



Ministry of Tourism  
and Environment



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# Report on Mechanism for Continuous Publication of the Energy Balance

Consultancy Services to Conduct Energy  
Supply and Demand Study 2018 – 2022

## **CBIT Maldives**

Capacity Building for Improved Transparency  
of Climate Change Mitigation and Adaptation  
Actions in the Maldives



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# Report on Mechanism for Continuous Publication of the Energy Balance

Consultancy Services to Conduct Energy Supply and Demand Study 2018 – 2022



**CBIT MALDIVES**

*Capacity Strengthening for Improved Transparency of  
Climate Change Mitigation and Adaptation Actions in  
the Maldives Project*



**Prepared for:**

Utility Regulatory Authority (URA), Maldives

**Prepared under:**

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Ministry of Tourism and Environment

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## List of Abbreviations

BESS	Battery Energy Storage System
DAG	Data Analysis Group
EI	Energy Information
EIA	Energy Information Administration
EIM	Energy Information Management
EMS	Energy Management System
FENAKA	Fenaka Corporation Limited
GMR	Greater Male' Region
MACL	Maldives Airport Company Limited
MBS	Maldives Bureau of Statistics
MCS	Maldives Customs Service
MWSC	Male' Water and Sewerage Company Limited
PV	Photo Voltaic
STELCO	State Electricity Company Limited
URA	Utility Regulatory Authority
IPP	Independent Power Producer
PV	Solar Photovoltaic
GMR	Greater Male' Region
FSM	Fuel Supply Maldives
EIM	Energy Information Management
GEF	Global Environment Facility
EIA	Energy Information Administration
ESDS	Energy Supply & Demand Study
NDC	Nationally Determined Contributions
SGDs	Sustainable Development Goals
WG	Working Group
EIC	Editor In Chief
EB	Editorial Board



## **Executive Summary**

This report, developed under the "Capacity Strengthening for Improved Transparency of Climate Change Mitigation and Adaptation Actions in the Maldives Project (CBIT Maldives)," presents a comprehensive mechanism for the continuous publication of the Maldives' Energy Balance. It highlights key challenges in energy information management, including fragmented data sources, inconsistent reporting practices, and a lack of coordination among stakeholders. These issues have hindered the development of a reliable and transparent energy data framework.

The proposed mechanism focuses on establishing a EIA under the Utility Regulatory Authority (URA). The EIA will ensure structured workflows for data collection, validation, analysis, and dissemination. A mandatory reporting framework will address existing gaps by securing regular and accurate data submissions from all relevant stakeholders.

The mechanism includes clear roles for key entities: the URA, as the lead agency; a Working Group (WG) to coordinate efforts; a Data Analysis Group (DAG) to ensure data quality and perform analyses; and an Editorial Board (EB) to oversee the publication process. Together, these groups will produce an annual energy balance report featuring detailed narratives, infographics, and actionable insights for policymakers and stakeholders.

By addressing administrative issues and improving data management, this initiative aims to support national priorities, including reporting on Nationally Determined Contributions (NDCs) and advancing Sustainable Development Goals (SDGs). The proposed system is designed to foster data-driven decision-making, enhance transparency, and strengthen governance in the Maldives' energy sector.

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# 1. Introduction

Energy plays a critical role in the sustainable development and economic growth of the Maldives, a nation uniquely challenged by its geographic dispersion, heavy reliance on imported fossil fuels, and vulnerability to climate change. Effective management of energy supply and demand is essential not only for ensuring energy security but also for meeting the Maldives' international commitments, such as the Nationally NDCs under the Paris Agreement and the SDGs.

Despite its importance, the Maldives faces significant challenges in energy information management. Current systems are fragmented, with data sources scattered across institutions and sectors. Reporting practices are inconsistent, and crucial data gaps persist, limiting the ability to make informed decisions, plan for future energy needs, and monitor climate-related actions. The absence of a centralized mechanism to compile, analyse, and publish energy data regularly has further hindered transparency and accountability in the sector.

This report, developed under the CBIT Maldives project "Consultancy Service to Conduct Energy Supply and Demand Study 2018-2022" funded by the Global Environment Facility (GEF), addresses these challenges by proposing a robust and systematic mechanism for the continuous publication of the Maldives' Energy Balance. It provides a detailed roadmap for establishing an efficient EIA framework, ensuring that energy data is collected, validated, and published on a regular basis.

By streamlining data flows, fostering institutional collaboration, and embedding transparency into energy sector governance, the proposed mechanism will enable the Maldives to better align its energy management practices with global standards. The report aims to empower policymakers, stakeholders, and development partners with reliable data to guide energy planning, track progress toward climate goals, and foster sustainable growth across the nation.

## 1.1 Present Status

Unlike the energy systems of most countries, the Maldivian energy system is fragmented on geographical lines and the data sources are scattered both physically and systemically. Although several entities are possessing various operational data, efforts to collate these into energy information are not quite frequent. The present practice adopted by the Maldives is to consider sector operations for a period of several years and conduct an Energy Supply & Demand Study (ESDS).

Adding more complexity to the issue, certain data streams are aggregated into larger data flows, sometimes mixing demand data from two or more economic sub-sectors like industry and commerce. Multiple schemes of customer categorisation adopted by different stakeholders have contributed to this unintended aggregation more than any other reason.

Another key issue affecting the EIM is the lack of willingness of data providers to share energy data to various reasons. This is affecting the demand side more than the supply side.

Recognizing that recent efforts to publish energy information have primarily been donor-funded and project-specific, URA has decided to take the lead in making this a routine task. This initiative will be carried out with support from stakeholders and input from other technical experts working in the sector, ensuring continuity and broader sectoral engagement.

## **2. Need to Change Approach to Energy Information Management**

Being a country heavily dependent on fuel imports, the Maldives is keen to reduce the dependence and adopt a more proactive planning approach to manage the energy sector operations. One important pillar of a good planning effort is taking informed decisions. Thus, the availability of a robust timeseries of energy supply and demand data has become a priority.

Similarly, reporting climate related data and evaluation of programmes such as the NDCs and SDGs require the continuous monitoring of energy data, as reporting is an important aspect of fulfilling a country's climate obligations.

### **2.1 Administrative Issues**

When the available statistical systems of the Maldives are examined, several issues which hampers the development of a sound EIM can be found. These are briefly discussed below:

The dispersed nature of the energy sector and other economic activities present many challenges to the national statistical system. As a result, not all the energy sector stakeholders are aligned as data providers. Similarly, end user categories are not properly assigned to standard internationally accepted sub-categories. As a result, some transactions are misreported.

Compared to the energy data, demographical data are better captured but the geographical spread has posed some challenges, especially in the housing sector.

Given the situation of some legacy power plants in operation, taken over by the utilities, energy sector base data appears to be not quite authentic, requiring a fair amount of field work to document. The situation with regard to the land vehicles and maritime fleets is not different to the case of power plants.

#### **2.1.1 Incomplete Reporting**

Some major energy uses, which occur in industrial islands and some other specific places may not be reported, as the operations are undertaken by companies operating in the private sector, outside the purview of any energy sector authorities and entities. In addition, capacity augmentation of existing plants and introduction of renewable power generation to reduce diesel use may escape the energy information flow as such activities are not always reported by the private sector.

Similarly, uncommon energy commodities such as charcoal, woodchips and briquettes for leisure activities too may escape the energy data gathering efforts. Considerable effort is required to keep such aspect monitored and reported.

#### **2.1.2 Discontinuity of Data Streams**

In the absence of a routine data submittal practice and the lack of practice with regard to capturing base data (such as proven capacity at plant commissioning) both operational data and base data streams exhibit gaps, which need a considerable effort to fill.

A robust framework to secure such data is required. It would be beneficially to identify the legal and regulatory measures which will ensure compliance under a mandatory reporting framework.

