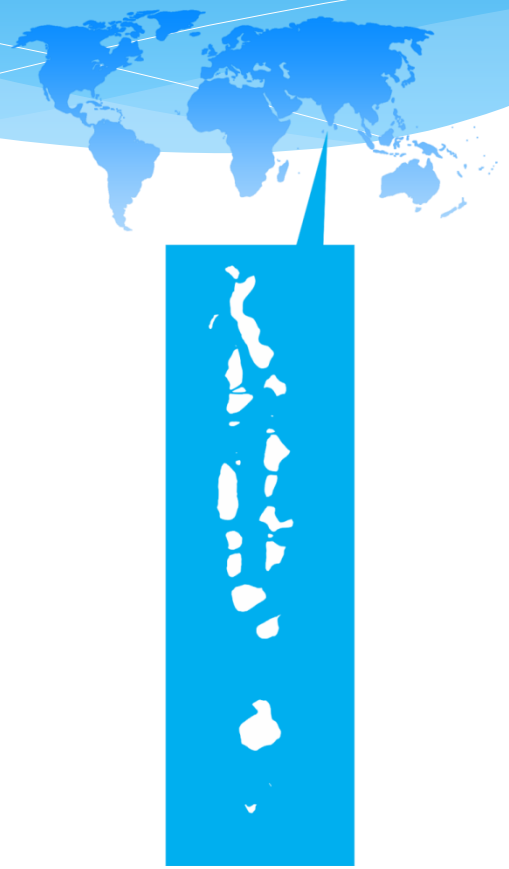
ENERGY BALANCE IN THE MALDIVES

Presented by: Fathmath Fizna Yoosuf
Engineer
Maldives Energy Authority

Country Overview

- 1192 beautiful tropical islands
- 190 inhabited islands
- 107 Tourist Resorts
- Population of 407,660
- 6-8% GDP growth annually
- Total land area: approximately 300 km2

  (less than 1% of the EEZ)



Energy Sector of Maldives

Energy Sector Highlights

* **Depend almost entirely on foreign imports**
* **Oil imports**
    - **USD 555M in 2014 (Close to 20% of GDP)**
* **2014 imports**
* Total fuel: 667,011 metric tons
    * Diesel: 385,937 metric tons
    * Aviation gas: 223,024 metric tons
    * Petrol: 44,393 metric tons
    * cooking gas: 13,656 metric tons

The electricity sector of Maldives

* Maldives is composed of geographically separate islands.
* Currently all islands have their own power systems
* Each island is effectively a mini-grid with a diesel based generation system
* Very few islands have the PV systems feeding electricity directly into the grid
* No interconnection between the islands exist as of today.
* The electricity service is provided by utilities or managed by themselves in the islands

Electricity Service Providers

* Service providers can be generalised into the following
  * Inhabited islands in the Male' (capital) region provided by State Electric Company Ltd.
  * Outer Islands provided by FENAKA corporation (majority) and Island Community/Council
  * Resorts provided by themselves as self producers (normal utility tariff does not apply)
* includes design, installation and commissioning of power systems

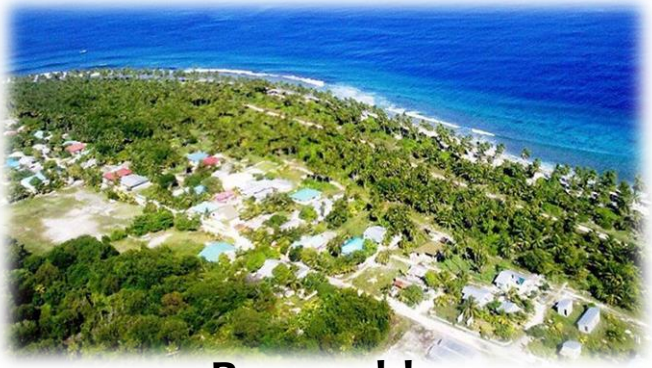
Electricity Service Providers

* All public utility companies (FENAKA and STELCO) are owned by Ministry of Finance but adheres to the regulations implemented by MEA.
* All power systems and electrical installations must comply with the regulations of Maldives Energy Authority.
* Licensed engineers and consultants are only allowed to carry out works related to power. This includes design, installation and commissioning of power systems

