needs to be addressed as an urgent matter. Technical assistance and capacity building is therefore one of the important task to be managed and funded under Maldives SREP IP.

Without the necessary training and technical support, the existing institutions in the Maldives will face significant challenges in delivering the ambitious Maldives SREP IP targets and beyond. While the country has set up a cabinet level Ministry responsible for energy sector development, the Maldives Energy Authority for the enforcement of the sector related regulations, and state owned utilities to manage and operate utility services throughout the country, these organizations are constrained by human resource shortages.

The knowledge of island specific RE resources in the Maldives remains nascent. Given the sparseness of the Maldivian islands and low availability of funding for such country-wide exercises, there has been little or negligible work carried out in the past to systematically collect RE resource data. In general, knowledge of RET exists mainly on solar and slightly on wind, though the country has not experimented with such technologies on a broader scale. There are no known biomass resources indigenous to the Maldives, conventional hydro-power is not an option as there are no rivers, streams, or inland water bodies suitable for harnessing such energy. However, there is huge interest in the country to explore other renewable resources such as Ocean Thermal Energy Conversion (OTEC), tidal and marine currents, etc.

Objective

To create an enabling environment, strengthen human resource capacities and improve access to credible data in order to achieve the long term objectives in the RE sector.

Scope

Creating an enabling environment: through Maldives SREP IP technical assistance the RE policy and the regulatory framework will be strengthened by developing and implementing policies, laws, regulations, rules, standards and incentive schemes to integrate RE in the energy sector. Electricity FIT and tariff mechanisms, standardized PPAs, guidelines for investment approval, licensing of electricity operators, etc. to support RE development have been carried out and continue to be supported by the WBG and ADB. This will increase the efficiency and speed of project development. Additional SREP resources may be utilized.

Financing requirement of this component is expected to be about USD 2.2 million. USD 0.2 million of SREP funding will be used in conjunction with ADB, GIZ and GoM to create an enabling environment for RE investments.

Human capacity building: will be developed for planning, implementation and operation of RE systems. In addition to training, international expertise will be sought to supplement local capabilities for example on advisory services on technical design, procurement, packaging projects, bidding & awarding contracts, legal and commercial aspects, etc. for SREP investments. Resources from SREP will be used where needed. The German cooperation project implemented by GIZ is supporting institution building for the energy and climate change sectors, and will offer important synergies.

Financing requirement of this component is expected to be about USD 1.7 million. USD 0.485 million of SREP funding will be used in conjunction with GIZ and GoM to develop human resource capacity in the country.

Improved access to quality data: The proposed activity is expected to finance the construction of a national network of wind and solar data collection stations that will allow the optimization of wind, solar and energy storage components of the island power systems. Wind data will be collected at a range of heights up to ±80m, and solar data will include direct and diffuse radiation, and radiation reflected off lagoon surfaces. Funds will be used for real-time data collection, monitoring and analysis. In addition, ocean energy data will be gathered.

The MMS will be strengthened and supported under the Maldives SREP IP in managing a national network of RET measuring stations, capable of providing reliable data to allow proper planning and design of RET based power systems across the islands.

Financing requirement of this component is expected to be about USD 1.1 million. Funding from multilateral donors channelled through the WB in addition to funds from GoM will be used in improving RE resource data collection and management system in the country.

4.4 ACTIVITIES COMPLEMENTARY TO MALDIVES SREP IP

4.4.1 DEEP SEA WATER UTILIZATION

Detailed planning is underway by Maldives Water and Sewerage Company for a district cooling project at the new International Airport terminal in Hulhule Island. The project will supply cold sea water from a depth of 1,400m for AC/cooling, offsetting electricity generated by diesel. An intake system and chiller plant will be installed at Hulhumale' which will allow future expansion into residential housing. The project is expected to supply about 2,500 refrigerant tons, will result in an estimated GHG reduction of approximately 14,000 tCO_2/year, and will save approximately 5 million litres per year of diesel fuel. The anticipated date of commissioning is 2014; the project will be privately financed.

4.4.2 ENERGY EFFICIENCY

Abatement costs are difficult to derive for many classes of consumption because the variables are so great, and deriving reliable samples across the islands is difficult. Nonetheless, data has been measured for three crucial areas of demand which represent the bulk of night time energy use. These are air conditioners, fridges, and street lighting. Normal domestic lighting is universally provided by compact fluorescent lamps and offers little potential for energy saving.

The estimated costs and scale of abatement opportunities, based on replacing equipment at the end of its life with more energy efficient units are shown in Figure 19. Even if equipment were to be replaced immediately, levelised costs of the savings the net benefit would still be lower than the avoided cost of electricity as shown in Figure 20.

It is clear that potential energy savings are highly cost effective and significant in scale. By focusing on these three items of equipment, energy use at night will be significantly reduced – thus reducing the overall cost of providing 24 hour RE.

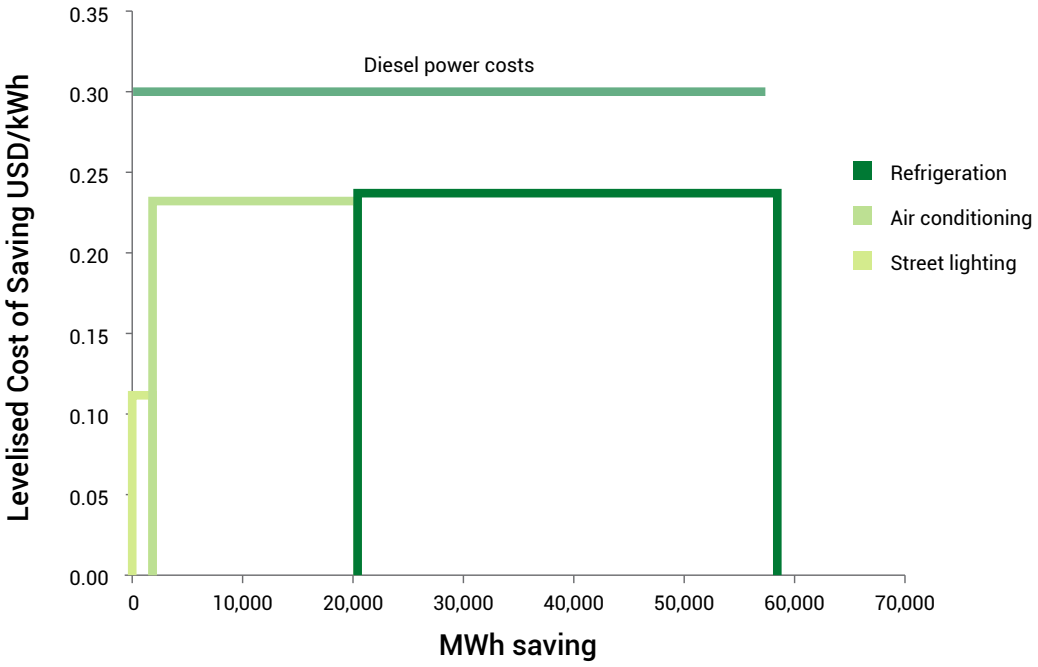


Figure 19: Levelised cost of savings from equipment replacement at end of life

Savings for both graphs are shown in MWh/year. The scale of savings is based upon extrapolation from limited data, and may well underestimate the actual savings possible.

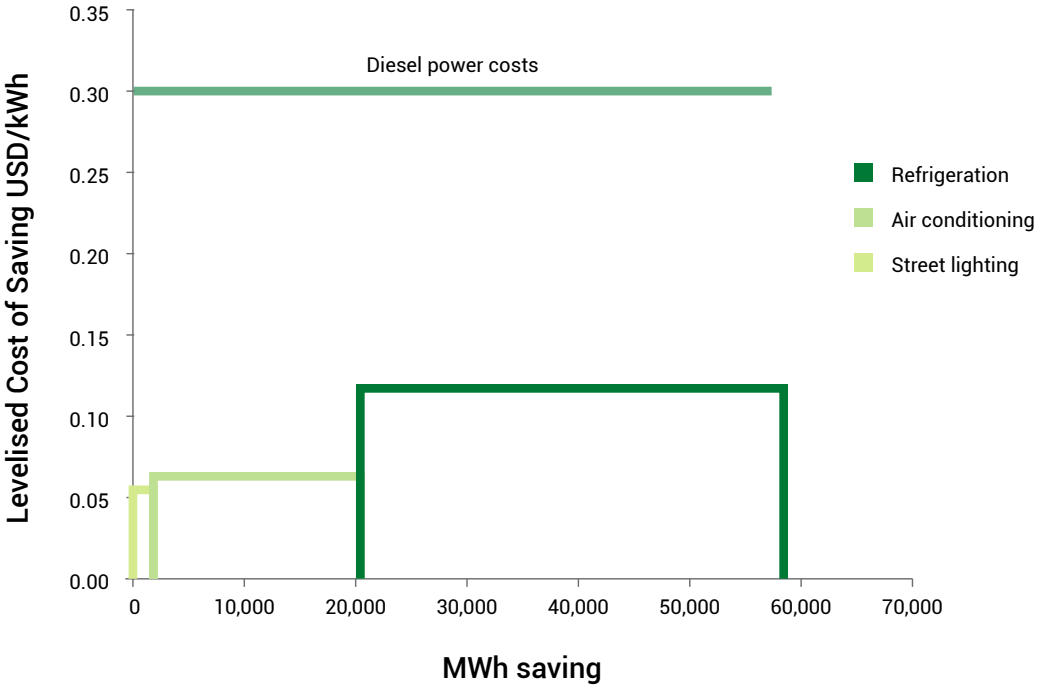


Figure 20: Levelised cost of savings from immediate equipment replacement

While Maldives SREP IP may not directly finance energy efficiency initiatives, the government believes that there will be significant benefits complementing RE investments. Therefore, funding opportunities are expected be sought from the Governments budget, MDBs and other financing sources. There is a potential role for MGF in reinvesting savings from programmes which may likely be funded in the future.

4.4.3 TOURISM INDUSTRY

The tourism industry being a large consumer of energy in the Maldives, has a significant role to play in transforming energy sector. It has to increase activities on renewable energies and energy efficiency. In order to better engage tourism industry, demonstrative effects on low carbon investments, proper regulations and incentive mechanism have to be established. Examples of good practice and cost saving from the public utilities projects coupled with technical support available from MEE will be used persuade the resort sector to move from diesel to solar PV and higher levels of energy efficiency. An energy conservation programme assisted by IFC has been initiated to support resorts in identifying energy wastage and in assisting them making their investments greener.

4.4.4 TRANSPORT SECTOR

Marine transport accounts for approximately 22% of current GHG emissions. The high cost of fuel is a major factor in the economics of both fishing and public inter-island transport. In order to explore feasibilities of introducing RETs and fuel efficiency in the transport sector the government, in collaboration with bilateral partners, will undertake necessary studies and pilot projects.

5. ENVIRONMENTAL AND SOCIAL MANAGEMENT FRAMEWORK

The Environment and Social Management Framework (ESMF) will outline the positive impacts on the island's environment as well as remedial measures, preventative and control strategies for potential negative environmental and social impacts due to proposed project activities.

Community consultation and engagement will be an integral part of identifying potential environmental and social impacts and mitigation measures to address any adverse impacts associated with projects. In implementing the proposed projects under the IP, EPA will ensure that all projects are carried out in accordance with Environmental Impact Assessment Regulations of the Maldives. Where applicable, projects will comply with WB/ADB Safeguards Policies.

The following illustrates the ESMF stages for the approval of projects to be implemented under the IP. The process would consist of:

a) Screening for projects requiring significant environmental/social impact assessments;
b) scoping to identify potential positive and negative environmental and/or social impacts on the communities and natural environment;
c) determining the likely negative environmental and social impacts;
d) undertaking stakeholder consultations and public disclosure;
e) setting and implementing the appropriate mitigation and management measures; and
f) monitoring and reporting on environmental and social parameters during the implementation of project activities.

5.1 ENVIRONMENTAL AND SOCIAL IMPACTS

Environmental impacts are expected as a result of the proposed Maldives SREP IP projects. Due to the nature of activities, investments will result in minor civil works from the construction and installation of new RE generation systems, future decommissioning of RE installations, batteries, rehabilitation and expansion of existing power generation systems, and disposal of inefficient or old appliances.

Further risks may be associated with minor impacts to biodiversity, land or other assets, generation of solid waste from construction debris, oil spill from motorized construction equipment, accumulation of used batteries, etc. Some of these impacts may be unavoidable especially during construction and installation. Nevertheless, impacts would likely be of a temporary nature and can be prevented, minimized or mitigated using appropriate mitigation and management measures. Potentially identifiable environmental and social impacts and mitigation measures for the technology options used in the proposed projects in the IP are summarized in Table 10. While there are negative impacts, the majority of proposed projects is expected to have substantial positive environmental and social benefits.

Table 10: Impacts and mitigation measures for the technology options

Types of Impacts	Solar PV	Wind Energy	Waste-to-Energy
Environmental impact / construction and operation	• Construction waste and noise • Disposal of components at end of life (Batteries, PV panels, inverters, etc.)	• Possible impact on the marine environment due to fixing poles in the shallow lagoon for lagoon mounts schemes. • Dealing with construction waste and impacts from work force. • Bird strikes • Visual impact as any wind energy system will be mounted on tall masts in clear spaces. • Noise and dust during the construction may be nuisance to the neighbourhood. • Noise during operation of wind turbine .	• The construction will involve activities that will create environmental disturbances normally encountered in major construction projects. • Improper storage/handling of, waste dumps and other sources of contaminants may lead into ground water pollution. • Noise and dust during the construction may be nuisance to the neighbourhood. • Construction waste • Emissions from the combustion of waste • Management of fly ash.
Social Impacts	• Disruption to households during installation of solar panels and cables. • Reduced fossil fuel-based power generation and reduced dependency on fuel import costs • Increasing community resilience to changes in fuel prices. • Encouraging productive usage of energy in small electricity consuming islands.	• Reduced fossil fuel-based power generation and reduced dependency on fuel import costs – increasing community resilience. • Loss of land or other immovable properties	• Reduced primary fuel costs will help reduce energy costs and improve community resilience. • Increased surface water runoff

Types of Impacts	Solar PV	Wind Energy	Waste-to-Energy
Mitigation Measures / Environment (Anticipated environmental impacts of projects will be minor, localized and manageable.)	• Proper disposal of construction waste • EPA will be developing and enforcing regulations on safe disposal of components at end of life, • To minimise the social impacts, efforts need to employ Maldivians during the construction and operation stage of the projects. • Proper siting decisions can help to avoid aesthetic impacts to the landscape and seascape. Siting decisions will be taken in consultation with all local stakeholders. • Good construction management practices in place that reduce negative impacts to the environment. • Arrangements for safe disposal of solar panels and batteries on decommissioning or replacement.	• Siting of turbines to avoid areas of live coral cover and marine life. • Proper disposal of construction waste and avoiding marine spillage. • Chances of bird strikes are extremely rare but may not be completely avoidable. • Proper siting of the wind farms to avoid aesthetic impacts to the landscape and seascape. Siting decisions will be taken in consultation with all local stakeholders. • Carrying out the work during acceptable hours of the day, contractor prepares schedule of activities and keeping public informed. • Maintaining coastal vegetation belt.	• Selection of site that has least impact on biodiversity and water. • Best practicable technology to effectively control gaseous emissions need to implemented to control the air quality. • Effective storage mechanism that addresses ground water contamination, odour, etc. • Acceptable disposal site in place for ash disposal. • Good construction management practices in place that reduces negative impacts to the environment.
Mitigation: Social Impacts	• Maintaining site cleanliness during construction. • Carrying out the work during acceptable hours of the day, contractor prepares schedule of activities and keeping public informed. • Equipment and machinery kept in good condition in meeting acceptable noise standards. • Public complains registration.	• Place wind turbines away from the community as much as possible. • Replacement of lost assets.	• Construction site fencing. • Careful management of site operations.