### **2.1.3 Disaggregation of Data Streams**

As some of the energy users are not categorised in accordance to an internationally applied scheme, certain end uses are aggregated, preventing further analysis. This makes it difficult to report end uses in the four categories used by agencies such as the International Energy Agency (i.e. industries, transport, other and non-energy uses).

### **2.1.4 Absence of a National Statistics System**

The Maldives is endowed with a fully-fledged statistical institution, which operates a robust administrative database. However, energy sector operations are not fully captured by this system. Like in many other countries, the administrative dataset requires periodic upgrading of the relevant frames by conducting national surveys and censuses.

### **2.1.5 Assignment of Responsibility**

The newly established URA is yet to receive its full cadre and is tasked with the overall EIM task. However, the operations involve multiple stakeholders, necessitating the establishment of a compulsory reporting framework and a fixed calendar of events. This structure should assign clear roles and responsibilities to each stakeholder to ensure streamlined and effective coordination. Stakeholders.



### 3. Mechanism for Data Collection

This chapter provides the guidance for data collection, data entry, data analyses and data validation in the process of compiling the energy balance. The energy balance tables are structured to have three compartments, *viz.*, (1) energy supply, (2) energy conversion and (3) energy use. Each energy balance table appears in three forms, *viz.*, (1) original units, (2) tonnes of oil equivalent (toe) table and (3) tera joules (TJ). Raw data is entered into the original units table, while the subsequent tables, *i.e.*, the toe and TJ tables are constructed by multiplying the corresponding values in the original units table by standard conversion factors.

Each section has a different approach for data collection and data analysis. The following sections in this chapter will detail the mechanisms involved in each section, ensuring its replicability.

#### 3.1 Energy supply

Energy supply is the first compartment in the energy balance table. Table 3-1 depicts the first compartment of the energy balance table (original units).

**Table 3-1 Energy Supply Table (Original Units)**

<b>Maldives Energy Balance YYYY (in original units)</b>						
	<b>Renewable (GWh)</b>	<b>Electricity (GWh)</b>	<b>LP gas (kt)</b>	<b>Petrol (kt)</b>	<b>Aviation gas (kt)</b>	<b>Diesel (kt)</b>
<b>Supply</b>						
Primary Energy	Elect 1					
Imports			LP 1	P 1	Jet 1	D 1
Direct Exports						
Foreign Aviation and bunkering				(P 2)	(Jet 2)	(D 2)
Statistical difference						
<b>Total Energy Supply</b>	Elect 2		LP 2	P 3	Jet 3	D 3

Data should be entered into all cells containing variables. Below is given the methodology for data entry.

- 1) Renewable
  - The summation of the Renewable column in the Energy Conversion Table Table 3-2 shall be entered in the column Renewable against the row Primary Energy in GWh (Elect 1).
  - Elect 1 should be a plus value.
- 2) LP gas
  - Imports of LP gas in thousand tonnes (kt) shall be obtained from the Maldives Customs. Data should be entered as it is (LP 1).

## 3) Diesel

- The quantity of diesel that dispensed for bunkering operations shall be obtained from the Fuel Supply Maldives in million litres.
- The million litres value should be multiplied by specific density of diesel (0.84) and converted into kt and entered into the table.
- Since bunkering refers to a quantity that is leaving the Maldives, this value should be entered as negative value in the table (D 2).
- The diesel imported into the Maldives should be obtained from Maldives Customs in kt.
- The value of diesel dispensed for bunkering should be added to the Maldives Customs imported diesel quantity and entered under imports (D 1).

## 4) Petrol

- The quantity of petrol that dispensed for bunkering operations shall be obtained from the Fuel Supply Maldives in million litres.
- The million litres value should be multiplied by specific density of petrol (0.75) and converted into kt and entered into the table.
- Since bunkering refers to a quantity that is leaving the Maldives, this value should be entered as negative value in the table (P 2).
- The petrol imported into the Maldives should be obtained from Maldives Customs in kt.
- The value of petrol dispensed for bunkering should be added to the Maldives Customs imported petrol quantity and entered under imports (P 1).

## 5) Aviation gas

- The quantity of aviation gas imported to the Maldives shall be obtained from the MACL in litres.
- This value shall be multiplied by the specific density value (0.8) and entered under imports in kt (Jet 1).
- The quantity dispensed (litres) to international airlines shall be obtained from the MACL, multiplied by specific density of aviation gas (0.8) and converted into kt and entered into the table.
- Since foreign aviation refers to a quantity that is leaving the Maldives, this value should be entered as negative value in the table (Jet 2).

## 6) Total Energy Supply

- The variables Elect 2, LP 3, P 3, Jet 3 and D 3 will be the summation of the corresponding columns

## 3.2 Energy Conversion

Energy conversion is the second compartment in the energy balance table. Table 3-2 depicts the second compartment of the energy balance table (original units).

**Table 3-2 Energy Conversion Table (Original Units)**

Energy Conversion						
Thermal Power Plants		Utility T				(Utility D)
Solar Plants	(Utility S 1)	Utility S				
Airport		Airport T				(Airport D)

Desalination		RO T				(RO D)
Resort diesel generation		Resort T				(Resort D)
Resort solar	(Resort S 1)	Resort S				
Own Use						
Conversion Losses						
Losses in Transport and Distribution		(Utility L)				
Consumption for Non Energy Use						
<b>Total Energy Conversion</b>	<b>(Elect 1)</b>	<b>Elect 2</b>				<b>(Total D)</b>

Data should be entered into all cells containing variables. Below is given the methodology for data entry.

1) Thermal power plants

- Thermal power generation shall be obtained from the two Utilities, *i.e.*, STELCO and FENAKA and entered in GWh (Utility T).
- The RO T value should be subtracted from the above value, since it is accounted for by the Utilities. The calculation of RO T will be elaborated subsequently, in a section below.
- The diesel quantity used in power generation by the Utilities shall be obtained from the Utilities in litres.
- This value should be multiplied by the specific density of diesel (0.84) to convert into kt.
- Since diesel is used in power generation, the negative value should be entered in the diesel column, against thermal power plants (Utility D).

2) Solar power

- Solar power generation shall be obtained from the two Utilities, *i.e.*, STELCO and FENAKA and entered in GWh (Utility S).
- This value shall be entered as a negative value in the column Renewable, against solar plants (Utility S 1). The value is negative, because it refers to the solar resource used to generate electricity.

3) Airport

- The diesel quantity used for power generation in the airport shall be obtained from the STO data collection form in litres.
- This value should be multiplied by the specific density of diesel (0.84) to be converted into kt, appropriately.
- Since diesel is consumed in power generation, the negative value of kt should be entered in the diesel column against the Airport row (Airport D).
- Assuming the efficiency of Utility D/ Utility T, the generation of electricity should be derived from Airport D and entered in the electricity column against the Airport row (Airport T).

4) Desalination

- Electricity generation shall be obtained from the RO plant workbook and entered in the column Electricity against the row Desalination in GWh (RO T).
- Diesel consumption shall be obtained from the RO plant workbook in litres.



- This value should be multiplied by the specific density of diesel (0.84) to be converted into kt appropriately.
- Since diesel is consumed in power generation, this value will be entered as a negative value in the column Electricity against the row Desalination in GWh (RO D).

### 5) Resorts

- Electricity data of resorts shall be obtained from a representative sample survey carried out with resorts.
- Electricity generation per bed night should be derived from that sample separately, in kWh/bed night, for diesel and solar, respectively.
- The total bed nights of resorts shall be obtained from the latest Statistical Pocket Book.
- Resort T will be calculated by multiplying total annual bed nights by the diesel kWh/ bed night value, and shall be entered in the Electricity column against the Resort Thermal row in GWh (Resort T).
- The quantity of diesel used for electricity generation should be derived assuming the efficiency Utility D/ Utility T.
- Since diesel is consumed in electricity generation, this value should be entered as a negative value in the column Diesel against the column Resort Thermal in kt (Resort D).
- Resort S will be calculated by multiplying total annual bed nights by the solar kWh/ bed night value, and shall be entered in the Electricity column against the Resort Solar row in GWh (Resort S).
- This value shall be entered as a negative value in the column Renewable, against Resort Solar (Resort S 1). The value is negative, because it refers to the solar resource used to generate electricity.