Electricity Installed Capacity

Inhabited islands

Installed capacity: 141 MW



Tourist Resorts

Installed Capacity: 105 MW

Renewable

Installed capacity: 4.5 MW

Industrial islands

Installed Capacity: 20 MW

Total Installed capacity: 270.5 MW

ENERGY BALANCE IN MALDIVES

Energy supply of a country remains as one of the key drivers of economic development

The energy balance is a multipurpose tool. The main purposes of its compilation include:

- To enhance the relevance of energy statistics by providing comprehensive and reconciled information on energy situation in a country
- To establish the basis for estimation of CO_2 emissions
- To provide an input for forecast modelling
- To provide a common framework for international comparisons
- To provide comprehensive information on energy supply and demand in a country in order to understand energy security, the effective functioning of energy markets and other relevant policy goals and to formulate energy policies

Main components of Energy Supply

* ***Components of Energy Supply***
* ***Energy Conversion***
* ***Components of Demand Side***
* ***Final energy balance***

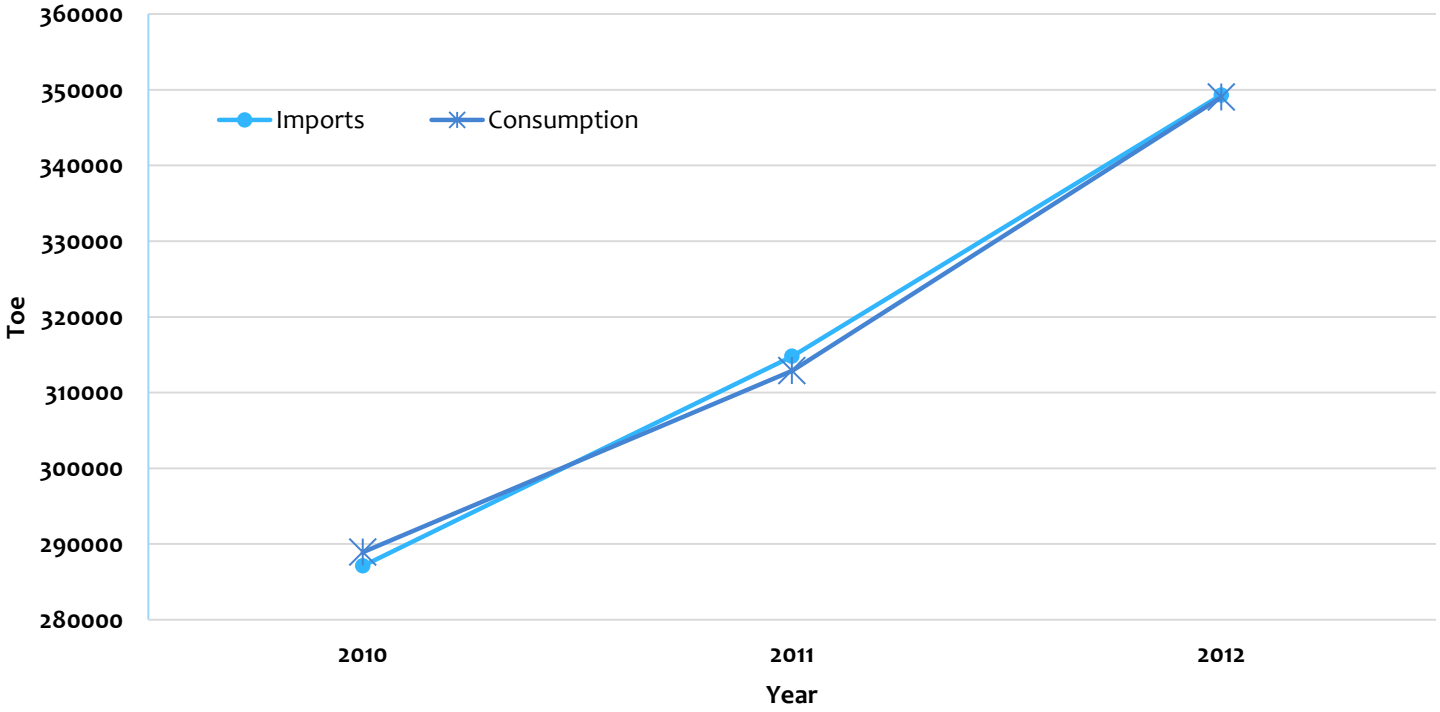
1.Components of energy supply

* Diesel
* Petrol
* Liquefied Petroleum Gas (LPG)
* Kerosene
* Jet A1 fuel
* Solar energy

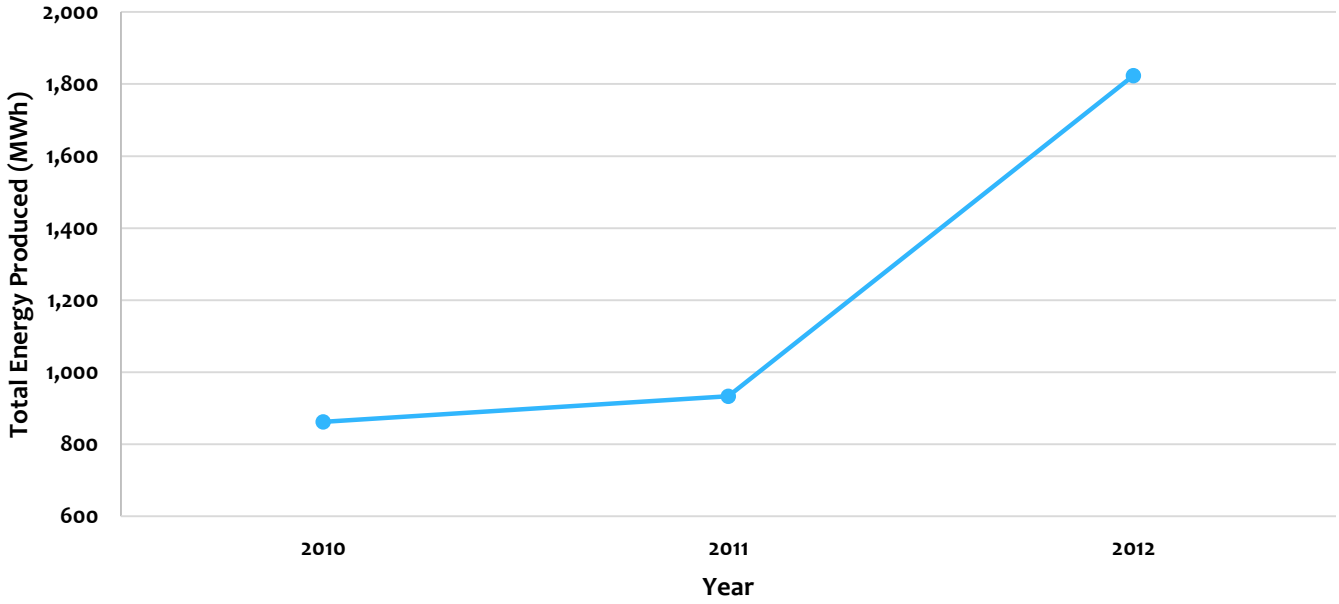
1.Components of energy supply

* The main supply of energy includes Diesel, Petrol, Liquefied Petroleum Gas (LPG), Kerosene, Jet A1 fuel and solar energy.
* Due to several installations of solar PVs in Greater Male' Region and some areas in the Other Atolls, a huge increase in the solar energy production from 2011 to 2012 is observed. A significant increase in the import of jet A1 fuel is also observed in 2012 compared to 2011.