6. FINANCING PLAN

The following table provides a detailed overview of the Maldives SREP IP costing and financing plan by component and sources of funds:

	SOURCES OF FUNDING (USD 000)											
Components	**SREP**	**GoM**	**WB IDA**	**WBG Guara--ntee**	**ADB**	**IFC/ ADB (PSOD)**	**GIZ**	**JICA**	**Private**	**Others**	**IDB**	**TOTAL***
IP Preparation Grant	315											315
Renewable Energy for Greater Male' Region												
Greater Malé Region Solar PV Investments	6,000	2,500	3,000	12,000				11,000	26,500			49,000
Waste-to-Energy (Thilafushi)	5,000					10,000			5,000			20,000
Greater Malé Region Renewable Power System Integration	500											500
Sub Total	11,500	2,500	3,000	12,000	0	10,000	0	11,000	31,500	0	0	69,500
Renewable Energy for Outer Islands												
Small power station RE	12,000	3,000			3,000					3,000	5,000	26,000
Power system rehabilitation		5,000			3,000						5,000	13,000
Outer island solar and wind investments (under FIT)	1,000		2,000	8,000			960		9,000			12,960
Outer island Waste-to-Energy investment	3,000								7,000			10,000
Sub Total	16,000	8,000	2,000	8,000	6,000	0	960	0	16,000	3,000	10,000	61,960
Technical Assistance and Capacity Building												
Creating an enabling environment	200	1,000			400		600					2,200
Human Capacity Building	485	100					1,100					1,685
Project Preparation and feasibility studies	1,500	100					600					2,200
Imporves access to quality data		300								800		1,100
Sub Total	2,185	1,500	0	0	400	0	2,300	0	0	800	0	7,185
GRAND TOTAL	30,000	12,000	5,000	20,000	6,400	10,000	3,260	11,000	47,500	3,800	10,000	138,960

Allocation between components is indicative and will be adjusted based on feedback from Investors

Total does not include WBG Guarantee

7. RISK ANALYSIS

7.1 TECHNICAL RISKS

The principal technical risks and mitigation measures associated with this programme are as follows:

- Outputs may be lower than expected due to environmental factors or performance reliability issues. For private power projects, where revenues are based on performance, developers have a strong incentive to ensure project function as designed. Supply of waste resources will be based on agreements between the island council and the WTE developer. In the case of the small electricity consuming islands 100% RE generation projects in the outer islands, diesel generators will continue to be used as a backup. A phased approach would be adopted to study the impact of a high proportion of RE with batteries and diesel prior to a transition to eventual 100% RE. In small electricity consuming islands existing diesel generator sets will remain as redundancies. For RE projects under the FIT mechanism the electricity generation is a small proportion, therefore, any shortfalls will be met with existing diesel generator sets.

- Technology may not perform as expected. The German GIZ project is contributing to evaluate alternative power station configurations (specifically diesel-PV hybrid systems), with a view to testing the best solutions under the project on Support for the Climate Neutral Strategy of the Maldives. SREP and MDB counterpart funding will be used to design and specify projects for tendering and to make sure best practice technology solutions appropriate to the Maldives will be specified.

- Corrosion is a potential challenge. This risk can be reduced by using marine grade equipment.

- Designing and implementing systems for high levels of RE in small electricity consuming islands would be a challenge. System design would need to factor in renewable resource assessments, load profile, expected growth in demand over the medium term, productive energy usage, necessary distribution system improvements etc. In addition, regarding storage - there would be maintenance and battery replacement issues that would need to be studied. This would be undertaken under the feasibility studies in the project preparatory phase with SREP and MDB counterpart funding.

- Rapid increase in demand. Previous investment projects in the outer islands have seen significant growth in load (annual growth of 20% in some cases) on completion of installations. This is a challenge that would need to be considered during the project design. Efficiency in energy usage including through tariff signals and energy labelling by MEA and load management measures would be assessed.

7.2 COMMERCIAL RISKS

Key commercial risks are as follows:

- Insufficient interest by developers, many are likely to be foreign investors, in projects targeted for private sector investments. For projects, that sell electricity under the FIT regime, MEA will devise tariffs and purchase agreements taking into account perceived levels of risks and returns that are appropriate to this type of investments. Maldives SREP IP will explore guarantee instrument to cover payment, currency depreciation and related risks that are of concerns to potential investors.

- Individual installations may be too small to be of interest to investors. MEE will support investors and utilities to aggregate projects to offer suitable scale.

- The regulatory frameworks for RE investments are inadequate. MEA (with support from ADB and WBG) is putting in place required planning criteria, technical codes and standards, as well as tariff regulations to support private sector RE investments.

- Lenders may have limited capacity and/or interest in lending for RET investments. Appropriate financing from SREP and from MDBs will be available to mitigate risks that international investors may perceive in lending for RET projects in the Maldives. The power purchase agreements and other legal documents will be drafted taking into consideration that many of the developers and investors will be from offshore.

- Selection of the small electricity consuming islands for RE would include criteria on the financial and economic cost of supplying diesel based power to such islands and the replacement cost with solar and batteries. A phased approach to RE for small electricity consuming islands would be adopted based.

7.3 INSTITUTIONAL RISKS

The principal risks are as follows:

- There is a small pool of technically qualified staff with experience in RETs;
- a few senior civil servants are highly experienced and capable administrators, but they are overloaded already; and
- the electricity sector has no tradition of either strategic planning or technical innovation. Even the largest utility, STELCO, has no experience outside its traditional area of diesel generation.

SREP and MDB partners are working closely with MEE and will be working with utilities in order to overcome these shortcomings. Under the Maldives SREP IP resources have been allocated to further strengthen the capacities within the MEE, the MEA and the Utilities. There are no restrictions in bringing in expatriate experts where investors perceive skill shortages for design, installation and operation of their power plants. The ongoing organisational restructuring of

the MEE and MEA will create additional opportunities to recruit civil servants to both these organisations.

7.4 COUNTRY RISKS

- ***Political risks:*** Changes in the administrative structure within the Government may create uncertainty for developers. The creation of an enabling environment (through Maldives SREP IP and other initiatives) independent of political consideration and greater transparency in decision making mitigates this risk.

  The provision of training and capacity building would enhance the efficiency and effectiveness of the workforce in the sector.

- ***Fiscal constraints:*** Maldives, as a small island State, has limited access to external financial resources. This is coupled with high borrowing rates that in turn translates into high investment cost.

  Blending SREP funds with leveraged resources may reduce the cost of capital and associated risks.

- ***Geographic constraints:*** Dispersed islands and lack of sufficient land mass leads to high logistics and transportation cost. In addition, it offers limited opportunities for building large scale power generation facilities which are often more economic than small scale applications. RETs such as solar PV are inherently modular and well suited to meeting the needs of relatively small dispersed communities. The limited transport network linking most of the population centres, increases cost to investors. During the construction phase available bulk transport strategically used can reduce transport costs. During operations, difficulties associated with inter island transport, is lessened as RETs do not require regular fuel shipments.

  Seasonal exposure to rough seas and stormy weather can disrupt inter island transport. However, rough weather conditions are short and can easily be avoided through proper planning.

8. RESULTS FRAMEWORK

For future monitoring and evaluation of the results of the Maldives SREP IP funded activities, an indicative results framework for the IP is presented below. The Ministry, through the PMU, will have overall

Results	Explanation of the result statement	Indicators	Baseline	Targets	Assumptions	Means of verification
Maldives SREP IP Transformative Impact						
Support low carbon development pathways by reducing energy poverty and increasing energy security	SREP is the major intervention in the Maldives supporting the government's carbon neutrality goal. In addition to the global benefit of CO_2 reduction, the projects contribute significant to energy security both at the national level and in the most vulnerable islands by displacing diesel required for electricity generation.	Share of RE in the national electricity mix in the inhabited islands.	<1%	100%	Carbon neutrality by 2020 assuming adequate resources are available, lower technology costs and human capacity is in place.	National Statistics
		Annual electricity output from RE in GWh	<7GWh	1700 GWh[25]	Carbon neutrality by 2020 assuming adequate resources are available, lower technology costs and human capacity is in place.	National Statistics
	In order to achieve the above objective, GoM will need to mobilize significant resources from private and public sources over the next 20 years.	Increased public and private investments (USD) in RE sector per year	USD 3M	USD 100M	National M&E system and M&E framework of the implementing agency	Increased public and private investments (USD) in targeted sub-sector(s) per country per year

25 1700GWh is needed to achieve carbon neutrality by 2020 in the inhabited islands (excluding tourist resorts) based on the assumptions of 10% growth, and a plant factor of 0.8.

Results	Explanation of the result statement	Indicators	Baseline	Targets	Assumptions	Means of verification
SREP Programme Outcomes						
1.Increased supply of RE	In order to achieve the transformation to increased energy supply and demand based on RE the economic viability of the RE sector will need to increase. This means that the sector will need to grow in size and provide the benefit of increased employment.	Additional energy output from new RE (GWh) CO_2 emissions avoided (tCO_2/yr)	< 1GWh/year <1,000 tCO_2/yr	~70 GWh/year 56,000 tCO_2/yr	Electricity production based on resource characteristics and technology performance of the Maldives. GHG emissions calculated based on avoiding diesel generation and transmission losses for distributed solar PV.	Government M&E framework
2. Improved macro-economic and fiscal situation.	Presently diesel import is about 350 million litres (20% of the GDP). One important benefit is to replace diesel electricity with RE to reduce the impact on the balance of trade and government subsidies.	Quantity of diesel avoided. Amount of subsidy provided to public utilities for diesel relative to 2011 subsidy.	Nil Nil	23 million litres per year (6% of total diesel import) ~USD 7 million per year (30% of subsidy provided)	Based on 2011 fuel prices.	Government M&E framework
3. New and additional resources for RE projects	The SREP will involve the leveraging of new and additional resources, clean production and consumption technologies. This will occur in the context of projects where multiple sources of funding will be leveraged by SREP for particular investments.	Leverage factor of SREP funding; USD financing from other sources (contributions from MDBs, governments, multi-laterals and bi-laterals, CSOs, private sector)	N/a	USD 100M/year	These would be actual investment amounts committed or provided for total SREP.	Government M&E framework

9. MALDIVES SREP IP CRITERIA

Increased installed capacity from renewable energy sources: Annual energy consumption in the outer islands is estimated to be 428GWh. Almost all of this is generated from diesel based sources with the exception of small RE demonstration projects that generate less than 1GWh/year. The RE investments planned under the Maldives SREP IP are expected to generate 70GWh/year which is approximately 16% of the annual electricity demand of the inhabited islands.

Increased access to energy through renewable energy sources: At the moment there is no inhabited island in the Maldives providing electricity entirely on RE sources. Maldives SREP IP is envisaged to install RE in 10 inhabited islands that would be completely transformed from diesel based energy to RE. In addition, 24% of all inhabited islands will have a greater share of RE in their energy mix as a result of the Maldives SREP IP. Furthermore, 71% of the population will be benefiting from the RE installations.

Low Emission Development and "leap-frogging" technologies: Currently Maldives depends entirely on diesel fuel for electricity generation, to a cost of which is equivalent to approximately 20% of the GDP. By installing RE electricity generating facilities under the Maldives SREP IP, approximately 22 million litres of diesel will be avoided annually. This will help to avoid emission of approximately 56,000 tons of CO_2/year. The current RE installed capacity in the Maldives is approximately 2MW, at the end of the Maldives SREP IP this will increase to 26MW. The ambitious Maldives SREP IP is expected to bring state of the art RE technologies and expertise to the Maldives within a relatively short period.

Affordability and competitiveness of renewable sources: The unit cost of electricity generation in the Maldives is believed to be the highest in the South Asia region due to its dependence on imported diesel for energy generation. Electricity generation cost (or diesel costs) ranges from USD 0.31/kWh to USD 0.46/kWh. High electricity generation costs translate into heavy subsidies in order to make electricity affordable to the population. In the year 2011 alone, the Government spent about USD 25million through fuel subsidies. With the increased penetration of RE into the energy mix under the Maldives SREP IP it is expected to save at least USD 7million/year on fuel subsidies while in addition saving the cost of some 22 million litres of diesel fuel.

Productive use of energy: Although all islands have access to electricity service in most islands the power systems are very poorly designed and maintained. As a result, the quality of the electricity supply on these islands is very low and does not allow the consumer to use modern electrical appliances. The implementation of the power system rehabilitation programme under the Maldives SREP IP will improve the performance of the power systems as well as the overall system efficiency and make the systems RE ready. With better and more reliable electricity service provided at an affordable price due to better systems and increased share of RE the productivity of the beneficiary communities will be further improved.

Economic, social and environmental development impact: Access to sustainable, affordable and reliable energy will not only foster economic, social and environmental development but it will also enhance the national energy security. The savings achieved due to reduced cost of energy generation can be used to stimulate developments in other socioeconomic sectors for the betterment of the local population. Diesel based energy generation is considered to be environmentally

unsuitable due to its associated potential for negative environmental impacts on sensitive island environments. Noise, associated with operation and maintenance of diesel generator sets on small islands, is often seen as highly destructive for the vulnerable members of the communities. These impacts can be largely mitigated and/or avoided through the introduction of RE based energy generating facilities. In addition, opening up the RE market to attract private sector and to increase foreign investments, a cadre of green jobs which in the Maldives are virtually non-existent will be created.

Economic and financial viability: Comparison of the generation costs for RE based and that of diesel based electricity clearly indicates competitive advantage of RE based electricity over diesel based electricity generation in the Maldives. The current FIT structure has been found to be open to improvement, but still attractive to private investors. The further strengthening of the FIT together with the overall regulatory framework under the Maldives SREP IP is expected to generate significant interest among the potential investors.

Leveraging of additional resources: The proposed investments are expected to be leveraged by more than USD 4 for each dollar invested by SREP - making this a total investment of over USD 138 million. The largest share of the leveraging is expected to come from the private sector followed by contributions from the Government of Maldives and MDBs. The significant investments expected from the private sector would be a unique, an innovative aspect of this IP and a positive example for other countries.