### 6) Losses

- Losses in GWh shall be obtained from the two Utilities, *i.e.*, STELCO and FENAKA and entered in the column Electricity against the row Losses in Transmission and Distribution.
- Since this value is a loss to the electricity system, it should be entered as a negative value (Utility L).

### 7) Total Conversion

- (Elect 1), Elect and (Total D) shall be the summations in the corresponding rows.

## 3.3 Energy Use

Energy use is the third compartment in the energy balance table. Table 3-3 depicts the third compartment of the energy balance table (original units).

**Table 3-3 Energy Use Table (Original Units)**

Energy Use					
Fishing industry					Fish D
Desalination	RO U				
Airport	Airport U				
Road Transport			Road Tr P		Road Tr D
Domestic navigation			Navi Tr P		Navi Tr D

Domestic Aviation				Dom Jet A	
Resorts	Resort U	LP Re U			
Household, Commercial and Other	HH, Com U	LP Other U			
<b>Total Energy Use</b>	<b>Total Elect U</b>	<b>Total LP U</b>	<b>Total P U</b>	<b>Total Jet U</b>	<b>Total D U</b>

## 1) Industry

- Electricity use in Industries shall be the electricity use in RO plants.
- Electricity generation in RO plants is assumed to be the same as the electricity use, therefore the generation value (RO T) shall be entered in the Electricity column against the Desalination row in GWh (RO U).

## 2) Airport

- Electricity use in the Airport is assumed to be the same as the generation value (Airport T), therefore this value shall be entered in the Electricity column against the Airport row in GWh (Airport U).

## 3) Resorts

- Electricity use in Resorts is assumed to be the same as the generation sum of diesel and solar values (Resort T + Resort S), therefore this value shall be entered in the Electricity column against the Resorts row in GWh (Resort U).
- LP gas usage data of resorts shall be obtained from a representative sample survey carried out in resorts.
- LP gas use per bed night should be derived from that sample in kg/bed night.
- The total bed nights of resorts shall be obtained from the latest Statistical Pocket Book.
- Resort LP U will be calculated by multiplying total annual bed nights by the above derived kg/ bed night value, and shall be entered in the LP gas column against the Resorts row in kt (LP Re U).

## 4) Household, Commercial and Other

- Electricity use in the Household, Commercial and Other category in GWh shall be obtained from the two Utilities, *i.e.*, STELCO and FENAKA.
- The RO U value should be subtracted from the above value, since it is accounted for by the Utilities.
- This calculated value should be entered in the Electricity column against the Household, Commercial and Other Row (HH, Com U).
- LP gas use in the Household, Commercial and Other sector shall be calculated by deducting LP Re U from the total imported LP gas value LP I and entered in the LP gas column against the Household, Commercial and Other row in kt (LP Other U).

## 5) Fishing activity

- The fish catch shall be obtained from the latest Statistical Pocket Book.
- The ratio fish catch per fishing trip (0.85) was obtained from a previous Energy Supply and Demand

study carried out in the Maldives.

- Accordingly, the total fish catch of the year was divided by the above ratio to estimate the number of fishing trips per year.
- The diesel use per trip (204 l per trip) was obtained from a previous Energy Supply and Demand study carried out in the Maldives.
- The diesel use for fishing was calculated in litres, by multiplying the total number of trips per annum by the diesel per trip value.
- This was multiplied by the specific density of diesel (0.84) and entered in the Diesel column against the Fishing row in kt (Fish D).

#### 6) Transport Petrol

- The land transport fleet was constructed by imputing data from the latest Statistical Pocket Book and previous studies and surveys carried out by the Ministry of Transport.
- The parameters used in calculating the petrol demand, *i.e.*, petrol to diesel shares of imported vehicles, km per day for petrol vehicles and km per litre for petrol vehicles were extracted from a previous Energy Supply and Demand study in the Maldives and surveys carried out by the Ministry of Transport.
- The petrol vehicle fleet was constructed in Nos. by multiplying the total fleet by the ratio of petrol vehicles.
- The total distance run by each type of petrol vehicles was calculated in million km per annum by multiplying the distance per day of petrol vehicles by the corresponding fleet.
- The total petrol use (million litres) in vehicles was calculated by dividing the above mileage (million km per annum) by the km per petrol litre value.
- The million litres of petrol were converted into the corresponding mass, by multiplying by the specific density of petrol (0.75), and entered in the Petrol column against the Land Transport row in kt (Road Tr P).
- Assuming that petrol is only used in transport, either for land or water-borne navigation, the above petrol (Road Tr P) shall be subtracted from P 3 in the Energy Supply Table to calculate the quantity of petrol used for navigation. This value should be entered in the Petrol column against the Domestic Navigation row (Navi Tr P).

#### 7) Transport Aviation Gas

- The quantity dispensed (litres) to domestic aviation shall be obtained from the MACL, multiplied by specific density of aviation gas (0.8) and converted into kt and entered the column Aviation Gas against the row Domestic Aviation in kt (Dom Jet A).

#### 8) Transport Diesel

- The land transport fleet was constructed by imputing data from the latest Statistical Pocket Book and previous studies and surveys carried out by the Ministry of Transport.
- The parameters used in calculating the diesel demand, *i.e.*, diesel to petrol shares of imported vehicles, km per day for diesel vehicles and km per litre for diesel vehicles were extracted from a previous Energy Supply and Demand study in the Maldives and surveys carried out by the Ministry of



Transport.

- The diesel vehicle fleet was constructed in Nos. by multiplying the total fleet by the ratio of diesel vehicles.
- The total distance run by each type of diesel vehicles was calculated in million km per annum by multiplying the distance per day of diesel vehicles by the corresponding fleet.
- The total diesel use (million litres) in vehicles was calculated by dividing the above mileage (million km per annum) by the km per diesel litre value.
- The million litres of diesel were converted into the corresponding mass, by multiplying by the specific density of diesel (0.84), and entered in the Diesel column against the Land Transport row in kt (Road Tr D).
- Assuming that diesel is only used in power generation, transport (either for land or water-borne navigation) and fisheries activity, the diesel values Total D, Fish D and Road Tr D shall be subtracted from D 3 in the Energy Supply Table to calculate the quantity of diesel used for navigation. This value should be entered in the Diesel column against the Domestic Navigation row (Navi Tr D).

▪

#### 9) Total Use

The total values, *i.e.*, Total Elect U, Total LP U, Total P U, Total Jet U and Total D U will be the summation of the corresponding columns in the Energy Use Table.

### 3.4 toe Tables

The toe Tables, which is the second Energy Balance table, shall be constructed by multiplying the values in the Original Units Table by the respective conversion factors.

The kt to ktoe conversion factors are tabulated in Table 3-4.

**Table 3-4 Conversion Factors for kt to ktoe**

Fuel	ktoe/kt
Diesel	1.035
Petrol	1.070
Aviation gas	1.065
LP gas	1.130

### 3.5 Tera Joules Table

The Tera Joules Tables, which is the third Energy Balance table, shall be constructed by multiplying the ktoe values in the ktoe Table by 41.868, which is the conversion factor for ktoe to TJ.

### 3.6 Other Parameters

The above section describes the calculation / estimation of all values that appear in the energy balance, there are however, a few more salient parameters discussed in the study. This section elaborates on the data collection mechanism involved in selected salient parameters.