Total energy produced by diesel 2010-2012



Total energy produced by Solar PV 2010-2012



2.Energy Conversion

* In Maldives the most significant energy conversion is from diesel energy to electricity. Nearly 100% of all electricity produced in Maldives in from diesel based systems. The generation and distribution of the electrical systems are decentralized with each separate island operating a self-sustaining diesel power generation and distribution system
* Greater Male' Region
* Other Atolls
* Power production in tourist resorts
* Electricity production in industries (auto-producers)

3.Component of Demand Side

Greater Male' Region	2010	2011	2012
Estimated Population	110,897	112,769	114,682
Estimated Electricity Consumption (MWh)	292,823.60	295,510.71	313,107.52
Specific Electricity Consumption (kWh/Capita)	2,640.51	2,620.50	2,730.22
Growth rate of SEC		6.09%	4.13%

Demand side energy consumption in Greater Male' Region.

*The demand side is the use of the energy by end users or the final energy consumption. This data include different patterns of energy usage from different sectors and subsectors

3.Component of Demand Side

*** Households, Commerce and Public Sector**

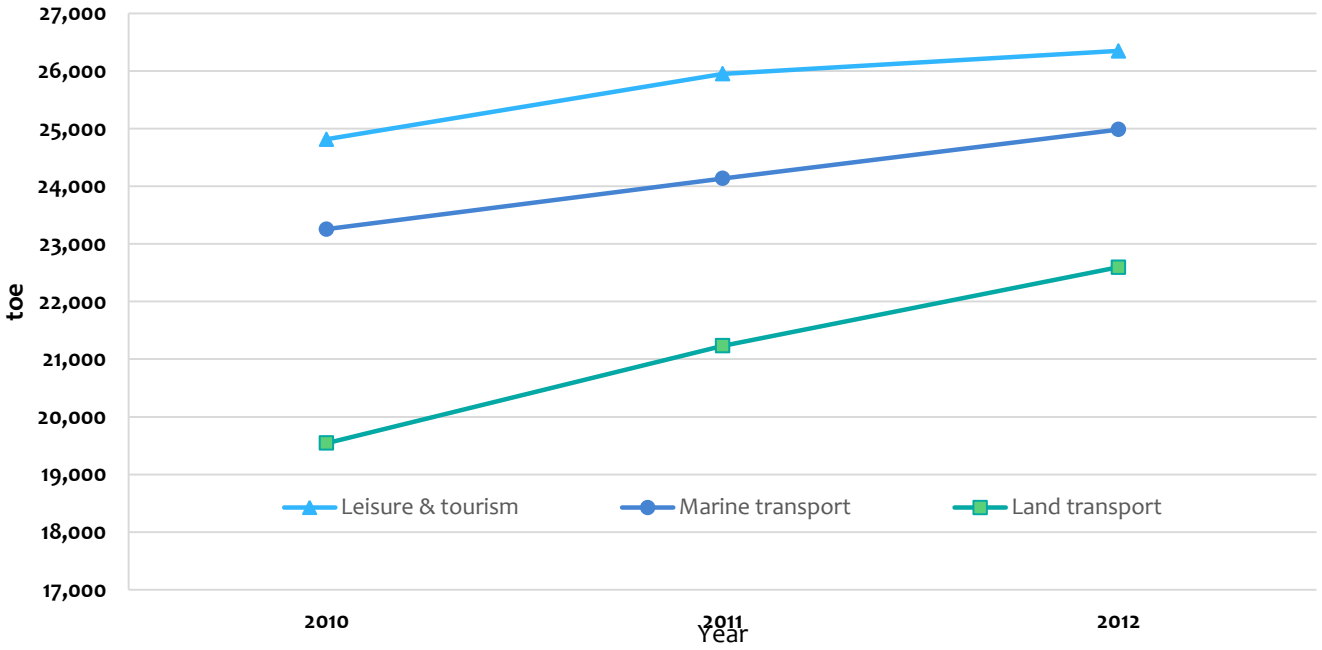
Other Atolls	2010	2011	2012
Estimated Population	208,841	212,366	215,970
Estimated Electricity Consumption (MWh)	161,240.96	196,719.40	228,985.92
Specific Electricity Consumption (kWh/Capita)	772.07	926.32	1,060.27
Growth rate of SEC		23.16%	16.33%