Gender: In principle, there is no gender disparity in the Maldives with regards to access to electricity service is concerned. However, the energy sector is largely male dominated with very few trained female professionals. The technical capacity building component under the Maldives SREP IP will focus on bridging this gap through providing opportunities in particular to women interested to work in this sector.

Co-benefits of renewable energy scale-up: Significant co-benefits will include an increased energy security to vulnerable and small communities and enhance socioeconomic conditions. Furthermore, the proposed WTE projects will improve the local environment in the islands by a better management of waste and by reducing the extent of land needed for waste disposal. The WTE components are expected to bring significant health and tourism benefits to the local communities.

The reduction in operational costs of the power systems, an improved country's balance of trade due to reductions of diesel imports and potential tariff reduction as a result of lowered power generation costs and the creation of more employment opportunities are considered as significant fiscal co-benefits of the Maldives SREP IP.

Last but not least would the successful implementation of full RE systems on small electricity consuming islands generate a strong demonstration effect to be translated to other island or countries to learn from this experience and apply it to their own context to meeting the energy needs of isolated populations.

9.1 MALDIVES SREP IP CO-BENEFITS

Significant direct benefits, such as lower cost of electricity, enhanced energy security, reduction in CO_2 emissions were described previously. The following are some of the co-benefits of the Maldives SREP IP implementation:

Social and economic: The programme envisages significant investments in small, more vulnerable islands by transforming their electricity supply to be 100% RE based. Increased energy security should contribute to enhanced socioeconomic (and environmental) conditions in these small communities.

Energy security: The country is entirely dependent on imported oil as the primary source of energy, making it exposed to fluctuations and increases in oil prices. The cost of importing fossil fuels in the year 2011 accounted for roughly 20% of the national GDP. Diversifying the fuel mix not only contributes to an increase in RE generation but also contributes to energy security by reducing the Maldives dependence on oil imports as a large percentage of their economy and by utilizing indigenous resources of energy.

Improvement in local environment: Waste management is one of the most pressing environmental concerns for the government. Unsustainable waste management practices on the islands have been resulting in damage to marine life and degradation of the fragile ecosystems including coral reefs, wetlands, and beaches. In addition, groundwater becomes contaminated as a result of waste oil penetration and toxic chemicals given the sandy nature of island soils and the shallow water lens. The WTE projects, in particular, will improve the local environment in the islands by better management of waste and reduce the extent of land needed for waste disposal. In islands where solar and wind displace diesels local benefits will accrue due to reduced risk of oil spills during transport and lessening problems associated with improper waste oil disposal.

Health benefits: Due to the unsustainable waste management practices, in particular open burning at the largest dump sites in the Maldives, workers and residents (including school children) are exposed to associated health hazards. For example, people working in Thilafushi and other waste disposal islands and those living downwind have been suffering from respiratory diseases caused by open burning of waste, which often required treatment overseas. As a result of sustainable waste management and disposal, coupled with power generation and water production, these hazards would be eliminated.

Tourism benefits: Maldives is seen as a clean, beautiful environment that is visually appealing to tourists from all over the world. One of the major deterrents of tourism is the image of waste disposal on some of the inhabited islands neighbouring the resorts. For example, Thilafushi is located in an area where there are many existing tourist resorts. Tourist complaints of open burning and unsustainable waste management practices at Thilafushi have become a cause of concern for the Government needing urgent attention and intervention given the importance of tourism on the economy of Maldives.

Fiscal benefits:

a) State-owned utilities – reduction in operational costs, power systems efficiency, less volatility, and transfer of power generation risks to the private sector.
b) Budget – improving the country's balance of trade due to reduction of diesel imports and the government will require less funds for diesel fuel subsidies to the public utilities.
c) Households – potential revenues from renting of the rooftops to investors and revenues from sale of electricity through FIT.

Global demonstration effect: Small island States are often faced with many challenges to promote RETs. The Maldives' determination to demonstrate leadership in overcoming those - including the pledge to become carbon neutral by 2020 - can show that if small island States can take significant strides towards achieving greater energy security, other countries can follow this examples. Maldives wants to encourage other countries to learn from its experience and apply it to their own context.

Creation of green jobs: The programme emphasises significantly enhancing institutional and human capacity in the sector. The emergence of healthy and growing RE and energy efficient sectors will contribute to the creation of intellectually stimulating high quality green jobs around the atolls where most of the work will take place.

APPENDIX 1 - CONCEPT NOTES

ACCELERATING SUSTAINABLE PRIVATE INVESTMENTS IN RENEWABLE ENERGY PROGRAMME (ASPIRE)

Background

This programme will cover distributed PV and wind RE investments under the FIT, private investments in WTE and associated technical assistance.

Public sector financial resources are limited, thereby constraining RE investments that are typically capital-intensive. Therefore, the ASPIRE programme aims to address this by encouraging and facilitating private investments in the sector through targeting the following key barriers:

- Investment climate uncertainties due to currency and payment risks as well as those related repatriation of profits. This leads to premiums which affect the economic viability of RE projects;
- regulatory frameworks are at a nascent stage;
- domestic capital has little experience and/or appetite for investing in this sector; and
- small scale of power distribution and dispersed investment projects make it difficult to attract private sector and to reach economies of scale.

As a result of these barriers, distributed RE supply has been happening on an ad-hoc and opportunistic basis.

Objective

For the Maldives to achieve the scale of RE deployment and make greater strides into its policy objectives on the carbon neutral strategy, it must put in place the required safeguards that would lead to the scale-up of RE in the country.

Project Selection

The ASPIRE Programme will consist of the following projects:

- Project 1: Renewable Energy Investments under a Feed-in Tariff
- Project 2: Utilization of Waste-to-Energy Technologies in Outer Islands
- Project 3: Implementation Support and Institutional Development

Project 1: Renewable Energy Investments under a Feed-in Tariff

- *Sub-Project 1.1:* Greater Male' Region Solar PV investments - it is possible to feed PV generated electricity amounting to 20-30% of the peak day time demand in greater Male' region without significant investment in sophisticated systems upgrading. Considering

the respective peak demands for various islands in the region, 15 MW of solar PV can be safely fed in to grid systems in the greater Male' region. PV installations will be undertaken for Male' (11MW) and in Hulhumale' (4MW). There is the potential for more, once the submarine cable is in place. The FIT is already in place with MEA updating it and will be the basis for deploying the solar PV programme.

- *Sub-Project 1.2:* Outer island solar and wind investments (under FIT) - combined RE investments in solar PV and wind will be undertaken on the outer islands. Some 15 out of 30 of the islands selected will be made RE ready under the POISED programme funded through ADB and IDB. The project envisages an installation of about 3 MW on medium to large electricity consuming islands (>1GWh/year). The installed RE will offset up to 30% of peak day time demand.

This will be carried out by the private sector on a commercial basis with the electricity sold to FENAKA at the FIT. This is a precursor to investments in a greater share of RE on these islands once storage costs decline. SREP resources, blended with IDA, may be used to design guarantee instruments to mitigate sovereign, currency and counterparty risks.

Project 2: Utilization of Waste-to-Energy Technologies

There are islands in the Maldives where WTE has been found to be technically, financially and economically feasible based on assessments which were carried out. These are: S.Hithadhoo, HDh. Kulhudhufushi and R. Vandhoo. Through this investment, diesel used for electricity and water production will be displaced by the WTE systems. The private sector will finance the installation of about 2MW, SREP and WBG financing will be used to provide risk mitigation facilities and/or incentives to private companies.

Project 3: Implementation Support and Institutional Development

Support to MEE, STELCO and FENAKA for preparation and implementation of FIT scheme including mobilization of private investors. Some support may be needed for improving the technical requirements for successful RET deployment as well as developing standards for interconnection and performance monitoring. Funds will be sought from SREP and other bilateral sources for preparing the utilities for planning for the future phases of RE expansion beyond Maldives SREP IP.

In addition to training, international expertise will be sought to supplement local capabilities of decision-makers and implementation staff. Support is envisaged for human resource development at MEE and the public utilities for strengthening their technical, planning and management capacities.

Financing Plan

	SOURCES OF FUNDING (USD 000)											
Components	SREP	GoM	WB IDA	WBG Guara--ntee	ADB	IFC/ ADB (PSOD)	GIZ	JICA	Private	Others	IDB	TOTAL
ASPIRE												
Greater Malé Region Solar PV Investments	6,000	2,500	3,000	12,000				11,000	26,500			49,000
Outer island solar and wind investments (under FIT)	1,000		2,000	8,000			960		9,000			12,960
Outer Island Waste-to-Energy investments	3,000								7,000			10,000
Implementation Support & Institutional Development	750	100					200					1,050
Sub Total	10,750	2,600	5,000	20,000	0	0	1,160	11,000	42,500	0	0	72,010

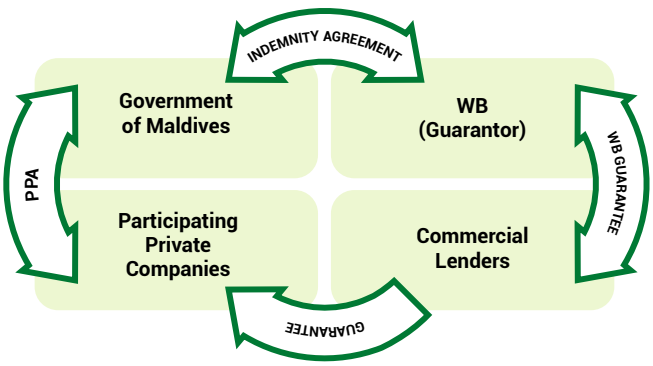
Implementing Arrangements

Preparation activities as well as technical assistance required to implement the Maldives SREP IP programmes and projects will be carried out by PMU/MEE. Guarantee facilities and channelling of subsidies, soft loans, and grants to private developers are envisaged to be administered by MGF when fully operational. An interim arrangement will be considered while MGF is being setup. This will be evaluated and decided during project preparation stage.

Outer island investments will be implemented by FENAKA with PMU support if required. Grant agreements between WB and MoFT will be executed with on lending agreements to the utilities. Technical assistance, monitoring, evaluation and oversight will be the responsibility of MEE/PMU together with the implementing utility.

RE investments under the projects will be implemented by the private sector with risk mitigation / guarantee facilities by the WBG. STELCO and FENAKA will be the buyers of electricity under the FIT. MEE will provide policy, promotion and implementation support coupled with regulatory support from MEA.

The WTE investments will be developed under a Public-Private Partnership (PPP) arrangement where the investor is expected to self-finance the project(s). SREP funds could be used to cover electricity payment risks. The following Figure gives an overview of the proposed guarantee arrangements.



Guarantee arrangements under SREP

Lead Agency

WBG

Transformative Outcomes and Outputs

The outcome of ASPIRE will be to tap into the full potential of RE development and implementation in the Maldives. This will support portfolio development for the sector and serve as learning platform for moving towards the achievement of the carbon neutral strategy.

The following outputs are expected to be achieved under ASPIRE:

- 20MW of RE generation installed (approximately 15MW (solar PV) in the greater Male' region and 5MW (3MW solar PV/wind[26] and 2MW WTE) in the outer islands);
- increased energy security;
- reduced cost of electricity generation with possible reduction to tariff;
- creation of new employment and business opportunities in the RE industry;
- about 12 million litres of diesel avoided per year; and
- reduction in GHG emissions by approximately 31,000 tCO_2/year.

26 This includes islands that will be made RE ready under the POISED programme Power System Rehabilitation funded outside the SREP though ADB and IDB.

CONCEPT NOTE

PREPARING OUTER ISLANDS FOR SUSTAINABLE ENERGY DEVELOPMENT PROGRAMME (POISED)

Background

As of today, almost all outer-islands produce their electricity by diesel generators. Several of these systems especially on the smaller islands have evolved rather than being designed. In most cases, generators were added ad-hoc without regard for maintenance issues, or the cost of operation. Maintenance is carried out by able and resourceful local personnel, but there is no provision for a national spares stock, or any centralized expertise. In consequence many generators are wrongly sized for their load and most are consuming much more fuel than necessary.

In addition to problems with generation, there are major issues with the distribution grids on some small islands where losses are estimated to be high[27].

For small electricity consuming islands, immediate installation of solar/wind with battery storage is economically justifiable for offsetting nearly 100% of diesel in a phased manner. For medium to large electricity consuming islands with inefficient energy generation, power system upgrading is a prerequisite to increasing the overall share of solar/wind. In the case of efficient medium and large electricity consuming islands the transition to an increased share of solar/wind can be brought about almost immediately. In the latter cases, the share of intermittent solar/wind is expected to be maintained at under 30%. Further increase in share of RE will be considered, once solutions for addressing grid stability issues associated with greater share of RE are available[28].

Objective

As electricity generation from solar PV, and wind in some locations, is less expensive than energy generation from diesel based on avoided cost of fuel in the Maldives, this programme will support achieving full RE systems on 10 small electricity consuming islands and deploying RE-diesel hybrids on some medium to large electricity consuming islands.

Project Selection

POISED will consist of the following projects:

Project 1: Small Power Station RE

Approximately 10 small power stations (between 250-350MWh/year) will be converted to full RE (approximately 2MW) using an optimum mix of wind and solar PV, with batteries to provide energy storage. Diesel electricity supply costs are in high on small electricity consuming islands (~USD0.40/kWh). These have been selected for implementation by the state-owned utility FENAKA. They are the most difficult to fund commercially and they involve tight integration - at small scale of wind, solar, energy storage and generator control. In addition, distribution systems on these islands would need to be assessed and upgraded to handle high levels of RE

27 Distribution losses were appraised at around 25% or more in some of the small and medium electricity consuming islands that were covered under the ADB financed Outer Island Electrification Project. These were brought down to 4-10%.

28 Assessment of Grid Stability for Increased Renewable Energy Integration in the Pacific Region. 15 July 2012, Vanuatu. Joint IRENA-PPA workshop (www.irena.org/documentdownloads/events/VanuatuJuly2012/Summary.pdf)

penetration. The project would look into measures to address surplus RE and spillages (for e.g. can be used for ice making to support the local fishing industry). Measures to support energy efficiency including through tariff signals by MEA and load management would be assessed and supported. In addition, productive usage of energy on such islands would be supported including through linking up with ongoing ADB/IDB supported investments in the Maldives.

The phase-wise plan for full RE on the identified small electricity consuming island would be developed during the project preparation phase and will be based on assessment of demand on the islands, RE resource assessments, potential for energy efficiency, space constraints, environmental and social impact.

Project 2: Power System Rehabilitation

Up-gradation of power systems is a prerequisite to introducing high levels of RE to the medium- and large electricity consuming islands' power stations that have inefficient generators and grids. Under this project, about 15 power systems that are least efficient will be replaced and made ready for RE installations. The replacement of inefficient generators and up-gradation of distribution systems in 15 islands with a small range of modern, electronically controlled generators will be funded through an ADB loan possibly blended with other sources of financing.