#### 1) Installed Capacities of Power Plants

- The installed capacities of diesel generators, solar technologies and battery energy storage systems shall be obtained from the two Utilities, *i.e.*, STELCO and FENAKA.

- Capacities of diesel generators, solar technologies by type (ground mounted, rooftop and net-metered) shall be reported in MW, while battery energy storage systems shall be reported in MWh.
- The capacities of diesel generators in resorts, at the Airport and desalination plants, however, are not reported. Policy and regulatory interventions will be required to obtain data from these entities.

## 2) Key Energy Indicators

- Per capita Electricity Use (kWh/person) – the total electricity use shall be divided by the mid-year population.
- Per capita Energy Use (MJ/person) – the total energy use shall be divided by the mid-year population.
- The mid-year population should be obtained from the Maldives Bureau of statistics.
- Energy Intensity of the Economy (TJ/GDP million USD) – the total energy use shall be divided by Real GDP.
- The Real GDP (million USD) shall be obtained from the latest Annual Report of the Maldives Monetary Authority.

## 3) CO<sub>2</sub> Emissions

- The values in the ktoe Table shall be multiplied by the relevant conversion factor CO<sub>2</sub> emissions as indicated in Table 3-5.

**Table 3-5 CO<sub>2</sub> Conversion Factors**

Fuel	CO <sub>2</sub> Gg/toe
Diesel	3.06
Petrol	2.84
Aviation gas	2.92
LP gas	2.57

## 3.7 Assumptions and Mechanisms for Improvement

The assumptions involved in these calculations and the necessary regulatory and other methods for the improvement of data capturing, analyses and presentation, are summarised in Annex 1.

## 4 Proposals for a Mechanism for the Continuous Publishing of Energy Balances

Giving due consideration to the shortcomings discussed in the preceding section, a phased approach, a workable institutional framework, and a calendar of events to be complied with are proposed. This paragraph will describe these three aspects of the proposed EIM.

### 4.1 Proposals for a New EIM Framework

The EIM of the Maldives can be setup by carefully following a step-by-step process. These steps would require minor changes to suit the country's situation and are described below in a generic form:

### 4.2 Choosing Readerships

A publication on energy information (EI) will be valuable for many groups of persons. Firstly, there is a captive readership comprising of energy planners, data providers and energy sector stakeholders. It will also provide valuable content to managers of national budgets, donors and development partners and agencies responsible for climate change mitigation and adaptation. An exhaustive study will prepare a list of captive readerships and a broader group of likely readers.

#### 4.2.1 Deciding on Data and Information for Consideration

Several stakeholder consultation sessions will need to be held, firstly to assess the data and information available in the country and secondly to gauge the information needs of the core readership. Special emphasis must be made to involve the Bureau of Statistics and Climatic Change department of the ministry in these sessions to future proof the publication. Many ongoing activities such as national censuses, NDC reporting, and SDG reporting schemes can support this effort and benefit from the proposed EIM.

After the sessions, an initial multilevel list of energy statistics, ranging from the available data sets to desirable data sets will have to be compiled, along with a list of activities to be undertaken to realise the desirable, but not yet available data and information.

#### 4.2.2 Deciding on Key Outputs

After careful evaluation of the available data and data which can be easily collected, the preliminary nature of the output can be decided. This will be a step towards construction of a results framework of those immediate data collection efforts and will also yield a continuous improvement plan for the EIM. The exercise will also allow the EIA to figure out the output channel (i.e., whether a detailed printed report, downloadable e – document or a web-based database etc.) and its properties. At the end of this activity, a draft Table of Contents (ToC) or the page layout of a web-based database must be realised.

#### 4.2.3 Choosing the Key Information Outputs

Based on the consultations and decisions made above, what type of EI will be published and at what level of detail those will be published needs to be documented. In essence, this exercise will yield the blank tables, charts, graphs and other infographics which will be depicted in the output. Each one of the outputs will have a raw data source and a process linking the output to the raw inputs and these relationships will have to be documented at this stage.

#### 4.2.4 Designing Data Collection Formats

A more detailed discussion with data providers will be taken up, to agree upon data which will be provided by

various data providers, relevant non-disclosure requirements and finer details like data resolution, cut-off dates and collections frequencies. At the end of this session, the EIA shall have a complete set of data collection formats (including the set meant for immediate data requirement and also advance formats which will be used to gather desirable information if future).

#### **4.2.5 Identification of Data Gaps**

The enhanced data and information requirement discovered above will have to be documented and presented again to data providers and the Maldives Bureau of Statistics (MBS) for confirmation and acceptance. This document will feed the action plan for further requirement of the EIM process. Special mention must be made to improve the administrative data system, the national statistics and the business registry in implementing these continuous improvement programme.

#### **4.2.6 Establishment of Data Collection Cycle**

The data collection cycle must focus on the immediately passed calendar year, as retrieval of data and information for the immediate year will be that much easier. The trial data collection effort will make many unknowns, known, and establish norms and practices for comfortable operation of the cycle. The trial run will also identify many shortcomings and provide room for improvement, which must be documented and used for finalisation of the practices and for continuous improvement.

#### **4.2.7 Define Workflows**

Upon the finalisation of the data collection cycle, the workflows involved needs to be documented for future users of the EIM. The workflows established will also laydown a firmed-up calendar for the data providers to be prepared for the cycle. However, at no point must the workflow dictate or curtail any improvement effort of the process.

#### **4.2.8 Data Conditioning**

The incoming data streams must undergo plausibility checks, units' confusion checks and related data cleaning processes. Several cycles later, the data conditioning process can be assisted with a well populated plausible data ranges and other such error detection methods to ensure accuracy. At the same time, missing data shall be filled in, using an acceptable method, such as trend analysis and interpolation. All assumptions made in these imputations need to be documented, as valuable content for notes on data tables.

#### **4.2.9 Data Validation**

The conditioned data sets need to be validated with the core data providers, and this can be best realised through a **validation workshop**. That occasion can also be used wisely to deal with the non-responding data providers also to capture any missing data or errors detected through the plausibility checks. In essence, this important step is to be treated as the major quality control aspect of the whole EIM process.

#### **4.2.10 Finalisation of Outputs**

In this step the EIA will be faced with certain choices, on what kind of EI must be carried in the final output, level of emphasis needed or any exclusions to be made. This will be mostly guided by the narrative of the output and each aspect will nurture the other, taking the EIA to maintain a fine balance on level of disclosure and level of confidentiality.

#### **4.2.11 Channels to Be Used**

After the outputs are chosen and narratives written, the content can be cleared for pre-publication conditioning which will include activities such as proof reading, editing, preparation of graphics, insertion of pictures and choosing colour themes etc. Depending on the method and channel chosen for dissemination, these attributes will vary widely.

#### **4.2.12 Launching of The Publication**

Irrespective of the chosen channel, it will be useful to have a formal launch and a media briefing to mark the first dissemination of the EI. The event can be used to publish the salient information for public consumption. After several repeated cycles, this launch will become a highly anticipated event, as it reflects the country's economic dynamics.

#### **4.2.13 Post Publication Tasks**

An engaging dialogue must be maintained with the consumers of the EI and the readers must be engaged through either a comments section (in the case of a web-based output) or a feedback form where the business replies to the facility. It can be utilised to create a wish list of future EI requirements, outline expected improvements and identify data quality issues and errors overlooked in the EIA. With each cycle, the number of imputations, errors, and assumptions will diminish, resulting in a significantly improved publication.

### **4.3 Structure of the Energy Information Administration (EIA)**

To execute the proposal presented above, a robust EIA needs to be set up. Whilst the full empowerment of the URA is contemplated, this EIA will not require additional human resources to function. The EIA will have five primary entities interacting with each other, and their roles and responsibilities are described below:

#### **4.3.1 Utility Regulatory Authority**

The primary responsibility of the EIA will be left for the URA, and it will draw the necessary powers from the Permanent Secretary of the relevant ministry. It is expected that any strengthening of existing laws and making new provisions in the acts will be done without any hindrance by the Parliament.