Demand side energy consumption in Other Atolls

3.Component of Demand Side

* Electrical energy is the main type of energy that has been utilized at the demand side. The growth of specific electricity consumption has been increasing for Greater Male Region and Other Atolls with a more rapid growth in the Other Atolls.
* In the tourism sector most energy is found to be used for cooling.
* Use of energy for the transport was determined by segregating the transport sector into three categories; transport for leisure and tourism, transport of passenger and cargo and land transport.
* Fisheries sector has been traditionally the main primary economic activity in the Maldives. It is also an extremely energy intensive economic activity involving transport and various manufacturing and industrial processes contributing to the energy consumption of the sector.

3.Component of Demand Side

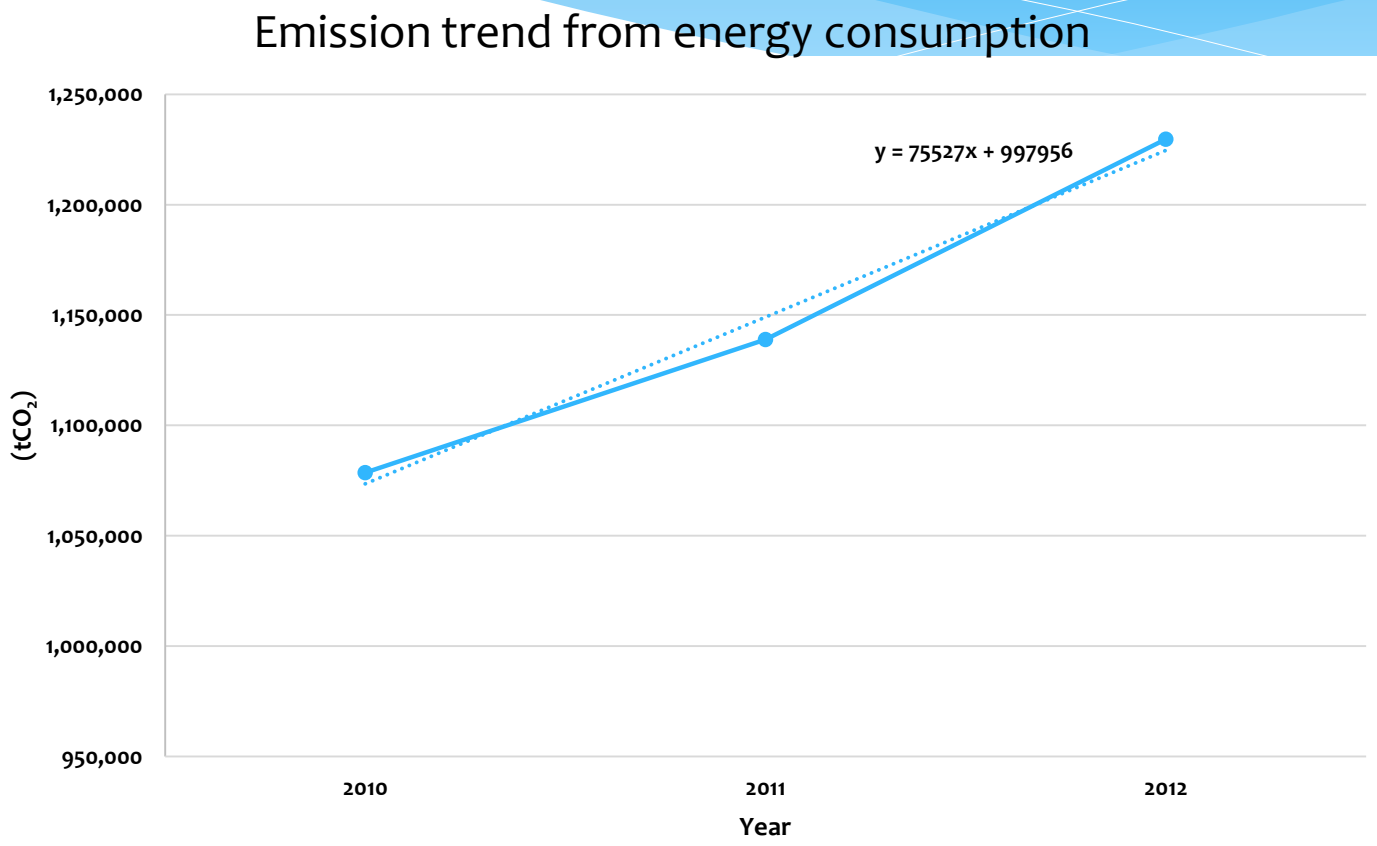