Another 15 power systems developed under ADB outer islands electrification project will be assessed for additional investment requirements in control systems to make them ready for about 30% RE installation by capacity. Preparatory grants from SREP would support these studies while required investments could be supported by MDBs.

Private sector investments of about 3MW on these 30 outer islands would be supported through a FIT set by MEA. There is ongoing technical assistance support from ADB and WBG to MEA on a FIT, standardized contracts etc. These investments would benefit from guarantees under the ASPIRE programme. At a subsequent phase, taking on larger capacities of RE can be tackled once energy storage costs have fallen.

Project 3: Implementation Support and Institutional Development

Support will be provided to FENAKA to design and implement these projects, to train FENAKA staff in operating and maintaining these systems, to monitor performance and to support planning for greater RE scale up on these islands. International expertise will be sought to supplement local capabilities within FENAKA.

Financing Plan

	SOURCES OF FUNDING (USD 000)											
Components	SREP	GoM	WB IDA	WBG Guara--ntee	ADB	IFC/ ADB (PSOD)	GIZ	JICA	Private	Others	IDB	TOTAL
POISED												
Small power station RE	12,000	3,000			3,000					3,000	5,000	26.000
Power system rehabilitation		5,000			3,000						5,000	13,000
Implementation support & institutional development	750						400					1,150
Sub Total	12,750	8,000	0	0	6,000	0	400	0	0	3,000	10,000	40,150

Implementing Arrangements

The implementing agency will be FENEKA. The power station work is closely integrated with the operations and equipment already installed in power stations. It will therefore be carried out by FENEKA, supported and advised by MEE (and later MGF). Actual engineering work will be done either by FENEKA or under Engineering Procurement and Construction (EPC) contracts where initially the utility would lack the skills and resources needed to carry out this task. Support relevant for energy efficiency initiatives under POISED for small and medium electricity consuming islands to MEA and MGF or would be provided through MDB funding.

Lead Agency

ADB

Transformative Outcomes and Outputs

The outcome of POISED will be to demonstrate 100% RE based systems starting with 2MW of RE with storage on the 10 small electricity consuming islands that would be made 100% RE based systems in phases. In addition, 3MW of RE will be developed in 30 medium islands by private sector under the FIT to be announced by MEA with about 12 million litres of diesel avoided per year and reductions in GHG emissions by approximately 31,000 tCO_2/year. The ASPIRE programme would provide guarantees that would support the FIT.

The following outputs are expected to be achieved under POISED:

- 2MW of RE generation installed with adequate storage on 10 islands;
- reduction in GHG emissions by about 5,000 tCO_2/year;
- approximately 2 million litres of diesel avoided/year;
- power systems on 15 islands will be upgraded to reduce the generation and distribution losses;
- power systems on 15 islands will be assessed and made ready to accept about 30% RE;
- productive use of power supported in small and medium electricity consuming islands linked to employment creation and business opportunities; and
- capacity would be developed in FENAKA to design, procure, implement and maintain renewable projects on a larger set of islands.

CONCEPT NOTE

THILAFUSHI WASTE-TO-ENERGY PROGRAMME

Background

Growing urbanization and the importance of tourism explain the critical need for an efficient and sustainable waste management system in the Maldives. The capital Male' is one of the most densely populated cities in the world with around 47,000 inhabitants per km^2. As such, Male' cannot afford inefficient waste collection and disposal. In addition, many tourist resorts are located in the islands surrounding Male', and the preservation of a pristine environment is an absolute condition for the continued ability of these resorts to attract tourists and to sustain growth of any economic largely driven by tourism. The current practice where waste is collected in an ad-hoc manner and dumped at the shore, disposed of in the ocean, or transported to Thilafushi, where it is burnt openly destroys the marine environment, pollutes the air and puts people's health at risk.

The WTE power facility under this programme will be part of the larger waste management framework and contribute to the National Solid Waste Management Policy which provides a vision for an efficient waste management system. In September 2009, the Government appointed Advisory Services from the International Finance Corporation (IFC) to help structure and competitively tender an integrated waste management project for the Male' catchment area as a public-private-partnership (PPP). A competitive engagement process with the private sector is currently underway for implementation.

Objective

Implementation of an effective PPP waste management solution for the collection, processing and disposal of waste in the greater Male' region catchment through the implementation of a WTE facility.

Project Selection

The implementation of the WTE facility will be part of a solid waste management system for the greater Male' region and the neighbouring resort islands. The overall system will include waste collection and transportation to Thilafushi, waste processing and disposal on Thilafushi (segregation, recycling, composting, gasification and inert waste disposal in the landfill); and an up to 4 MW WTE power generation facility to replace the existing diesel-based power generators on the island – the latter being considered under the Maldives SREP IP.

The project is designed as a concession agreement where the project company will receive tipping fees and transportation fee, adjusted annually for certain factors. The rates will be applied to the quantity of waste handled and processed. The project company will need to serve greater Male' region, the outer islands and resorts that are within the catchment area identified by the MEE. In addition to the tipping and transportation fees, the project will sell compost, recyclable materials, and electricity.

As is typical with such projects, project financiers will analyse the various risks to the project including, but not limited to, sponsor's experience and track record, suitability of technology, waste supply arrangements, power off-take arrangements, foreign exchange risk, contractual arrangements, legal and regulatory environment, creditworthiness of contracting parties include state and state-owned entities and support structures. The current fiscal position of the Maldives government creates a counterparty risk for the project and the lenders that will need to be sufficiently addressed to provide necessary comfort to potential financiers.

Financing Plan

For all of the components of the integrated waste management system, the estimated total cost is approximately USD 58 million. This will likely be financed through an optimal mix of debt from lenders (e.g. 70%) and equity (30%) from the private sector sponsors. Both ADB's private sector operations department and the IFC have indicated their initial interest to consider funding up to USD 15 million each (USD 30 million total) of the long-term senior debt financing for the project(s). Additional sources of debt financing or commercial risk participations (through a B-loan or other structures through ADB and IFC) are likely to be needed to complete the financing of the project.

The WTE facility is considered under SREP, even though it will remain part of the waste management operations. Therefore, the financing plan for this programme is adjusted accordingly and based on estimated costs of approximately USD 20 million.

	SOURCES OF FUNDING (USD 000)											
Components	SREP	GoM	WB IDA	WBG Guara--ntee	ADB	IFC/ ADB (PSOD)	GIZ	JICA	Private	Others	IDB	TOTAL
Waste-to-Energy Thilafushi	5,000					10,000			5,000			20.000
Sub Total	5,000	0	0	0	0	10,000	0	0	5,000	0	0	20.000

Implementing Arrangements

Local banks are unable to provide long-term financing for projects, and the country risks have constrained the international commercial banks from actively considering financing projects without extensive political risk insurance. Such insurance may not be available for the tenors required for this project to be viable. As this project will have a strong developmental impact on the Maldives and promote the use of PPP structures to promote RE generation, SREP funds may be required to meet the financing gap or cover the incremental costs or risks of project implementation. ADB and IFC will consider the following options for deploying the SREP funds: (i) parallel concessional loans; (ii) partial credit or risk guarantees or other risk sharing mechanisms; (iii) buying down of fees and/or risk premiums from the commercial political risk insurance market; (iv) covering the risks associated with electricity off-take under the FIT scheme; and (v) other forms of subordinated or mezzanine finance. Once the feasibility study has been completed and a project structure determined in conjunction with the investors, a more specific financing plan will be proposed by the joint ADB-IFC team.

Lead Agency

IFC and ADB's Private Sector Operations Department (PSOD).

Transformative Outcomes and Outputs

The project will contribute to a reduction in pollution and greenhouse gas emission through the generation of electricity from indigenous RE resources, greater private sector participation in municipal services, and improved economic conditions through the provision of efficient urban infrastructure. It will provide electricity generation for the greater Male' area complementary to the Maldives SREP IP solar PV initiatives and support the Government's carbon neutral goal, while helping it comply with good global practices on the treatment and disposal of solid waste.

The following outputs are expected to be achieved under the Thilafushi WTE project:

- Up to 4 MW of the generation capacity;
- reduction of CO_2 emissions by 20,000 tons of CO_2 /year;
- approximately 7.5 million litres of diesel avoided/year; and
- environmentally safe disposal of 200 tons of waste/day.

CONCEPT NOTE

TECHNICAL ASSISTANCE FOR RENEWABLE ENERGY SCALE UP PROGRAMME (TA)

Background

The primary mandate of the MEE is to ensure the delivery of reliable, low cost and environmentally sustainable energy to support the economic development and enhance energy security of the islands. MEE is in the process of formulating a Renewable Energy Law with a long term perspective for RET development including a functioning system of FIT as well as supporting the establishment of a coherent and efficient structure for the electricity market.

The state-owned utilities and the proposed MGF will play an important role in the successful implementation of Maldives SREP IP and future RE expansion in the country. Furthermore, the MEA, as the regulator for the sector, is critical to the success of the FIT and private investment in the sector. Therefore, there is a strong need for building the capacities of these institutions and improving the access to quality and reliable data to inform future policy decisions and investment opportunities.

Objective

The TA activities will support the strengthening of an enabling environment, strengthen human resource capacities and identify additional RE investment opportunities.

Project Selection

The following TA activities will be supported through the Maldives SREP IP:

Project 1: Greater Male' Area Renewable Power System Integration

In order to further displace use of diesel generation additional RE is required. A feasibility study will be carried out under Maldives SREP IP to identify the RE options to deliver large-scale dispatchable power for greater Male' region and achieve economies of scale through inter-island connectivity. The study will recommend further initiatives to be supported from other resources.

Project 2: Improved Access to Quality Data

Country-wide RE resource mapping is needed to inform strategic policy decisions and support future development of RE programmes. The activity is expected to finance the construction of a national network of wind and solar data collection stations that will allow the optimization of wind, solar and energy storage components of the island power systems. Wind data will be collected at a range of heights up to ±80m, and solar data will include direct and diffuse radiation, and radiation reflected off lagoon surfaces. Funds will be used for real-time data collection, monitoring and analysis. In addition, ocean energy data will be gathered as well as strengthening of the MMS.

Project 3: Creating an Enabling Environment

Through Maldives SREP IP technical assistance the RE policy and the regulatory framework will be strengthened by developing and implementing policies, laws, regulations, rules, standards and incentive schemes to integrate RE in the energy sector. This includes the FIT, standardised PPAs, guidelines for investment approval, licensing of electricity operators etc. to support RE development. MEA is already in the process of carrying out those tasks and will continue to do so with the support from the WBG and ADB. In addition, business models for RE projects to attract private investments will be developed.

Project 4: Human Capacity Building

This project provides the necessary support for any significant development of the RE sector. Human resource capacity will be developed for planning, implementation and operation of RE systems. In addition to training, international expertise will be sought to supplement local capabilities. In addition, the project will provide support for setting up the MGF and MGFs spending policies in the RET and energy efficiency areas by providing necessary information, training, knowledge sharing, operational procedures and financial support for projects to increase their bankability. Assistance with the formulation of a suitable electricity tariff and mechanism to support RE including technical standards and information required for project financing is being provided by ADB.

Financing Plan

	SOURCES OF FUNDING (USD 000)											
Components	SREP	GoM	WB IDA	WBG guara-ntees	ADB	IFC/ ADB (PSOD)	GIZ	JICA	Private	Others	IDB	TOTAL
T/A for RE Scale Up												
Greater Malé Region Renewable Power Sys Integration	500											
Improved access to quality data		300								800		500
Creating and enabling environment	200	1,000			400		600					1,100
Human Capacity Building	485	100					1,100					1,685
Sub Total	1,185	1,400	0	0	400	0	1,700	0	0	800	0	5,485

Implementing Arrangements

The implementing agency will be MEE. SREP resources will be channelled through the WBG to carry out Project 1. Funding for Project 2 is being sought from bilateral sources through the WBG. SREP funds may be used to supplement, where needed. ADB will also carry out a number of TA activities under Maldives SREP IP.

Lead Agency

WBG and ADB

Transformative Outcomes and Outputs

- The greater Male' region renewable power system integration study will identify RE options to deliver dispatchable power including energy storage and to achieve economies of scale through island connectivity;
- a strong legislative framework will reduce risks and transaction costs and encourage investment in RE;
- strengthening of the capacity of government institutions and other relevant stakeholders as well as a clearer definition of responsibilities to improve regulatory environment for investors; and
- a network of masts and solar measuring stations covering the country in a representative fashion to provide real time data collection and distribution.

PROGRAMME PREPARATION GRANT REQUEST

SREP PROGRAMME
Project/Programme Preparation Grant Request

1. Country/Region:	Maldives	**2. CIF Project ID#:**	(Trustee will assign ID)
3. Project Title:	Preparing Outer Islands for Sustainable Energy Development (POISED)		
4. Tentative SREP Funding Request (in US million total) for Project[29] at the time of Investment Plan submission (concept stage):	Grant: USD700,000		Loan: N/A
5. Preparation Grant Request (in USD):			MDB: ADB
6. National Project Focal Point:	Ahmed Saleem		
7. National Implementing Agency (project/programme):	Ministry of Environment and Energy		
8. MDB SREP Focal Point and Project/Programme Task Team Leader (TTL):	Jiwan Acharya		Len George

Description of activities covered by the grant:

The grant will provide institutional support and training to FENAKA to develop projects for approval under SREP for

1. Conversion of 10 power station on small electricity consuming islands to full RE.
2. Replacement of the inefficient power systems in 15 medium electricity consuming islands to prepare them for installing 30% of demand from RE.
3. Readiness assessment of 15 efficient power systems in medium electricity consuming islands to prepare them for installing 30% of demand from RE.
4. The grant will also support MEA and other stakeholders (including MEE and MGF) on POISED related preparation, design, implementation aspects.

The activities covered under the grant would support

a) Review of technically suitable options for RE scaling up on the different island groups and preparation of feasibility studies.
b) Strengthening of FENEKA and other stakeholder implementation capacity to design and implement the POISED programme.
c) Preparation of project for review by SREP and MDBs.
d) Development of technical specifications and configuration for bid process and initiation of bid process related support.
e) Stakeholder consultations and support.

Suitable international expertise would be sought to supplement local capabilities within FENAKA operational and managerial staff to carry out the identified tasks.

9. Outputs:	
Deliverable	**Timeline**
Completion of feasibility studies	Within a 10 month period
FENEKA and other stakeholders develop capacity to design and implement POISED	Over a 15 month period
Project prepared for approval from SREP sub-committee and ADB Board	Over a 12-15 month period
Bidding documents prepared for initiating the Programme	Over a 12-15 month period
Support for stakeholder consultations on POISED design aspects including transition path to prepare islands for RE integration	*Over a 12-15 month period*
10. Budget (indicative):	
Expenditures[30]	**Amount (USD) – estimates**
Consultants	460,000
Workshops/seminars	50,000
Travel/transportation	70,000
Others (admin costs/operational costs)	50,000
Contingencies (max. 10%)	70,000
Total Cost	700,000
Other contributions:	
· Government	0.00
• MDB	0.00[31]
• Private Sector	0.00
• Others (please specify)	
11. Timeframe	(Tentative) Over 15 months.
Other Partners involved in project design and implementation:	Funds will be sought from other multilateral, bilateral sources to prepare the utilities for planning and implementation of the projects while planning for future RE expansion.
12. If applicable, explanation for why the grant is MDB executed:	Will be executed through ADB coordinating with MEE for project preparatory activities.
Implementation Arrangements (incl. procurement of goods and services):	The implementing agency will be FENAKA, supported and advised by MEE (later MGF) and ADB. Support to MEA would be provided on POISED related elements.