The URA will retain the role of the publisher of EI and claim the lead authorship of all publications. It will also play a supervisory role, a coordinators role and will be the main source of legal power for the EIA.

#### **4.3.2 The Working Group**

The URA will seek nominations from key agencies and data providers and appoint a Working Group. The tentative membership of this Group includes the URA, and other major stakeholders in the energy sector.

The primary functions of the Working Group will be:

- Data collection
- Coordination and supervision
- Forming the main narrative
- Ensure compliances and non-disclosure where relevant
- Assist URA in its EIA tasks

#### **4.3.3 Data Analytics Group**

This Group will be the core group which will receive raw data and process same in terms of quality assurance, compliance also in plausibility aspects. After the initial data receiving processes, the Group will perform all necessary calculations to prepare the outputs required for the publication. This Group will be also responsible to draft energy statistics and conducting the validations required and finalise outputs.

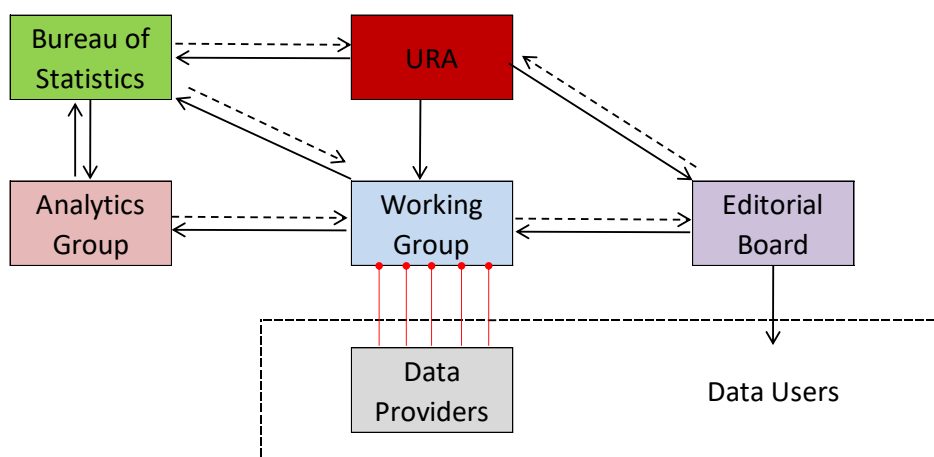
The group will also be responsible for identifying data gaps and writing terms of references (ToRs) for all tasks (such as surveys and research) to be undertaken to close the data gaps and to enhance the quality of the outputs. Once the measures to fill the data gaps are taken or improvement to the publications to be made are known, the Group will consume the survey reports and recommendations and adopt those in the next EIM cycle as appropriate.

#### 4.4 Editorial Board

This Board will be chaired by the URA representative, who will be identified as the Editor-in-Chief of the publication. This chair will be supported by a group of sector writers from both the supply side and the demand side. The Board will also have a language editor to improve language quality and a graphical content creator to assist the Board in visual communication aspects.

The main responsibility of the Board will be to digest the numerical content provided by the Analytics Group and review the main narrative formed by it. After perusing these, the Board will create written and visual content forming the core EI publication. Apart from these, the Board will be responsible for all pre-publication tasks.

The Board, on behalf of the URA will undertake to publish EI on an annual basis. Establishment of reader feedback and making recommendations on adopting necessary inputs will also be responsibilities of the Board. The institutional framework along which these entities will interact with each other in operating the EIA is depicted in the Figure below (Figure 4-1).



**Figure 4-1: Interaction between institutional frameworks**

## 5 A Calendar of Events

Upon establishment of a stable EIM system, the EIA can make the whole process a well-managed routine exercise. As a result, some of the activities which were described above will not be necessary to repeat in the ensuing cycles. The proposed calendar of events was prepared under several assumptions, and it is important to note the necessity of other data provision services, such as the administrative data publication will be realised on time, in sync with the proposed calendar. Such an eventuality will result in either considerable delays in publication of EI or broad assumptions will have to be made in the EIM to make good such lapses. The proposed calendar will ensure that the EI will be published seven months after the close of the preceding calendar year in the month of July.

It is important to identify key players in the sector and prepare a set plan for all the activities ranging from data collection to the launch of the publication. Clear identification of what needs to be collected and suitable methodologies with international standards are seen as major success factors.

It is strongly recommended to adopt an annual calendar to strengthen the continuous publication of the energy balance. It is proposed to use three main groups to fulfil the activities of continuous publication:

1. WG to coordinate and supervise the effort comprising of the members from relevant stakeholders.
2. DAG led by URA team, supported by the MBS and other key players will make sure the quality of the data by a trained team for data cleaning and quality assurance.
3. EB comprising of sector writers and contributors, headed by an Editor in Chief (EIC) to publish the ESDS report annually.

The sub-activities to be undertaken in making the annual publication are described in detail below:

### 1. Collect monthly data from stakeholders

After the stage *3.1.5 Designing data collection formats* described above and all preceding stages are passed, the periodical plan to collect data from each player needs to be implemented. At this stage, it is important to clearly identify the method of data collection (e.g. printed formats physically delivered or using a web portal etc.) needs to be finalized in line with the international best practices and standards. This activity will be carried out by the WG.

### 2. Conduct plausibility checks and data cleaning

The incoming data, depending on the method of data collection, will have to undergo the scrutiny of the WG and the DAG. If the method used is purely electronic, primary plausibility of data can be checked even at the data provider's console. However, if the data is received through other means, the trained DAG members can ensure the accuracy of incoming data, usually by looking at the past data points. Any suspicious data points and missing data points can be checked with data provider agencies and made good. At this stage, all necessary extrapolation and imputations must be completed and relevant notes made, so that such interventions can be taken up at the validation stage. This task will be led by the DAG, coordinated by the URA and supported by key data providers.

### 3. Generate quarterly compliance reports

The data analysis group will prepare quarterly compliance reports after analysing and compiling data received from the data providers. The agencies which failed to provide necessary data at monthly or quarterly intervals as the case may be, will be prompted to comply and provide the required data for the DAG to start the analysis. Even after several attempts by the URA to elicit any response from the non-



compliant data providers, a report will be published to reveal the names of the non-compliant agencies. This is proposed as a means of enhancing the level of cooperation and not as a punitive measure.

#### **4. Remind data providers on year end processes**

This activity is aimed at collecting year end data mainly from agencies which stock energy commodities. A schedule of such agencies will have to be prepared and send timely reminders to data providers, causing them to undertake the year end stock verifications. Similarly, operators of other energy facilities such as power plants and approving authorities will be prompted to report any gains or losses of installed capacities of the facilities they operate. This activity will be carried out by the WG supervised by the URA.

#### **5. Collect closing stock data with December data**

During the month of January in the year past the year of interest, closing stocks of energy commodities need to be collected by the WG under the supervision of URA. Similarly, data on plants commissioned or decommissioned during the year under reference are to be collected through the year end reporting process. Sufficient time to collate data must be allowed and collection of year end data within the month of January is recommended, as it is a period in which the yearend affairs will remain in focus.

#### **6. Update operating plant inventory**

On receipt of data from the year end processes, the operating plant inventory shall be updated. Special care must be taken to account all capacity additions to micro power producers such as solar rooftop systems, which often escape the attention of the planners. The DAG must compare these with the existing plant inventory and conclude the compilation of the plant inventory. New oil storage facilities and battery banks and other such storage devices too require the same treatment.

#### **7. Obtain business registry updates**

The business registry serves as a vital source of information on new energy users and potential entrants into the energy sector. By closely monitoring updates to the registry, the Utility Regulatory Authority (URA) can ensure that no new energy-related operations established during the year go unnoticed. This is especially important given that several industries are already operating their own energy facilities to power their businesses—often without the authorities having access to their plant or energy data. This is particularly relevant in the resort sector, where many properties operate self-contained energy systems.