Summary of the energy consumption by the transport sector

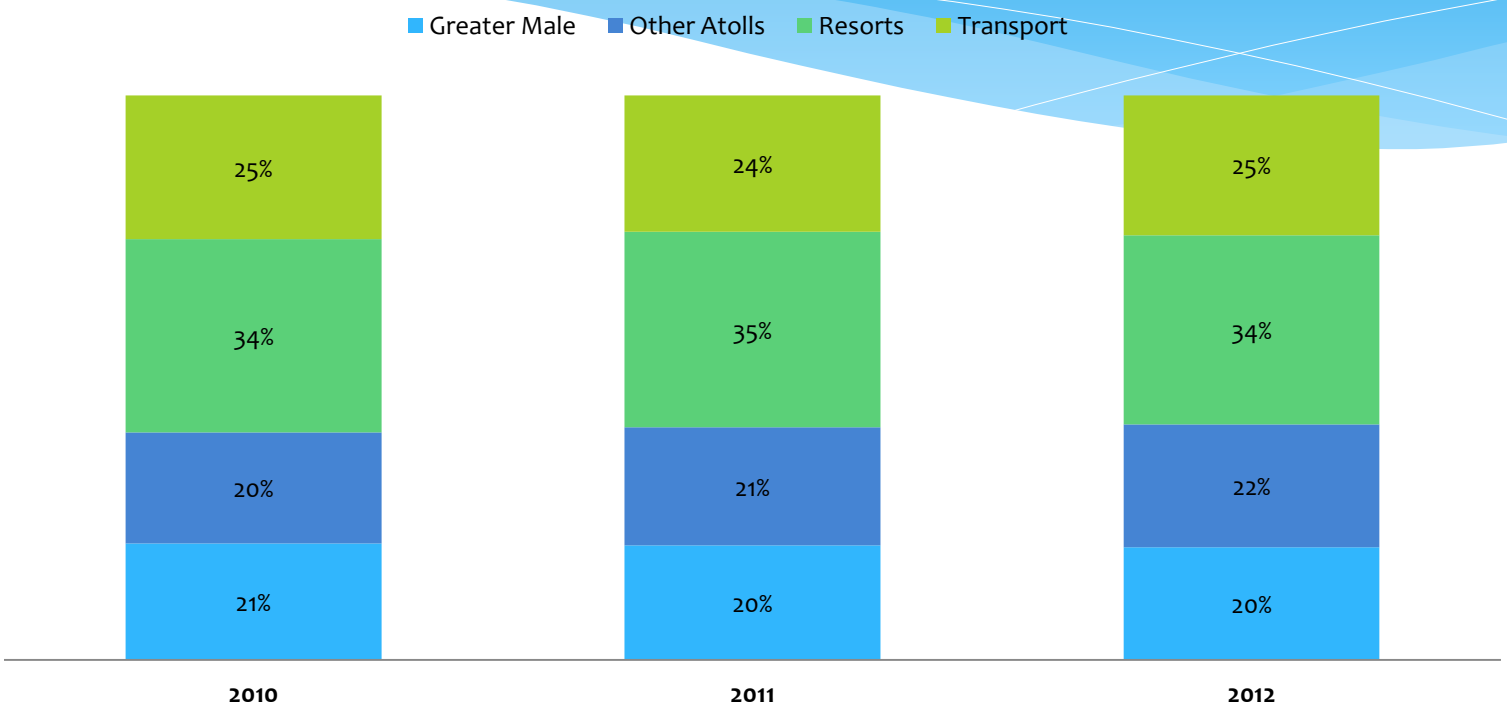
4.Emission

* Green House Gas emissions from energy use are one of the main contributors to climate change. Maldives is a country striving for low carbon development and energy use is their main contributor to its emissions (>80%).
* During this period the emission from energy use had been increasing at a rate of about 6-8% per year. This gives an increasing trend of 75,527 tCO_2 per year by energy sector alone.

4.Emission


Emission trend from energy consumption
y = 75527x + 997956
1,250,000
1,200,000
1,150,000
1,100,000
1,050,000
1,000,000
950,000
(tCO2)
2010
2011
2012
Year

4.Emission



Sector contribution to emissions by energy consumption

5.Energy Indicators