29 These expenditure categories may be adjusted during project preparation according to emerging needs.
30 Funds are expected to be confirmed for preparatory support in 2012 at ADB concept clearance.

PROGRAMME PREPARATION GRANT REQUEST

SREP PROGRAMME
Project/Programme Preparation Grant Request

1. Country/Region:	Maldives	**2. CIF Project ID#:**	(Trustee will assign ID)
3. Project Title:	Accelerating Sustainable Private Investments in Renewable Energy (ASPIRE)		
4. Tentative SREP Funding Request (in US million total) for Project[32] at the time of Investment Plan submission (concept stage):	Grant: USD1.000.000		Loan: N/A
5. Preparation Grant Request (in USD):			MDB: WBG
6. National Project Focal Point:	Ahmed Saleem		
7. National Implementing Agency (project/programme):	Ministry of Environment and Energy		
8. MDB SREP Focal Point and Project/Programme Task Team Leader (TTL):	Gevorg Sargsyan		Abdulaziz Faghi

Description of activities covered by the grant:

The grant will provide technical assistance and institutional support to MEE, MEA, STELCO and FENAKA to:

1. Develop FIT and WTE projects for approval under SREP.
2. Strengthen the institution's technical, planning and management capacities to attract national and international investors and lenders.
3. Carry out the feasibility study for greater Male' region.

The activities covered under the grant would support:

a) Set up of guarantees facility for political, regulatory and commercial risks.
b) Strengthening of MEE, MEA, FENAKA and STELCO.
c) Development of technical specifications, legal and commercial aspects, FIT and tariff mechanisms, standardized PPAs, guidelines for investment approval, licensing of electricity operators.
d) Development of marketing strategy to promote the Maldives SREP IP to national and international investors and lenders (incl. an investor's conference and/or roadshow for the first half of 2013).
e) Carry out of feasibility study for greater Male' region.
f) Carry out consultations with sector stakeholders.

31 Including the preparation grant request

9. Outputs:	
Deliverable	**Timeline**
Set up guarantees facility	18 months from approval
Strengthened capacity within MEE, MEA, STELCO and FENEKA to develop and implement the projects	1-2 years
Projects prepared for approval from SREP sub-committee and WB Board	1 year from approval
Consultation with sector stakeholders	1-2 years
Marketing strategy and mechanisms	1-2 years
Investors Conference	6 month from approval
Feasibility Study	12 months from approval
Stakeholder consultations	2 month from completion of study
10. Budget (indicative):	
Expenditures[33]	**Amount (USD) – estimates**
Consultants (study)	500,000
Consultants (project preparation)	150,000
Consultants (marketing activities)	100,000
Workshops/Seminars	50,000
Travel/Transportation	50,000
Others (admin costs/operational costs)	50,000
Contingencies (max. 10%)	100,000
Total Cost	1,000,000
Other contributions:	
GIZ	500.00
11. Timeframe	(Tentative) 18 month from approval.
Other Partners involved in project design and implementation[34]	Funds will be sought from other multilateral and bilateral sources for preparing the national institutions for RE expansion beyond SREP.
12. If applicable, explanation for why the grant is MDB executed:	
Implementation Arrangements (incl. procurement of goods and services):	MEE will provide policy, promotion and implementation support combined with regulatory support from MEA.

32 These expenditure categories may be adjusted during project preparation according to emerging needs.
33 Other local, national and international partners expected to be involved in design and implementation of the project.

APPENDIX 2 - SUMMARY OF STAKEHOLDER CONSULTATIONS

A number of stakeholder consultations were carried out between September 2011 and January 2012. The following is a summary of the discussions and feedback received from public and private stakeholders. Prior to the submission of the IP for approval, a third and final round of consultations was carried out in September 2012 which is also summarized below.

Summary of 3rd Public Consultation (12th September 2012)

A public consultation meeting was held on September 12, 2012, inaugurated by Dr. Mariyam Shakeela, Minister of Environment and Energy. She highlighted the importance for stakeholder participation for the successful implementation of the Maldives SREP IP and thanked the WBG and ADB for their support and assistance provided during the process of the IP formulation. Minister Dr.Shakeela then requested the participants to critically comment on the document and to provide their inputs to improve the document.

Opening remarks were also made by the representatives from MDBs highlighting the importance of stakeholder participation and their inputs to the IP followed by the presentation of the Maldives SREP IP by Mr. Ahmed Saleem, Permanent Secretary of the Ministry of Environment and Energy.

Stakeholders gave their inputs on the overall structure of the Maldives SREP IP as well as on the proposals for RE for greater Male' region, RE for outer island and institutional arrangements. The following comments and feedbacks were received from the stakeholder.

Comments	Actions taken
Concerns were raised for not having a strong regulatory framework including a transparent tariff structure with a FIT that reflects the proper costs of electricity for consumers and foreign investors. The importance of having FIT regulation in place prior to the implementation of SREP activities was highlighted by all participants.	Has been explained, it already one of the main pillars of Maldives SREP IP.
Participants suggested other options to be considered to utilize access to energy from RE sources other than Solar and Wind, as well as new forms of storage other than battery storage. To scale up RE in the greater Male' region in particular, additional investments in infrastructure (submarine cable) might be needed.	Is already included as part of the Feasibility study for greater Male' region.
Clarity was requested regarding the role of the proposed institutions to be created. Suggestions were made to also include MED into the structure in addition to develop a strong evaluation and monitoring mechanism.	Was explained during the meeting, MED is included as part of the institutional structure.
Participants requested the overall strengthening and clarification of private sectors role in the development and implementation of RE projects as well as the inclusion of civil society organizations and island councils.	New chapter was added to Maldives SREP IP to include the different stakeholder better into the implementation activities.

Concerns were raised regarding lack of technical know-how among utility staff and private sector stakeholder, following by suggestions to include technical training to utility staff and private sector. In general, the importance of building more local expertise for the RE sector was highlighted.	Training and capacity building is already an integrated part of the Maldives SREP IP.
Concerns were raised regarding the energy security for smaller communities related to the proposed shift from diesel based electricity generation to 100% RE.	Will be work out during the actual project preparation phase. The existing diesel generator sets will act as redundancy in case of PV system failure.
Concerns were raised regarding some of the technical risks such as corrosion, following suggestions to consider additional factors to address these risks in the technology selection.	Have all been covered under the risk assessment and appropriate considerations will be made during detailed design phase.
Suggestions were made to supplement SREP by programmes and projects on energy efficiency.	Energy efficiency is a necessary supplementary activity for the successful implementation of the SREP. There are already a number of on-going programmes, the Government will further strengthen this sector and seek support from other multi- and bilateral sources.
To better include the population, participant suggested that the government should carry out a number of awareness raising programmes on RE advantages or the proposed tariff structure. This could also educate people to why they should pay their electricity bills.	Government plans to introduce an RE module in training programmes conducted for the Island counsellors at the Institute of Local Governance and Development to sensitise them of the socio-economic and environmental aspects of RE technologies. MEE will also carry out media campaigns using mass media to raise awareness of the public on RE benefits.

Summary of prior consultations:

1. A public consultation meeting was held on September 7, 2011 to solicit comments on the Renewable Energy Investment Framework (REIF) – which forms the basis of government policy and thinking on RE and underlies the preparation of the Maldives SREP IP.

2. The following aspects were highlighted by the participants:

Comments	Actions taken
a. RE sector developments in the Maldives were to focus on energy efficiency and use of solar photovoltaic for RE generation.	
b. Concerns were raised regarding energy security in the proposed shift from dependence on diesel imports to imported biomass which is proposed for the Male' region.	Based on concerns raised, IP was revised and biomass investment removed.

c. Emphasis on local private sector playing a role came across strongly in the consultations and stressed that private sector should play a greater role in the development and implementation of RE initiatives.	IP took into consideration of this concern and the revised document now reflects the important role private sector is expected to play in the IP. In fact 34% of the total investment is expected from the private sector.
d. Concerns were raised regarding the role of the proposed institutions to be created, namely Maldives Energy Services Company (MESCO) (then referred to as Maldives Energy Finance Corporation (MEFCO) and Maldives Energy Technology and Support Unit (METSU) with respect to ensuring that competition will be enhanced and that these organizations do not bias project development and technology selection.	This concern was seriously taken into consideration and eliminated creation of new organisations and emphasis put on use/strengthening of existing institutions in the implementation of IP.
e. Concerns were raised on whether MESCO and METSU would be creating new bureaucracies and that priority should be given to strengthening existing institutions.	See above
f. Highlighted that there is a strong need to build local expertise and have less dependence on foreign consultancies to roll out the RE programme.	This concern too was considered and emphasised training of locals on the revised IP.

3. The REIF was placed on the web for public comment in October 2011.

4. A consultative meeting was held on November 28, 2011 with all the major Male' area power producers to understand better the forecasts of demand and plans for supply. The following key points were highlighted by the participants:

Comments	Actions taken
a. Reflected the uncoordinated nature of power planning in Male' area and importance of operationalising a coordination mechanism to establish a holistic approach to power planning for the greater Male'.	A detail study will be conducted under SREP to identify best options to meet the electricity need for the greater Male' region.
b. Highlighted the importance of a strong independent energy sector regulator to ensure sector development in an orderly fashion to safe guard interests of both producers and consumers of power.	MEA is developing a comprehensive energy sector regulatory framework with technical assistance from WBG and ADB. Through this support, regulations on licensing, standards of performance, energy efficiency labelling, investment approvals and technical regulations are being developed.
c. Establishment of an Energy Ministry or a Ministry which has "Energy" in its title was proposed to reflect the significance of the sector and establish a central authority that will provide information and direction on energy sector development.	The Minister of Environment and Energy represents the energy sector in the President's Cabinet of Ministers. A Minister of State solely dedicated to the energy sector has also been appointed to help the Maldives bolster its energy security and create important RE and energy efficiency policies and reduce greenhouse gas emissions.
d. Suggestions were made to establish more clarity on which government agency is driving the energy sector to ensure roll out of a consistent and coherent energy policy framework nationwide.	See comment c.

5. A draft of the Maldives SREP IP was placed on the Ministry of Economic Development web site on January 8, 2012. No formal comments were posted online.

6. A consultative meeting for all the major power producers (utilities and private) outside the resorts was held in Male' on January 17, 2012 to review the latest draft of the Maldives SREP IP. The discussions mainly surrounded on the proposal for having a biomass plant as a base-load power for Male' region and building local capacity of utilities to implement RE projects. The following key points were highlighted in the meeting:

Comments	Actions taken
a. To undertake an independent detail study to determine the best technology option for Male' base-load.	A detail study will be conducted under SREP to identify best options to meet the electricity need for the greater Male' region.
b. Not to discount totally the future prospects of Ocean thermal and marine currents as possible future technology options for base-load or backup power.	See comment a.
c. To integrate STELCO as a key player in implementing the base-load power project for the Male' region.	STELCO will be playing key role in implementing project related to greater Male' region.
d. Considering the many developments planned for the Male' region, it was highlighted that timing when to commission the proposed base-load power plant was critical.	It will be identified once the activity on comment a is completed.

7. A public consultation on the Maldives SREP IP was held in Male' on January 18, 2012 open to all comers. It was attended by a wide selection of stakeholders including NGOs, the Bank of Maldives, major power generators and consumers, RE entrepreneurs, and senior ministers. The meeting revealed that most of the concerns addressed by stakeholders on September 7, 2011 have been reasonably addressed in the draft IP that was published in the MED website for public consultation on January 8, 2012. In the consultation session, the following were highlighted;

Comments	Actions taken
a. Mild levels of concerns were expressed purely on environmental grounds to the proposal to consider biomass as a reference case for Male' base-load. Participants were reassured that the technology option for Male' area will be determined based on an independent study to verify the best technology option. Most participants were satisfied with the approach and expressed support for the study.	Based on concerns raised, IP was revised and biomass investment removed.
b. Suggestions were made not to discount the available technology options, particularly ocean thermal and marine currents.	A detail study will be conducted under SREP to identify best options to meet the electricity need for the greater Male' region

c. Proposals were put forwarded to consider micro-grids and adopt a cluster approach to deliver power in some of the outer islands.	In parallel to SREP implementation detail studies will be conducted with the assistance from other sources to cluster potential islands to interconnect.
d. The need for strengthening the regulatory framework was highlighted to facilitate take up of both RE projects and EE measures. It was also highlighted the importance of integrating these aspects in the design phase with better and improved building codes, FIT etc. Discussions also surrounded in using incentives and regulatory options to increase the compliance and take up of RE/EE pathways by the tourism sector. The importance of building and engaging local talent was highlighted during the discussions.	MEA is developing a comprehensive energy sector regulatory framework with technical assistance from WBG and ADB. Through this support, regulations on licensing, standards of performance, energy efficiency labelling, investment approvals and technical regulations are being developed.

APPENDIX 3 - ONGOING OR RECENTLY COMPLETED RENEWABLE ENERGY PROJECTS

Project for Clean Energy Promotion in Male'

The main objective of this Japanese grant aid project is to implement grid connected electricity generation through Photovoltaic technology. This would serve as an alternative means of producing electricity to cater for the growing electricity demand in Male', and also promote adaptation of clean energy as a means of Climate Change Mitigation. Under the project total of 395kWp of Solar PV systems has been installed at rooftops of 5 public buildings in Male'. These systems have been operational since March 2012.

Installation of additional amount of 280 kWp of solar PV systems will start in September 2012 and will be completed in March 2013. On completion of this project Male' will have approximately 775kWp solar PV rooftop mounted electricity generating facilities. This is approximately 1/12 of the absorption capacity of the Male' grid.

Clean Energy for Climate Mitigation (CECM) Project

Under the multi-donor Maldives Climate Change Trust Fund (CCTF) the Clean Energy for Climate Mitigation (CECM) Project has been developed to have a RE and energy efficiency demonstration activities on GDh.Thinadhoo Island.

Under the project 300kWp solar PV grid tied system will be installed on the various public buildings of GDh.Thinadhoo Island. This is almost one third of the maximum electricity demand of the island. By installing this amount it is expected to produce 500 MWh annually from solar PV and will avoid approximately 270 tCO_2 per annum.

In addition to the above installation energy efficiency and conservation activities will be carried out in the island together with additional studies on potential RE technology which could be used for electricity generation for GDh.Thinadhoo and nearby Islands.