To address this, the Energy Service Operating License Regulation (2023/R-148) mandates that all energy facilities must register and obtain an operating license from URA. A critical requirement of this license is the obligation for facility operators to submit accurate and timely data to the Authority. This regulatory approach strengthens national mechanisms for energy data collection and publication, reducing reliance on externally funded initiatives.

#### **8. Collect year end custom records**

Similar to the above, the MCS must be approached to secure the complete record of energy imports and possibly data related to the importation of equipment for power generation or other such energy sector operations.

#### **9. Collate 12-month data set and reconcile**

Armed with a complete set of energy data from energy sector operations, yearend data sets, business registry data and MCS data, the DAG can take stock of the data set and perform any reconciliations as appropriate, in preparation of the data analysis. This activity can be started along with the receipt of first set of data and will continue for several months until the last set of data is secured.

#### **10. Collect economic and financial data**

The MBS and the Maldives Monetary Authority (MMA) shall be engaged to access the country's economic, financial and demographic data for the year of interest. In the case of surveys and censuses carried out in the recent past, such sources can be used. If not, the relevant agencies must be approached to obtain year end or midyear estimates for a given data point (e.g. midyear population). It will be prudent to keep a record of all indices related to the country's monetary policy, such as the exchange rates and interest rates.

### **11. Conduct preliminary data analysis**

The preliminary analysis of data sets can begin early, and progress along with the receipt of the entire data set for the year of interest. This period will raise many questions and data gaps leading to making some assumptions and undertaking imputations and extrapolations by the DAG.

### **12. Validation of interim data tables**

All such operations and the results of the analysis must be presented to a core group of data providers for their comments, validation and acceptance. This validation shall be treated as the last point of data entry and correction. Any subsequent correction which crops up after this activity will have to be taken care of in the next issue of the publication, with an appropriate note to the relevant data point in the previous publication. This activity will be led by the URA.

### **13. Entry of data into database (time series)**

Although the main element of the publication i.e. the energy balance table will be a snapshot of the year of interest, it will be prudent to maintain the data streams which populate the energy balance tables in a time series, possibly in a spreadsheet database or a fully-fledged database application. Such time series of data will allow the analysts a first glimpse of the results coming out from their analysis and also will act as a quality control measure, spotting any outlier entries. This activity carried out by the DAG and the responsibility of maintaining the long-term records will also be shouldered by the DAG.

### **14. Update of Surveys and Research 'wish list'**

As described under 3.1.6 Identification of data gaps above, this phase will also generate a wish list for more data and information and trigger many surveys and research activities for MBS and other such agencies which will enhance the quality of the publication in the future. The DAG, with the guidance of the URA is expected to write the ToRs for the surveys and research to be undertaken from time to time, based on the resource availability.

### **15. Create infographics and other graphics**

Giving due attention to detail, the processed data shall be used to generate the necessary graphs, charts and other such infographics. It is recommended to use a standard colour palette to depict energy commodities and carriers, so that the readership will easily relate to the colour as an identification tag to a particular energy commodity or carrier. It is recommended to use professional services of a graphic artist to enhance the outputs provided by the DAG. Apart from the infographics prepared, it is also proposed to insert pictures of major energy sector happenings in the publication and a suitable cover story to reflect the year of interest. This activity will be carried out by the EB.

### **16. Approval of infographics**

Since the infographics form the most powerful tools of communication, it will be a vital activity for the URA to scrutinise the infographics and other such outputs for clarity and accuracy, before being allowed into the publication. Special care must be taken to obtain the approval of the relevant line Ministry of the URA for the selection of infographics and photographs.

## **17. Write sector narratives**

The editorial board will write the sector narratives by using the numerical content provided by the analysts and create appropriate written and graphical content for the readership. The individual sector narratives will be written by the relevant sector expert serving the EB.

## **18. Collate sector narratives and write main content**

Given the situation in which many writers being involved, the Editor in Chief (EIC) will have to collate all sector narratives to a common language style and write the main content of the publication at this point. In generating the main content, care must be taken to include the major events which occurred in the energy sector and also to showcase the future aspiration of the energy sector decision makers. For this purpose, it is recommended to maintain a Vade Mecum (a record keeping method) of energy sector events ranging from price variation of energy commodities to inauguration of a power plant etc.

## **19. Language and consistency checks**

Language editors in the editorial board will have to check the consistency and the quality of the report in terms of language and tone. The activity must also function as the point of cross checking the publication for internal inconsistencies if any.

## **20. Compilation of draft final report**

Having collected all the updated content for the publication, the EB can proceed to generate the draft final publication. At this point, the authorities in charge of the energy sector shall be contacted for their contribution of messages and also for prior approval of the tone of the content.

## **21. Extraction of short content**

The URA shall peruse the draft final report and extract a short summary of the publication to be used as social media and web content targeting the busier readership. The short content must be short enough to attract a discerning reader but long enough to direct the reader to the full report.

## **22. Approval from the authority**

The draft final publication and the short content extracted from it shall be submitted to the appropriate authority who will authorise the publication. At this point, all messages and administrative information and publication references (e.g. ISSB references etc.) shall be completed.