* Indicators are useful for monitoring the progress of specific goals. It plays an important role in measuring a country's state of development by monitoring the progress or lack of progress towards sustainability. The choice of energy fuels, delivery and use of energy services have an impact on the social, economic and environment. Thus, the energy indicators play an important role in measuring and assessing the current and future effects of energy use on social, economic and environmental aspects of a country

5.Energy Indicators

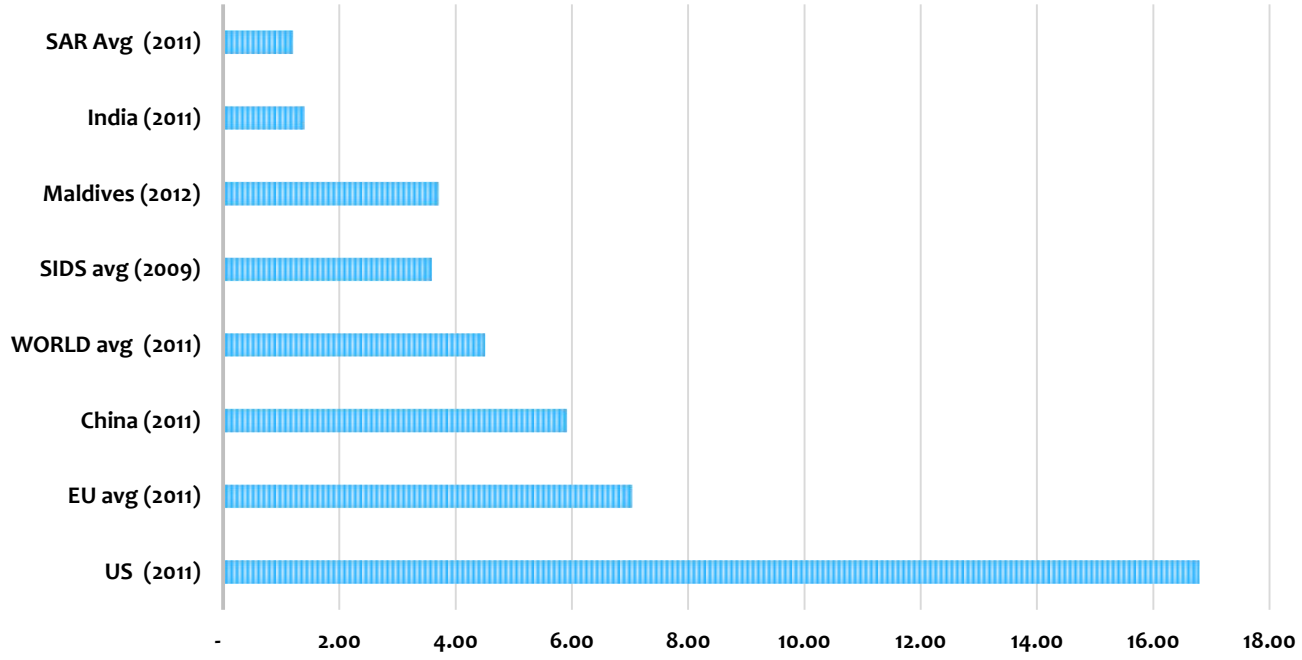
Selected indicators	2010	2011	2012
Population	319738	325135	330652
Total Primary Energy Supply	354,052.93	375,999.34	426,921.11
Fisheries	30,784	28,169	28,538
Tourism	69,503	72,241	74,261.5
TPES/Capita	1.11	1.16	1.29
TPES/1000 GDP$	0.13	0.13	0.15
CO2emissions (tCO2eq)	1,078,561.45	1,138,851.89	1,229,615.52
tCO2eq/capita	3.35	3.47	3.69
kgCO2eq/GDP$ (PPP)	0.50	0.48	0.53
tCO2eq/TPES	3.02	3.00	2.86
Electricity Consumption (MWh)	930,457.21	983,311.22	1,052,619.15