STELCO Six Island Solar PV Project

This is the first project in its kind in the Maldives which have been completed under a power-purchasing agreement signed between State Electric Company (STELCO) and Renewable Energy Maldives (REM). Under the project total of 652kWp PV panels were installed in five different islands where STELCO provide electricity service. 294 kWp were installed in K.Villingilli, 64 kWp were installed in K.Guraidhoo, 78 kWp were installed in K.Himmafushi, 120 kWp were installed in K.Maafushi, 48 kWp were installed in K.Kaashidhoo and 48 kWp were installed in K.Thulusdhoo.

Support of the Climate Neutrality Strategy of the Maldives

This joint undertaking of the Maldivian-German cooperation of MEE and GIZ operates on three levels in order to improve the conditions for the implementation of a climate neutrality strategy in the Maldives. The project provides advisory services for ministries, governmental agencies and utilities in order to promote private sector engagement for increased use of RE technologies

for electricity generation as well as measures on energy efficiency. Training measures for public and private decision makers as well as for engineers or project developers will be carried out under the project in close cooperation with Maldivian training institutions.

Low Carbon Development Project- GEF

A project to promote low carbon energy and energy efficient technologies is under implementation by MEE in collaboration with United Nations Environment Programme and United Nations Office for Project Services. The project is co financed by various partners including a USD 3.9 million grant from the Global Environment Facility, and USD 21.2 million co financing leveraged from various partners.

The project is specially targeted towards the building sector. Under the project, an assessment and monitoring system for Energy Efficiency Road Maps for the building sector focused on small island tropical environments will be established and new design parameters for Energy Efficiency (EE) & Low Carbon Energy (LCE) buildings selected and recommended. The project aims to develop local technical expertise and facilitate technology transfer in the sector. Furthermore, the project will undertake commercial-scale demonstration of EE & LCE technologies and finance EE and LCE building technologies. The project will also contribute to the formulation of policies for transformation of markets for EE & LCE technologies.

At present, a memorandum of understanding to be signed between MEE and UNEP is being negotiated to manage the operational aspects of the project. The contract is expected to be signed within four weeks time.

Energy Efficiency Project- UNIDO

The MEE and MEA are currently working with United Nations Industrial Development Organization to develop a project on improving energy efficiency in the Maldives. The overall objective of this project is to establish a sustainable mechanism for promoting energy efficiency in the tourism and manufacturing industries in Maldives. Under the project, it is planned to develop national policy, guidelines and programmes on energy management standards in the Maldives, and facilitate voluntary commitments and companies policies to implement EnMS in selected tourism and manufacturing industries. The project will facilitate the adoption of national EnMS based on ISO 50001. In addition, a curriculum for energy audit certification scheme conforming to international standards will be developed, and a system for certification of national experts as EnMS auditors will be established.

The project is currently being designed with assistance from UNIDO. The project is expected to utilize 1.1 million US dollars from GEF from its STAR allocation to Maldives, and will be co financed by the various project partners.

Ongoing or recently completed renewable energy projects

Project	Company	Finance Source	Progrress	Remarks	Size (kW)
ONGOING PROJECTS					
Project for Clean Energy Promotion in Male'	Contracted to Toyota Tsusho Corporation	Govt. of Japan	On-going	Installed 395kWp solar PV grid connected system on selected public rooftops in Male'.	~775
Clean Energy for Climate Mitigation (CECM)		CCTF	On-going	Solar PV grid connected system on selected public rooftops in GDh.Thinadhoo	~300
Solar Grid Connected System for Small Island (K.Dhiffushi)	KEPCO	GSEP, Govt. of Japan	On-going	Solar PV grid connected system in K.Dhiffushi	40
PROBABLE/POSSIBLE PROJECTS					
Wind in Malé Region - Power Purchase Agreement (STELCO)	X.E.M.C New Energy	Private Sector	Data collection only	Wind/Gas hybrid system	20,000
SUCCESSFULLY COMPLETED PROJECTS					
PV powered mobile phone masts	Dhiraagu	Dhiraagu	Completed	Total 258kW PV in 174 Locations	258
Solar PV system	Soneva Resort	Private	Completed	10kWp Solar array in the resort	70
PV power for 6 islands in Male' atoll	REM and WIRSOL APAC GmbH	Private sector	Completed i July 2012	Installed solar PV up to 30% of the peak demand	652
Rooftop Solar PV System	JICA	Govt. of Japan	Completed	Solar PV systems at L.Gan and L.Fonadhoo	15

APPENDIX 4 - ENERGY EFFICIENCY PROJECTS

Energy Efficiency

In order to deliver the highest possible level of GHG reductions at the lowest possible cost, a series of activities parallel to those funded by SREP will be pursued. The objectives will be to reduce the costs to society of energy use by increasing energy efficiency, and to reduce the absolute amount of power used at night, in order to reduce the costs of providing solar power through energy storage devices. (Solar power delivered through batteries can cost 250% as much as the cost of using power in the day when the sun is shining). Much of the technical support for this work will be carried out by Energy Department of the Ministry of Environment and Energy.

Energy Efficiency In Government Estate

The GoM spends of the order of USD 10 million a year on electricity. Major potential savings have been identified in this sector. These savings will be used to support energy efficiency programmes elsewhere to reduce subsidies and emissions. In addition, significant wastage occurs at night when demand should be low, but lighting, cooling, and appliances that are left running unnecessarily. MEE will initiate and implement a 20% Savings Campaign to use untapped efficiency and to lift saving potential for government buildings as this is the single most effective step in achieving greenhouse gas reduction at the lowest cost to the economy. This will not only save money because it lowers the energy bill of the government, but can also raise public awareness for clean energy and serve as a best practice example for other private buildings or industry.

Domestic Energy Efficiency

Domestic energy efficiency is a key target for reducing emissions and the energy costs for consumers. Research in one of the islands shows that 25% or more of electricity is used for cooling devices (air conditioners and fridges) and that these are frequently grossly inefficient. Complementary work on building insulation will contribute significantly to reducing air-conditioning load.

Promotion To Resort And Industrial Sectors

The resort and industrial sectors are one of the major power generators and consumers. One key objective of Energy Department will be to offer these sectors working examples of energy efficiency and RE generation – with complete transparency of costs – and to actively promote these to private energy generators and users. This will help to persuade and encourage these sectors to take their own steps to becoming oil independent.

The GoM may support this activity by making fiscal adjustments to encourage the transition to low carbon. Even now Government is working together with IFC in conducting Cleaner Audit programmes at resort.

Financing Energy Efficiency

The principal energy efficiency measures identified have very rapid paybacks. These will be funded through a combination of GoM budget support, MDB loans, and private sector capital (on a shared saving basis). Savings made will be returned to MGF and re-invested in further savings programmes.

APPENDIX 5 - ELECTRICITY CONSUMPTION BY ISLAND CATEGORIES

Large electricity consuming islands

	Island	kWh/year
1.	Kulhudhuffushi	8,078,052
2.	Fuahmulah	7,627,596
3.	Thinadhoo	5,437,900
4.	Addu City (per island)	3,648,335

Medium electricity consuming islands

	Island	kWh/year
1.	Villingili	2,752,160
2.	Kudahuvadhoo	2,663,828
3.	Naifaru	2,620,240
4.	Hulhumeedhoo	2,480,760
5.	Hinnavaru	2,414,704
6.	Dhidhdhoo	2,246,440
7.	Maafushi	2,047,932
8.	Eydhafushi	2,000,408
9.	Hanimaadhoo	1,825,748
10.	Manadhoo	1,824,520
11.	Velidhoo	1,709,440
12.	Thimarafushi	1,667,728
13.	Hoarafushi	1,500,156
14.	Gadhdhoo	1,308,976
15.	Himmafushi	1,281,688
16.	Milandhoo	1,231,496
17.	Alifushi	1,183,642
18.	Holhudhoo	1,167,316
19.	Ihavandhoo	1,158,264
20.	Vilufushi	1,103,908
21.	Gan-Mathimaradhoo	1,052,908

Small electricity consuming islands

	Island	kWh/year
1.	Guraidhoo	992,880
2.	Thulusdhoo	991,600
3.	Gan-Thundi	909,000
4.	Gan-Maahinna	857,372
5.	kanditheemu	853,336
6.	Kashidhoo	846,252
7.	Kolamaafushi	811,020
8.	Kelaa	789,552
9.	Dhaandhoo	759,456
10.	Maduvvaree	737,351
11.	Hulhudhuhfaaru	728,588
12.	Kendhikolhukulhudhoo	706,718
13.	Makunudhoo	701,112
14.	Dharavandhoo	692,186
15.	Maamendhoo	687,593
16.	Madaveli	655,088
17.	Gemanafushi	637,704
18.	Maavah	585,228
19.	Baarah	556,452
20.	Isdhoo	554,352
21.	Miladhoo	534,413
22.	Kurendhoo	532,465
23.	Faresmaathodaa	519,003
24.	Hoadedhdhoo	518,652
25.	Kendhoo	513,644
26.	Madifushi	506,688
27.	Meedhoo	474,028
28.	Gan-Mukurimagu	458,704
29.	Maamendhoo	457,560
30.	Neykurendhoo	456,668
31.	Bilehdhoo	450,704
32.	Innamaadhoo	417,641
33.	Landhoo	406,594
34.	Maalhendhoo	398,139
35.	Hithadhoo	394,272
36.	Nellaidhoo	390,812
37.	Fiyoree	389,972
38.	Vaadhoo	378,960
39.	Hithaadhoo	359,838
40.	Rathafandhoo	359,292
41.	Hulhudheli	350,468
42.	Ukulhas	342,932
43.	Kamadhoo	341,869
44.	Magoodhoo	341,220
45.	Nolhivaram	338,098
46.	Maafaru	337,456
47.	Nadella	335,744
48.	Maalhos	326,100
49.	Rasgetheem	320,058
50.	Kanduhulhudhoo	314,564
51.	Filladhoo	311,748
52.	Kudafari	307,192
53.	Olhuvelifushi	306,400
54.	Bandidhoo	305,748
55.	Rasmaadhoo	302,730
56.	Lhohi	301,450
57.	Kandoodhoo	294,776
58.	Dhevvadhoo	289,212
59.	Buruni	287,272
60.	Meedhoo	250,723
61.	Dhiyamigili	245,276
62.	Inguraidhoo	330,525

APPENDIX 6 - PROPOSED FEED-IN TARIFF

Proposed Feed-in Tariff

The proposed FIT and Net Metering regime is expected to form the core of RE development in the Maldives, and be the catalyst in scaling up RE technologies. To support this objective it is proposed that the existing FIT regime is supplemented with a new FIT regime aimed at meeting the needs of larger developers as well as small rooftop systems.

The Existing FIT Programme

To encourage private investments in RE, the Government instructed the 7 regional utilities in March 2011 to purchase electricity sold to the grid from RE sources at the rates shown below. To incentivise the utilities, it was decided, that the government would provide the utilities with USD 0.03/kWh purchased from RE source.

Utility Services Provider	Existing FIT (USD/kWh)
1. State Electric Company Limited: Greater Male' Region	0.22
2. Upper North Region (Ha, Hdh, Sh)	0.29
3. North Region (N, R, B, Lh)	0.29
4. Central Region (M, F, Dh)	0.26
5. South Central Region (Th, L)	0.35
6. Upper South Region (Ga, Gdh)	0.35
7. South Region (Gn, S)	0.26

To demonstrate the commitment to this policy, state owned utilities were quick to participate in this programme even without a mandatory Renewable Portfolio Standard (RPS). Immediately after the FIT order was issued, STELCO singed a PPA with Renewable Energy Maldives Pvt Ltd to install 652kW of Solar PV on rooftops of 6 selected islands operated by them. Though the government approved FIT was USD 0.22/kWh, the agreed tariff under this 20 year contract was USD 0.25/kWh. To satisfy the investor STELCO had to sacrifice its share of USD 0.03/kWh.

It was evident at the time if the government forced STELCO to apply the official approved FIT of USD 0.22, there was a good possibility that the contract would not have materialised as USD 0.25/kWh was the absolute minimum Renewable Energy Maldives Pvt Ltd was willing to accept despite the first mover advantage and full market capitalisation in these 6 islands.

As this FIT failed to have desired effect, the government decided to revise the tariff. The new existing FIT (henceforth eFIT) was introduced in September 2011. The eFIT was set after taking into consideration regional fuel prices variations and fuel efficiency variations prevalent in the respective regions. As an incentive for utilities, the eFIT was set 10% lower than it would cost to produce a kWh using diesel from their existing power plants.

The new eFIT also failed to materialise into contracts. To date, the only installation which has been successfully implemented under the eFIT is the "Project for Male' Clean Energy Promotion" funded under a Japanese grant. Therefore, commercially the eFIT cannot be considered a success, as private investors have shown little or no interest.

In the Maldives, electricity costs could be reduced considerably through the use of solar. Many existing diesel generators on the islands are extremely expensive to run as they have a capacity far above the demand of their islands, with electricity costing up to USD 0.70/kWh in some areas.

Despite its obvious commercial appeal, the lack of general awareness and success stories continue to hamper new project development in the sector. There are also clear indications that very few Maldives have funds to invest in rooftop solar PV systems, even if such systems were to cut the average electricity bill in half and pay for itself in 5-6 years. Therefore, to make the FIT successful, financial incentives such as concessional loan arrangements to cover part of initial investments and long term price guarantees are considered to be introduced as necessary preconditions as utilities and investors are now requesting the revision of the eFIT as they cannot continue further contracts based on just good will alone without financial and regulatory safeguards.

Proposed Modified FIT and Net Metering Programme

To remedy these weaknesses and to provide a low cost, streamlined and effective way of decarbonising the national electricity system the following modified FIT (henceforth mFIT) will be introduced for large scale installations taking into consideration cost-based compensation for RE generation, with different prices offered to different technologies, project sizes, and regions.

In addition, the Government is also planning to allow electricity customers that generate electricity using a RE source, to connect its facility to the distribution network under a Net Metering scheme. Unlike in the mFIT programme, these customers owned facilities are expected to be of small capacity, and hence they would be allowed to be connected through the existing electricity connection of the customer's premises.

The distinguishing feature of this approach is that there will be no payment for the electricity feed in by the customer into the grid. All feed ins will be set off against the customer's own consumption, first in the current billing period, and if there are any further access credits, in future billing periods.

The mFIT and Net Metering programme will be backed by a Renewable Portfolio Standard (RPS) policy and subsequent regulations to obligate the utilities and large power consumers to generate part of their energy from RE source.

The following specific features will be considered in the design of the mFIT that would be reviewed under the ongoing technical assistance by ADB to MEA to formulate a new RE tariff structure for Maldives.

Proposed mFIT Tariff Components

Balancing the needs for efficient land use, maximum penetration of renewables into the grid, and minimum cost of power, mean that the mFIT needs to be slightly more complex than a simple payment per kWh. Although it may seem overly complex for relatively small projects, these projects are potentially very large in proportion to any individual island grid.