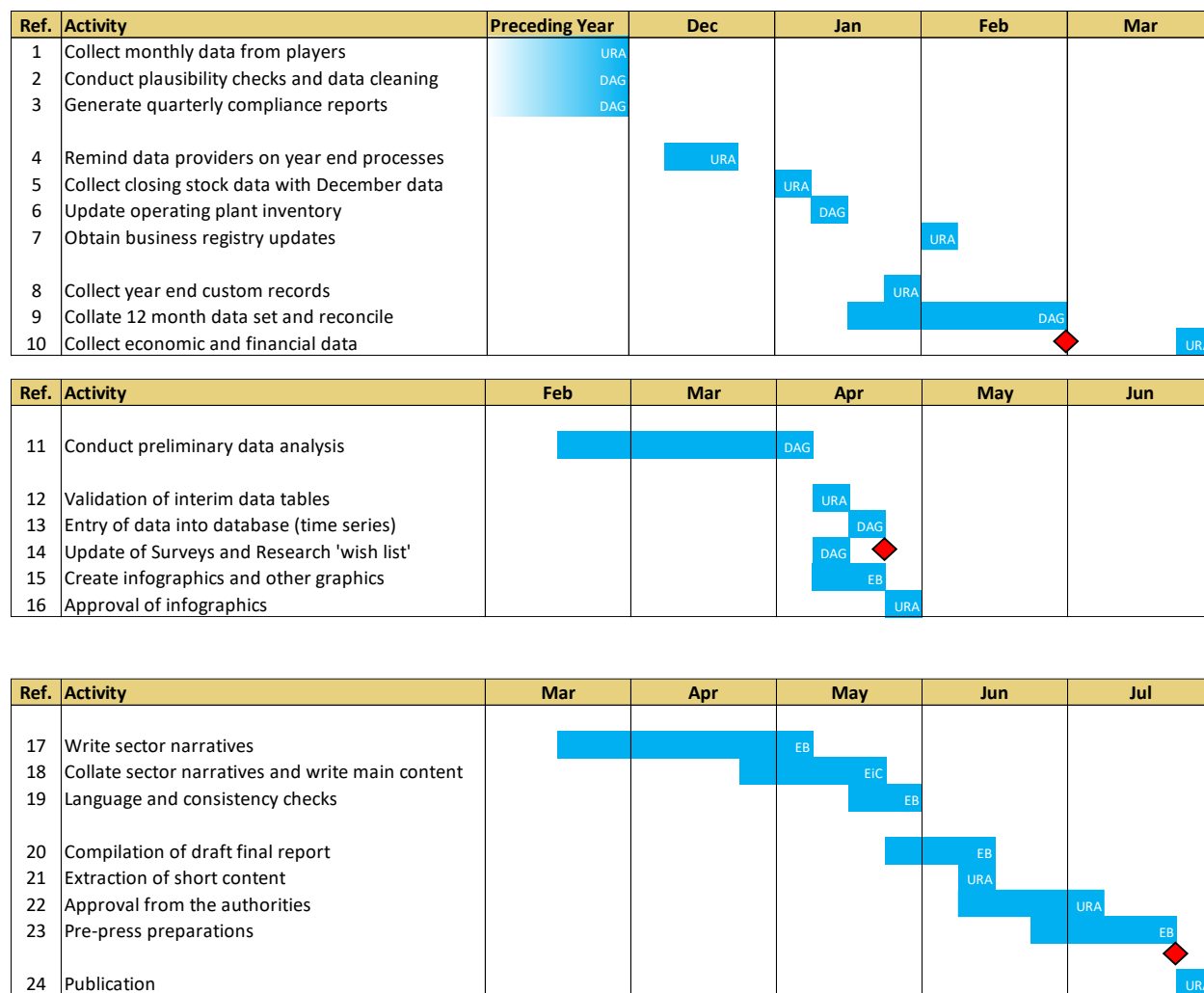
## **23. Pre-press preparation**

The services of a print media expert shall be obtained by the EB to add the final edits to the publication, making it ready for the press and other such outputs such as e-copies. It is recommended to use a particular theme to relate to the year of interest.

## **24. Publication**

Although it is possible to upload the press-ready e-copy to the authority's website, it is recommended to launch the publication in the print form too, in an annual event targeting the mainstream media and the social media. The event can be also styled to assemble all the contributors, so that a viable community of energy data users and providers can be formed for better collaboration.

The sequence of the above activities is presented in three phases in a Gantt chart below:



## 6 Measures to Be Taken to Streamline the Continuous Publication of Energy Balance

The continuous publication of the Maldivian Energy Balance requires many measures to secure data and information from several sources. As described in the previous sections, these data and information fall into two main categories; energy data and economic data. Securing a continuous flow of data from these sources require many different interventions.

These interventions vary between imposing new regulations to carrying out surveys and research. The interventions can be broadly categorised into five areas:

- (a) Securing data sources
- (b) Changes to laws and regulations
- (c) Securing baseline data and asset inventories
- (d) Characterization of energy systems
- (e) Maintaining a Vade Mecum

Each of the interventions and the expected impact on the data flow are described in detail below.

### 6.1 Securing Data Sources

This intervention is required mainly to ensure the data related to economic aspects of the Energy Balance keeps on flowing. This requires the establishment of good relationships and form official contacts with agencies such as the Maldives Bureau of Statistics and Maldives Monetary Authority.

These data provider agencies must be kept informed of the data and information requirements and the date on which those are expected. The touchpoints expected to be sensitised, and the expected impacts are described below:

Area	Expectations
Maldives Bureau of Statistics	<ul style="list-style-type: none"> <li>Mid-year population estimate and results of population census, including locations data of persons.</li> <li>Population breakdowns based on administrative units.</li> <li>Progress of achieving SDGs and NDCs.</li> </ul>
Maldives Monetary Authority	<ul style="list-style-type: none"> <li>GDP of a given year with sector breakdown</li> <li>exchange rates, interest rates and other such information.</li> <li>total value of imports and exports.</li> <li>value of energy commodities imported and exported.</li> </ul>
Meteorological	<ul style="list-style-type: none"> <li>Weather data including rainfall, minimum and maximum temperatures.</li> <li>Cooling degree days of a given calendar year</li> </ul>
Maldives Customs Service	<ul style="list-style-type: none"> <li>Consignment wise import data of gas, oil products (quantities and prices) and solid fuels</li> <li>Bunkering data (quantities and prices) for aviation and maritime sectors with disaggregation on domestic and international use.</li> <li>Import of energy equipment including power generation, boilers (service water heating) and solar hot water systems.</li> <li>Vehicle imports data disaggregated on vehicle type and fuel type, including aircraft and vessels.</li> </ul>

Project Implementation Agencies	<ul style="list-style-type: none"> <li>Proposed projects which might have energy impacts.</li> </ul>
Ports and airports	<ul style="list-style-type: none"> <li>Passenger volumes and destination data freight volumes and destination data</li> <li>Flight records and voyage records</li> </ul>

Upon establishing good contacts with these agencies, standard data and information requests can be dispatched to each agency on a set date. Initially, data formats can be paper based and could be digitised eventually.

## 6.2 Changes in Laws and Regulations

During the study, it was observed that most private enterprises such as industries and resorts operate with limited supervision. As a result, level of compliance to data requests were quite low. Accordingly, the following changes to the legislation are proposed.

Agency	Expectations
New Power Plants	Power plants, either fossil fuel or renewable energy are being installed in many localities. However, records are available mostly for the utility operated plans. Industrial concerns and resorts which operate their own power plants are outside any reporting framework. Accordingly, a new law is proposed to ensure that any new, addition or change to a power plant be reported to URA with required data including location information. This law shall include all new capacity additions including rooftop solar PV. It is ideal to introduce a permitting scheme to regulate power generation for any purpose.
energy Storage Systems	Similar to power plants, energy storage systems which gets installed, needs to be reported on a mandatory basis with required data and information, including location. It is essential to introduce a permitting process to regularise the ESSs established for any purpose.
Charging Stations	Similarly, EV and electric boat charging stations shall come under a permitting system.
Fossil Fuel Infrastructure	Capacities and location details of storage and transport facilities (including pipelines, vessels and road trucks) covering both new and established items need to be properly recorded. Hence, a permitting system through a new law is proposed. This will be applied to all energy commodities (gaseous, liquid and solid), disaggregated on the type of fuel.
Sector tagging of end users	It was observed during the study, that many industries and businesses report energy use under a few board categories. This practice is prevalent across both, electricity supply and oil / gas supplies. A new law is proposed to require energy sector players to tag their customers using ISIC four-digit classification system. Such a law would allow URA to allocate energy shares accurately, among various economic sub-

	sectors. It will also lead to locate large scale industries with captive power plants via sector tagged oil supply records.
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Although a substantial part of the baseline data can be secured through these proposals, many such new requirements will arise in due course, when the periodic publication of the Energy Balance is attempted. It is recommended to treat such necessities on a case-by-case basis and proceed to frame new legislations without over burdening the legal system of the country.

### 6.3 Securing Baseline Data and Asset Inventories

This intervention is proposed to document the energy system of the country, so that estimates and assumptions can be minimised in future. Upon embracing a permitting system for energy facilities, all generation assets, storage assets and other such energy facilities can be collated into a single inventory, forming a sound baseline. The expectations of this intervention are as follows:

Area	Expectations
Power generation	all operating power plants, captive or otherwise will be reported with relevant data and information. Coupled with the permitting system proposed elsewhere, the inventory can be updated on an annual basis. This inventory will also cover renewable energy plants.
Energy Storage	All energy storage systems with status of health records and other data shall be included in an inventory.
Water Heating Systems	All service water heating devices such as boilers and solar hot water systems shall be included in an inventory. Details such as capacities, collector areas and type of fuel to be included.
Fleet of aircraft, vehicles and vessels	A complete inventory of all operational transport assets shall be realised through the annual registration process. This effort shall be carried out to weed out the non-operational stock of vehicles from the inventory. Type of fuel (including electricity) used, age and other such details must be recorded in this inventory.

Once such baseline data is secured, it will become easier to estimate the energy data and information from subsequent additions to the energy systems without deploying additional surveys and research.