Key indicators for Maldives

5.Comparison of Indicators with other countries

* As shown, the CO_2 emissions/capita for Maldives is much higher when compared to the South Asia Region average (SAR avg) and a very slight difference when compared to the SIDS average. These are calculated based on 2011 data for all the countries except for obtaining the SIDS average where 2009 figures are used.

5.Comparison of Indicators with other countries



Comparison of emissions per capita

5.Comparison of Indicators with other countries

* The indicators can help to integrate energy into socioeconomic programmes, to increase the share of renewable energy options by developing targeting more programmes and projects to this area

6.Final Energy Balance

* The main primary energy supply in Maldives is still dependent on imported fossil fuel (99.9%). Bulk of this imported fuel is diesel and the main energy used for production of electricity and transport. Indigenously produced and supplied energy accounts for about 0.1% of the total energy supply.
* Final Energy Consumption is based on demand of various sectors and uses. The major energy source in the demand side is electricity (38-40%) closely followed by diesel used for transport (28-31%) in various sectors. Tourism sector is the single most significant economic sector in terms of energy consumption. It accounts for 1/3 of the total energy consumption in Maldives.

7.Conclusions

* It was found that diesel is the most imported fuel type contributing to about 80% of the fuel being imported. The analysis shows that the power generation with the Greater Male' Region is relatively efficient where in the Other Atolls the well-populated and developing islands too have good efficiencies.
* A growth of 6% in 2012 in electricity demand for the Greater Male' Region was obtained where in the Other Atolls it was a 14% increase in 2012

8.Recommendations

* 1) A mechanism to obtain the data by powerhouses on their fuel usage, generated power and billed units
* 2) Reliable data from the tourism sector, especially on their power generation and energy usage on other activitiesPrivate Investment in RE with FIT Mechanism
* 3) Energy usage data for the domestic purposes in the Greater Male' Region and the Other Atolls needs to be collected at least as sample energy audits

THANK YOU

* For questions and comments you can contact us by telephone at (+960) 3019100 or email to secretariat@energy.gov.mv
* For further information and periodic updates please visit our website at www.energy.gov.mv