Three components are proposed, a land rent and a capacity reservation charge payable by the developer, and the tariff itself payable to the developer. The tariff will be set high enough to compensate for the rent and capacity reservation charges in a well performing project.

Land Rent

Due to the scarcity of land available, a substantial land rent is needed to ensure the project developers use land efficiently. There should be active encouragement also to use space that cannot be used for other future developments.

Capacity Charge

The Utility needs to have a clear understanding of how much power any developer is likely to produce and the capacity to absorb it. By taking up a slice of capacity a developer is denying this slice to another potential developer. Thus, there needs to be a mechanism to 'reserve' capacity, and to provide strong encouragement to a developer to actually deliver their reserved capacity, or alternatively to release it if a project is not performing to specification.

In addition, the Utility has a need for power over as long a period of the day as possible instead of in a single peak. This will reduce storage and voltage stabilisation requirements. With solar PV this can be achieved either by tracking, or with some interesting new mounting geometries.

Therefore a Capacity Reservation Charge is proposed. To be effective, the Capacity Reservation charge needs to be high; six months Capacity Reservation charge will be payable immediately upon the signature of the agreement with the utility in order to secure the commitment of the developer. After six months the charge will be levied monthly.

The Capacity Reservation Charge will apply equally to wind or solar PV. Combined wind and solar installations may be managed by the developer to ensure that when operated together they do not exceed the capacity booked even if the sum of the nameplate capacity of the devices is greater than the booked capacity. They can do this by shedding some power generation at infrequent times of year in case they exceed the booked capacity.

The Reserved Capacity will be fixed at the time of application by the developer for the mFIT. The amount of capacity reserved must be supported by technical details of the planned scheme and expected generation.

The developer may change the Reserved Capacity subject to 3 months notice and, in the event of increase, there being sufficient grid capacity to accept the increase. The capacity that the Utility guarantees to take will change accordingly.

Penalties will be imposed on developers whose project fails to achieve at least 80% of reserved capacity within 24 months of contract signature.

Tariff

The disadvantage of FIT mechanisms is that they do not offer price discovery through competitive tendering. The tariff needs to be set at a level that attracts developers, without giving away more than is necessary. This can only be ascertained by careful market research and discussion with potential developers.

Tariff and Charge Reviews

Once established, the tariffs and charges for a project will not be changed over the lifetime of the project. For new projects, the Government of the Maldives may review tariffs upwards at any time. Review tariffs downwards, and rents or Capacity Reservation charges upwards, at any time, subject to a six month notice that such a review may take place.

New Regulation on mFIT Power Purchases

New regulations on power purchases need to be introduced. Regulation is proposed to ensure that the Utilities are the ultimate buyers of all privately generated electricity, except where a supplier and consumer are not connected to any Utility and place no burden on the public purse for the provision of power. This covers all installations except resorts and possibly some isolated businesses. This ensures that all installations are separately metered, and that the Utility can manage the balance of supply and demand over seasons, days, and within any day and night economically.

Utilities should have a duty to publish their power purchase capacity. This will be a time series based on average current demand profiles, and the sum of contracted power purchases and expected power purchases. This will allow project developers to see what scope exists for new projects in any island.

Stakeholder Perspectives on the mFIT

Developer Perspective

The developer will have a strong incentive to build the project rapidly as the Capacity Reservation Charge will be levied whether the project is performing or not. The provision of guarantees will allay most of the concerns related to investment in the Maldives.

Utility Perspective

The payment of the capacity charge up front will give the Utility time and funds to prepare the island to accept the new project, and to put in place such measures that are necessary to ensure grid stability, energy storage, and load deferral.

The initial years of the mFIT regime will see electricity generating costs fall compared to existing diesel generation – thus allowing the utilities to build their balance sheets and become viable economic units.

Subsequently, utilities will be in a much stronger position to invest in the energy storage capacity needed to deliver the second round of RE penetration – lifting total RE supply to around 90%.

Government Perspective

This tariff regime will save money immediately for all the power systems not operating at maximum efficiency. Donor funding will help secure guarantees in the first years of the FIT regime. Over time, as its reputation and some capital base is build, the amount of the guarantees needed will decline.

APPENDIX 7 - PROFILE OF A TYPICAL SMALL/MEDIUM ELECTRICITY CONSUMING ISLAND

Socio-economics

The main economic activities on these islands include fishing and small scale agriculture. However, there is an increasing trend of employment in tourism sector due to development of resorts in close by islands. Moreover, the government offices, schools, healthcare facilities also provide some employment to the residents. In addition, small industrial activities exist in some islands. The infrastructure of the typical small-to medium electricity consuming islands consist of an island office, a school, a health post, a mosque, a power house, few retail shops, harbours and breakwaters and boat building sites.

An aerial view of a typical inhabited island

A healthcare centre

Natural water resources are limited to rain water collected from roofs and ground water which is boiled or treated before consumption. Few islands operate desalination plants to produce potable water.

Generally all islands are staffed with a healthcare worker while health centres/hospitals are found in islands with larger population. Similarly schooling up to grade 10 is found within the atoll but the highest level of education taught varies from island to island.

Electricity production and use

As of today, all islands of the Maldives are electrified through diesel based generation, and the power system of the island is operated either by government owned companies (STELCO or FENAKA Corporation) or by the Island Council. Although the electricity service is available in all islands, the reliability and quality of the service as well as general operating condition of the power systems are poor in some of these outer islands. This is mainly due to the lack of trained persons availability as well as limited resources and most apparent in islands where powerhouses are operated by the island councils.

A diesel generator installed at a powerhouse

The typical powerhouse is generally composed of the diesel based generation units, fuel system, control panels and distribution cables connections enclosed within one building. The distribution cables extend underground and go into distribution boxes in the street, and goes into the household/building.

Despite the regulations of MEA which enforce the power quality and safety measures, and regulations related to environmental protection enforced by the EPA, some powerhouses in these islands do not fully comply with all regulations. This is mainly attributed historically due to lack of proper feasibility studies and future planning, resulting in ad-hoc basis of power system installation in various islands. Moreover, in general there is only one technician at the powerhouse to oversee the operation of the system and rarely can attend major faults from the generation side.

Distribution box at an island

Fuel storage at the back of the power house at an island

In addition to this, fuel handling process from the operation side is not very well monitored, which sometimes lead to contamination of the fuel and lube oil by salt water (while being unloaded from the boats) and leakage of oil from the containers during transport and storing, all of which indirectly results in enhanced degradation of the generator sets which results in decreased performance of electricity production.

Some islands were observed to have large amounts of loss in generated units where losses from the generation side was possibly due to running of oversized generators and poor maintenance. There is also loss on grid side, which is possibly due to aged or undersized distribution cables and poor corrective measures taken to improve quality of the system such as phase balancing, harmonics, etc.

The operation of powerhouse also has various impacts on the environment mainly due to the noise, emissions and fuel handling. Moreover, spillage of fuel and lubricating oil during handling have diverse impacts the fresh water lens which is used as a source of drinking water in many communities.

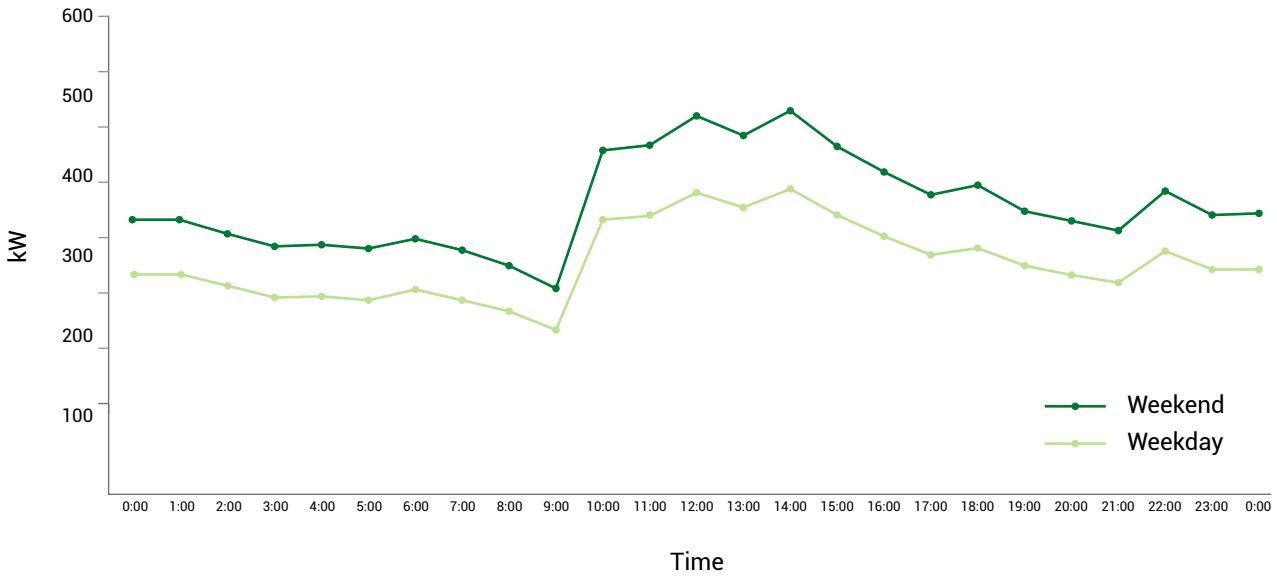
Black smoke emitted from a small powerhouse

Economics of electricity production

The average demand of these islands varies from 30kW to 300kW while the installed generator capacity of the island may be undersized or oversized which hinders the quality and efficiency of the electricity production process. These are factors which are generally difficult to address when the system is in operation due to high costs involved and the customers end up paying for the losses.

Tariff for the electricity service provided varies from one island to the next based on the generation cost, and is approved by the MEA. Electricity users are categorized into Domestic, Business and Government Customers, where Government and Business categories are charged at a higher tariff. Although the approved tariffs are applied, there is a large amount of subsidy provided by the government to cover the fuel costs.

As fuel costs is the main portion of the running cost of the power system, the increase of fuel cost due to the fuel being transported from long distances adds burden to the economics. Moreover, fuel reserve/ storage is very limited on these islands and there is always the potential of bad weather delaying fuel shipments from farther island, which adds to the risks of fuel security.



Load profile of a medium size electricity consuming island of the Maldives

APPENDIX 8: ASSESSMENT OF COUNTRY ABSORPTIVE CAPACITY

Overall Fiscal Outlook

1. The overall macroeconomic situation in Maldives continues to be challenging. The budget deficit (after grants) is expected to reach 30 percent of GDP in 2012 while the primary deficit is estimated to register 20 percent of GDP. Total revenue collection for 2012 is likely to fall short by around MVR1.2 billion[34] against the budget. Financing the rising budget deficit is also challenging as commercial banks showing reluctance to hold government paper that leads to a cash flow constraint for the government which it had met with domestic borrowings[35]. Given that domestic sources of finance are limited, the government is turning to foreign financing. A significant portion of the public debt is a result of the country borrowing significant amounts of foreign currency (largely to pay for fuel imports). The Indian government has agreed to provide USD 25 million in budget support[36] while the ADB is also expected to disburse USD 17 million as part of their economic reforms package (ERP) program. Both these inflows are expected in the 2012 (Q4) – which will provide some respite to the Government cash flow.

2. A number of debt service commitments are coming up in the next 3-5 months which may require some form of refinancing to reduce the public debt management burden. Two bonds of USD50 million owed to the Indian State Bank of India come for redemption in December 2012 and February 2013, respectively, and the Government is likely to seek an extension for payment of debt to keep an adequate balance of usable foreign exchange reserves which now stand at about 1 month of imports.

3. Against this backdrop, the government has taken a number of measures to prevent further escalation of the macroeconomic outlook. In June 20, 2011 the government presented four bills –collectively referred to as the ERP to the Majlis (Parliament). The ERP comprised of: (a) a (general) Goods and Services tax (GST) bill (b) a Corporate Profits Tax (CPT) bill; (c) a Personal Income Tax Bill (PTB) and (d) an amendment bill to the Tax Administration Act. Of the measures the GST was passed by the house in end August and was ratified into law in early September. The tax will come into effect in October. The GST Act also had provisions to raise the hitherto applicable TGST rate to 6 percent in 2012 and thereafter to 8 percent[37] in 2013. The proposed SREP interventions are also aimed at relieving public expenditures on diesel imports, subsidies and foreign exchange.

4. Inflation has also been rising since the currency depreciation in April 2011 and has been trending upwards as of May 2012. High food prices are mainly due to rising global food prices –given that Maldives depends heavily on imported food – as well as increase in domestic fish prices. From the second half of 2011, significantly higher international oil prices have also driven up domestic diesel prices, particularly on transport-related costs. In a bid to limit the pass-through, the government in January 2012 lowered customs duties on gasoline and diesel which in turn adversely affected revenue collection. Investment in renewable energy through SREP is expected to offset some of these adverse effects as the country reduces its exposure to volatile oil prices and external shocks.

34 Total revenue projections of MVR 9.2 billion against a budget of MVR 10.4 billion.
35 Such as the borrowing from Bank of Maldives in May at a rate of 9 percent –roughly 200 basis points above the Treasury bill rate.
36 There is a likelihood of another USD 25 million that would come later in the year.
37 The rate was 3.5 percent in 2011 – the first year of implementation.

5. The trade balance is skewed with high import growth outstripping export growth. Total imports reached USD884 million during the first seven months of 2012 largely due to higher imports of public enterprises, notably the State Trading Organization (STO), which accounted for around 27 percent of total imports. Fuel imports – the single largest import item in the country accounting for nearly 30 percent of total imports[38] rose 28 percent (year-on-year) during the period to July 2012 with average oil prices remaining more or less same levels as in the corresponding period in 2011 (around USD 102 per barrel). Support to offsetting diesel fuel by using solar, wind and waste to energy for power generation will contribute significantly to an improving the trade balance. The successful implementation of SREP investments would contribute to a reduction of about 23 million liters of diesel per year (or 6% of total diesel imports).

Absorptive capacity and SREP Implementation

6. The Government has a reasonably good track record in terms of implementation of projects on the ground through its line ministries. In particular, the Ministry of Environment and Energy has four active World Bank assisted projects under implementation, each at various stages of the project cycle. The ministry has capable staff to manage the procurement and implementation which they coordinate with the relevant national agencies (utilities, island/atoll councils, etc.) but will need additional support and strengthening as the program of activities increases under SREP.

7. As state-owned utilities, both STELCO and FENAKA have similar constraints on capital expenditures and limitations on their balance sheets. Under the SREP IP, the government (with support from the MDBs) would take appropriate measures to ensure that the utilities are able to carry out the public programs and disburse funds accordingly. The formation of FENAKA is expected to streamline decision making, standardize project design and facilitate procurement and installation activities for the outer islands under the SREP. Capacity strengthening and implementation support for the ministry and utilities will be part and parcel of the overall Maldives SREP IP.

8. The expected level of SREP resources is comparable to the envelope of IDA[39] and ADF allocations for the country. This may present a challenge if these were to be channeled to a single Ministry; however, the design of the program is informed by the political and macro-fiscal risks in the country and thus inherently contains risk mitigation measures. The proposed SREP interventions are designed to enable the program to be implemented and financed largely by the private sector, with the ministries and utilities undertaking the critical public sector activities necessary to facilitate private sector investments and to finance investments where private sector participation is not likely.

9. Furthermore, one of the key attributes of the Maldives SREP is the provision of a portion of available resources to be used as some form risk mitigation instruments, such as World Bank partial risk guarantees or other similar facilities. Through this approach, the Government would limit its exposure to using SREP and leveraged resources for direct investment into public-sector projects which would otherwise significantly limit its ability to absorb all of these funds and disburse/implement in a timely manner.

38 In value terms.
39 IDA and ADF allocations for the Maldives are about $20m each for a 3-year period in comparison to about $30 million proposed from SREP over a 5 year period.

APPENDIX 8 - INDEPENDENT REVIEW OF THE MALDIVES SREP IP

Dr Mike Allen
27th September 2012

1.0 INTRODUCTION

This review of the Maldives SREP IP has been undertaken in a number of steps. A limited number of versions of the draft document have been reviewed, with the final version received on 25th September 2012. On 26th September a call was arranged with representatives from the Maldives Government, WBG, ADB and the IFC in response to points raised during the review of the final draft IP.

It should be noted that the reviewer has not had the opportunity to visit the Maldives, nor to meet face to face with any of those listed above who are involved in this opportunity. He was however engaged during the preparation and review of the previous IP in January 2012 which covered many of the aspects in the current, updated IP.

As noted during the review of the previous IP, it is clear that considerable effort has been directed at the preparation of this Investment Plan. The Maldives provided one of the more comprehensive packs of information in originally seeking consideration under the SREP. Again this all highlights the focus that the Government of the Maldives has on moving to RE and the issues that are faced by the island nation with such wide spread centres of population. Importantly the approach being suggested in this IP has removed some of the complexity around government agencies that was apparent previously.

While there are no major concerns with the Investment Plan as presented, there are a number of points that have been raised and were addressed in writing from GoM and thoroughly discussed during the call on 26th September. These are included here for completeness and a record. The reviewer is confident that these issues have been noted and will be reflected as appropriate in the final version of the IP to be submitted to the SREP Sub Committee.

It is not the intention to present step by step comments on the Investment Plan. A summary of initial comments are included in the Appendices and various discussions are summarised there for the record.

2.0 COMPLIANCE WITH GENERAL AND SPECIFIC CRITERIA

In the review undertaken of the prior IP the notes below were included to briefly summarise the compliance of the Investment Plan with the General and Specific Criteria as specified in the TOR for that review. They are retained in this report with some modification as they provide an important gauge of the overall interpretation of the IP within the SREP aims and objectives.

2.1 Catalyse increased investments in renewable energy:

The plan does outline how it is anticipated that SREP investments and programme support will help attract other public and private funding. This is explained in some detail. The leadership of government agencies is expected to assist in establishing strategies that will provide public funded examples in remoter and smaller market segments and help aggregate the markets so that private investors have larger scale opportunities to develop.

2.2 Enabling environment:

The plan clearly elaborates the Government's commitment to drive as quickly as possible towards a low carbon economy. There is acknowledgement that there is a need for a simple, transparent but robust set of policies and regulations to attract and hold the interest of investors / developers. Experience to date with FITs is providing guidance as future FIT arrangements through a modified approach are being evaluated.

2.3 Increase energy access:

Access to electricity is not a major issue as power is available to most households. It is however diesel generation and the programmes under the SREP funding will allow displacement of diesel with predominantly solar PV, improving the cost of generation, eliminating a portion of the government funded subsidies to offset increasing diesel cots and offering longer term security and sustainability.

2.4 Implementation capacity:

The limited local capacity is clearly recognised and programmes reflect how this will be addressed. There is a determination to move away from long term dependency on consultant support and to build a national capacity drawing on local and international alliances. The private sector is seen as a key element of this development and various financial incentives to buy down risk are anticipated to encourage their participation.

2.5 Improve long-term economic viability of the renewable energy sector:

Specific funding allocations for guarantees and mechanisms to reduce the exposure to sovereign and payment risks are a central part of the financial plan. An adjusted FIT is proposed to ensure adequate returns while making sure that the overall commercial structure does not disadvantage the Maldives' economy. The need to build capable local enterprises to underwrite the needs of an expanding market is well defined and considered.

2.6 Transformative impact:

The Investment Plan describes in detail how it will initiate transformative change in achieving national-scale outcomes and the delivery of SREP aims and objectives. It also clearly identifies the contribution of programmes funded through other sources to complement this change.

3.0 RECOMMENDATIONS

It is believed that a number of features of the Investment Plan deserve comment. As noted above they are not major issues but points that should be considered as the programmes supported by the SREP investments are implemented.

3.1 Private Sector Engagement

The encouragement of private sector participation is a key focus of the SREP. The Investment Plan recognises this and has several initiatives directed at attracting private investment. Discussions suggest that only limited, and somewhat anecdotal, information has been gathered to determine what the market sees as hurdles to investment. The obstacles to raising capital (whether by the public or private sector) that are suggested are common – sovereign risk, the resultant cost of capital, the high transaction costs for small scale investments, lack of familiarity/experience in the Maldives for many investors. It is suggested that this may need to be more rigorously tested in the finance markets.

The differences between reasonable IRRs determined in an analytical model and the real cost of doing business and actual returns are often quite large. Where there is limited investor interest in smaller (island) markets care needs to be exercised to ensure that entities invited to participate in the market have credibility, appropriate experience and substantial financial backing. There are a number of examples (outside the Maldives) where offers have been accepted from entities with questionable capacity largely because they were the only groups showing interest – offers are well intended but cannot be backed up with real experience and an ability to perform in what are often challenging environments. Subsidised costs and aggressive FITs for example can attract entrepreneurial groups with limited experience. The situation in the Maldives is complex and will require well experienced partners to ensure effective implementation of the plans as now envisaged.

It is noted that marketing of the opportunity will be a key requirement – this marketing should not hesitate to be selective in soliciting interest from those who have real value to offer. It will also be important that these marketing exercises provide feedback to build a better understanding of what will really attract private investment. A simple and transparent process for engaging the private sector will be build confidence in the market.

3.2 Technologies

The discussion on the selection of technologies appears well balanced. The options are limited as all appreciate. The extensive use of solar PV over lagoon sites (mentioned in the earlier IP but not reiterated in the current version) may well present some issues around corrosion, panel cleanness and maintenance. These are obviously being considered but their impact should not be underestimated. While there is extensive experience with the construction of accommodation facilities above lagoons there may no doubt be some opposition to extensive coverage of lagoons with solar panels.

3.3 Engagement of the Tourism Sector

With no in-country experience there is some reluctance to challenge the approach being promoted in the IP. However as the tourism industry represents almost 50% of electricity consumption, moving to a low carbon economy must involve this sector. It is suggested in the IP that if the

current programmes are a success and the solar PV industry opens up in the Maldives then the tourism sector will naturally follow. This may not be the case given their varied interests and it is recommended that the sector be engaged as early as possible to ensure that as the approaches to increased renewables evolve they reflect strategies that the tourism industry will adopt without resistance. This may also be an important pro-active opportunity to deepen the opportunities for PV sales within the Maldives, providing an additional attraction for investment when there is a clearer path to an increase in the scale of the market.

3.4 Economic and Financial Benefits

It is suggested that care be taken where analysis and reporting on anticipated cost and price reductions for electricity are being undertaken. There is a moderately complex mix of diesel fuel costs, fuel surcharge subsidies, FITs, residual O&M and amortisations expenses for upgraded diesel installations (irrespective of their reduced load factor with RE in the grid) being balanced against the actual costs of hybrid operations. The economic benefits to GoM are clear; the longer term impacts of FITs is to be considered and there may be some phasing out / reduction over time; the final pricing of electricity is not entirely clear and a caution is that whilst economic benefits accrue the real financial impact on end users may be muted. Raising unrealistic expectations is very easy; recovering from failing to deliver on these expectations can have significant impacts on the effectiveness of RE programmes.

APPENDIX 1

A1.1 Comments by reviewer and discussion Government of Maldives during call of 26th September

Comment: There are many references to SREP and I wonder if in fact some of these should be adjusted to reflect that SREP is just part of a wider Maldives programme? This is just terminology but may cause some confusion in any submission to SREP itself?

Discussion: This has been noted and will be adjusted in the final text.

Comment: I can't see any reference anywhere to a timetable for the projects. Given there is a gross budget of USD131m it would be informative to understand the time frame of the expenditure to assess how realistic this is.

Discussion: The expectation is that the SREP work will be spread over a 5 to 6 year period.

Comment: In my earlier review I have raised my concerns around the private sector response and how realistic it is to expect the levels of investment that are shown – 35% of the total sourcing, more of the project investments. Is there a Plan B if this fails?

Discussion; It was acknowledged that there had been limited opportunity to test the interest of the private sector widely. It was noted that STELCO operates a number of operations under PPAs with private developers. It was also suggested that the "road-shows" to attract potential investors will be targeted and are expected to generate wide interest, based on the response from contacts with a number of groups to date

Comment: I am also cautious about the variety of financial incentives, capital contributions, guarantees etc being proposed. It may not just be financial issues that discourage investors. In

addition I am concerned that where there are a range of incentives that you attract companies that may have limited experience and may not be able to complete the project. This all requires a very robust analysis of offers – not always so easy in a smaller, more remote market. There needs to be an equitable sharing of risks across the parties involved so that the interests are aligned.

Discussion: This point was noted and the risks appreciated. The intention is that there will be a well-managed and regulated process to engage the private sector.

Comment: I recognise that the IP is choosing not to engage early with the tourism sector but as it uses about 40% of electricity (and hence diesel used for generation) it must be a critical element of any energy market improvement. I think that some effort should go into an early canvassing of the industry to formally test the opportunities. I am a bit uncomfortable that it is suggested SREP should not support the (profitable) private sector – it may be the solution to getting an early step change away from fossil fuels and that is what SREP is designed to do. In contrast the smaller island initiatives may have less economic and environmental impact. The question is what are the benefits per USD invested from the various schemes, and I think that the tourism sector should be part of this assessment.

Discussion: There is reluctance to spend limited SREP resources on the tourism companies, many of which are foreign owned and well financed. The point was made however that a pro-active approach with the tourism sector could help build a larger and healthier overall market for RE and hence encourage broader participation by the private sector.

Comment: In my attached comments (marked up version of the IP) I note the issue around costs and prices. Given the heavy subsidies being provided to end users of electricity now, even with a reduction in the cost of production of electricity, it is likely that prices may in fact not fall. There is a danger in raising expectations around this. In a number of places there are comments about the fact that PV is cheaper than diesel generation – while in isolation this may be true, what is important is the effective cost in a hybrid system. All the major systems will still have diesel installations and their fixed costs (amortisation of upgraded plant, maintenance etc) will still be required to be covered. This may mean that the cost of generation does not in fact drop substantially but that the fuel surcharge can be reduced, as will the diesel costs. These latter are economic benefits (as the surcharge is subsidised by GoM currently) but will not necessarily see any reduction in power pricing to end users.

Discussion: The importance of these points was noted and the question of false expectations discussed. The example of islanders expecting that solar PV would be free highlights the market education that is needed

Comment: There are suggestions that national RE resources will be studied. In other areas there are notes that there are a limited number of options. Perhaps the focus should be on PV and wind and other longer term options left until later. Coping with just two or three technologies will be a challenge given limited national capacity at this stage.

Discussion: It is not intended to look beyond PV, wind and WTE at this stage. However the efforts to utilise deep cool seawater for cooling was noted

Comment: There is limited discussion about the MGF and how that will operate. The overall structure being considered appears more straightforward than was outlined in the 2011 proposal but the question needs to be raised as to whether there are still too many agencies in place given

the small size of the population.

Discussion: The MGF will not be established immediately, rather once there is adequate experience with RE roll out to justify its presence.

Comment: The FIT regime looks reasonable but simplicity will be important in making the opportunities more transparent to new participants.

Discussion: Had been discussed earlier. The ADB explained that it was working with GoM on reviewing the FIT structure / pricing and that it anticipates that there will be a progressive reduction of the FIT over time. Consideration is being given to a stepped sequence in which accelerated recovery of investment may be permitted in the initial (5) years.

A.1.2 Specific Comments on the IP Draft

A number of comments were provided in a marked up copy of the 25th September version of the IP. These were covered under various headings during the call of 26th September and the reviewer is confident that the matters raised have been addressed adequately.

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MDB Request for Payment for
Project Implementation Services (MPIS)[1]

PILOT PROGRAMS FOR CLIMATE RESILIENCE **FOREST INVESTMENT PROGRAM** **SCALING UP RENEWABLE ENERGY PROGRAM IN LOW-INCOME COUNTRIES[2]** **MDB Request for Payment of Implementation Services Costs**			
1. **Country/Region**:	Maldives/South Asia	2. **CIF Project ID#**:	(Trustee will assign ID)
3. **Project Title:**	Accelerating Sustainable Private Investments in Renewable Energy Programme (ASPIRE)		
4. **Request for project funding (USD million)[3]:**	*At time of country program submission (tentative):* USD 10.750 million	*At time of project approval:*	
5. **Estimated costs for MDB project implementation services (USD million)[4]:**	*Initial estimate - at time of Country program submission:* USD 0.428 million *Final estimate - at time of project approval:*	*MDB:* World Bank *Date:* October 10, 2012	
6. **Request for payment of MDB Implementation Services Costs (USD million):**	X First tranche: ☐ Second tranche:	USD 0.214 million	
7. **Project/program financing category:**	a - Investment financing - additional to ongoing MDB project ☐ b- Investment financing - blended with proposed MDB project x c - Investment financing - stand-alone ☐ d - Capacity building - stand alone ☐		
8. **Expected project duration** (no. of years):	5 years		
9. **Explanation of final estimate of MDB costs for implementation services:**	***If final estimate in 5 above exceeds the relevant benchmark range****, explain the exceptional circumstances and reasons:* n/a		
10. **Justification for proposed stand-alone financing in cases of above 6 c or d[5]:** n/a			

[1] The term "project implementation services" refers to MDB support throughout project life-cycle.
[2] Pick one program and delete others that are not applicable.
[3] Including the preparation grant request
[4] If the final MDB cost estimate exceeds the relevant benchmark, it needs to be supported by (i) a breakdown of costs of inputs required (staff/consultant time, travel, number of missions, etc) and (ii) by an explanation of the particular aspects of project design and implementation that drive MDB costs to exceed the benchmark (Item 9 in template).
[5] The justification should include an explanation of (i) why no linkages to ongoing or planned MDB financing have been possible or pursued, and (ii) the expected effectiveness of the proposed stand-alone SCF project in addressing the objectives and priorities of the country investment plan/strategy; and a confirmation that the proposed project forms part of the MDB's agreed country assistance strategy.