### 6.4 Characterization of Energy Systems

It is well understood that energy usage patterns and lifestyles evolve continuously and understanding the characteristics of such systems is essential for proper documentation of energy demands. Considering the economic development achieved by the Maldives over the years, it is essential to examine the dominant energy user segments closely. Once such characterisation is done, secondary data can be used to estimate the energy demand from such sectors. Accordingly, the following elements are proposed under this intervention:

Area	Expectations
Residential sector	Energy use, especially cooking practices and fuels are to be properly understood. Hence a sample survey and a research are proposed to cover the residential sector. It is expected that the use of fuel wood or its derivatives can be captured through this study. If the characterisation leads to any generalisation ( <i>e.g.</i> based on income level or family size). Secondary data can be used to estimate residential sectors' energy demand.
Resorts sector	the energy demand of a typical resort is not very well understood. Hence a census or a sample survey of resorts, covering all types and sizes needs to be undertaken, along with other output indicators such as bed nights. The study must cover the share of fuel used in power generation, LP gas usage for food cover etc.
Power plants	Given the large number of power plants in operation and their very different attributes ( <i>e.g.</i> size, age...etc.,) it is essential to conduct a thorough study of a sample of power plants (if not the whole population), so the conversion efficiencies, emission data and available capacities can be characterised. Such a characterisation will be able to operate vital information such a fuel volume used, plant factors realised and the applicable emission factor for a given plant configuration.
Fisheries sector	Given the size of the industry, a census on a sample survey of this industry is required to allocate the energy usage to it. The characterisation will construct a model which will be able to estimate the fuel usage for a given fish catch. Hence secondary data such as fish production can be used to derive fuel use in this sector.
Other sectors	A similar treatment of agriculture, desalination and manufacturing sectors is required to accurately estimate the energy usage in such industries.
Electric vehicles	Given the fact that unlike other types of vehicles, which are required to turn up at a fuel station, EV population needs to be thoroughly evaluated when the country is having a considerable EV fleet to estimate the electricity demand for home/office charging services (other than fee levying charging stations).
Transport sector	A sample survey, coupled with a properly calibrated fuel station survey will be required to characterise fuel demand from the land vehicle fleet. A similar effort can be made for aviation and navigation sectors, together with airport and port records to characterise energy demand from these elements of the transport sector. Ultimately, indices such as fuel used for passenger km and cargo kg can be deviated.

Once the characterisation of all major energy systems is accomplished, the energy demands from each such system can be accurately estimated by relating it to an output value related to that particular energy system.



For example, the water supply volume can lead to quantify the volume of diesel fuel burnt to operate the reverse osmosis plant.

## 6.5 Maintaining a Vade Mecum

Vade Mecum (meaning one-stop reference / guide to a particular subject), is a system used in the past for recording and retrieval of valuable information, which can be utilised to keep track of important events in the energy sector. In the continuous preparation of the Maldives Energy Balance, such a record will be quite useful. It is proposed that the URA will maintain the Vade Mecum. The elements to be addressed through this are as follows:

Area	Expectations
Government actions	All new legislations, establishment of new agencies and their characteristics and impact on the sector shall be recorded. More importantly, the roles and relationships expected from any new agency too shall be required.
policies	Energy policy, decrees and declarations of goals, etc., shall be recorded here with relevant references to official documents.
Prices and Tariffs	Starting with the prevalent prices at the start of a calendar year, a continuous record of all price revisions of all energy commodities shall be maintained.
Energy Research and Surveys	Working in close relationship with research institutes, a record of research and surveys carried out which can have an impact on the energy sector shall be kept.
Digital Transformation and Energy Transition	Events related to these important aspects shall be recorded to keep track of the achievements realised by the Maldives. NDC reporting and SDG reporting too can be incorporated in the same way.
Digital Scrap Book	A record of all events reported in the traditional and social media shall be maintained in the Vade Mecum in the form of a digital scrap book.

The continuous publication of the Energy Balance will cause the authorities to learn many things along the way. All the proposals made above can be realised only with time, and it is possible to improve these through the knowledge gained in performing the test. Publication is a journey with a lot of approaches for continuous improvement of quality, accuracy and timeliness of the publication.

## 7 Conclusion

The Maldives, as a nation highly dependent on imported fossil fuels, faces significant challenges in ensuring a reliable and continuous publication of its Energy Balance. Accurate and consistent energy data is critical for effective planning, policymaking, and monitoring progress toward national and international commitments, such as NDCs and SDGs. However, gaps in data collection, inconsistencies in reporting, and the absence of a standardized national energy information framework have hindered the ability to establish a robust EIM system.

To address these challenges, a structured and phased approach is necessary. This includes the establishment of a comprehensive EIA under the leadership of the URA, supported by key stakeholders such as MBS, MMA, and other relevant agencies. A well-coordinated framework will ensure the systematic collection, validation, and dissemination of energy data, enabling policymakers, energy planners, and development partners to make informed decisions.

A key aspect of this initiative is the development of a legal and regulatory framework to mandate data submission from all relevant energy sector stakeholders, including private enterprises, industrial facilities, and tourism establishments. Strengthening institutional collaboration and standardizing data collection processes will improve reporting accuracy, reduce data discontinuities, and enhance the ability to track energy consumption and supply across various sectors.

Furthermore, the integration of digital tools and automated reporting systems can streamline data submission and validation, reducing administrative burdens while improving data transparency. By implementing standardized reporting mechanisms, categorizing energy consumers according to internationally recognized classifications, and maintaining a national baseline inventory of energy assets, the Maldives can significantly enhance the credibility and reliability of its energy statistics.

The proposed measures, including the establishment of a clear calendar of events for data collection, validation workshops, and stakeholder consultations, will ensure that energy data is not only collected but also analysed and published in a timely manner. Continuous engagement with data providers and the public through feedback mechanisms will further improve the quality and usability of published reports.

In conclusion, the successful implementation of a robust Energy Information Management system will not only strengthen energy sector governance in the Maldives but also contribute to broader national sustainability goals. It will support long-term energy planning, facilitate the transition to renewable energy sources, and improve the country's ability to report on international climate commitments. By institutionalizing these reforms, the Maldives can pave the way for a more resilient, transparent, and data-driven energy sector, ensuring a sustainable energy future for the nation.

## **Annex 1 – Assumptions and Mechanisms for Improvement**

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Ref.#	Data requirement	Data available	Data deficit	Proposal to fill the data deficit	Secondary sources used to solve issue	Assumptions made	Proposed improvements to capture actual data in future	Proposed timeline for implementation
<b>Energy Supply</b>								
	LP gas imports (kt/yr)	Custom records on imports are available	N/A					
	Petrol imports (kt/yr)	Custom records on imports are available	N/A					
	Diesel imports (k/yr)	Custom records on imports are available	N/A					
	Aviation gasoline imports (kt/yr)	MACL records	N/A					
	Diesel dispensed in bunkering (kt/yr)	FSM data on diesel dispensed to vessels leaving Maldives (kt/yr)	Relatively minor quantities	Moved ahead with available data	None were available	Only FSM engaged in fuel bunkering	Regulations should be imposed to enforce a mechanism to capture bunkering data and to appoint a responsible agency to capture this data	1) Regulations should be imposed immediately 2) Data gathering should be initiated in the immediate aftermath of imposing the regulation

							(Preferably STO)	
	Petrol dispensed for bunkering (kt/yr)	No data was available	No data was available	Moved ahead in the absence of data	None were available	Petrol was not dispensed for bunkering operations	Regulations should be imposed to enforce a mechanism to capture bunkering data and to appoint a responsible agency to capture this data (Preferably STO)	1) Regulations should be imposed immediately 2) Data gathering should be initiated in the immediate aftermath of imposing the regulation
	Aviation gasoline dispensed for foreign aviation	MACL records	N/A					
<b>Energy Conversion</b>								
	Thermal generation (STELCO + FENAKA) (kWh/yr)	STELCO and FENAKA	N/A					
	Diesel (STELCO + FENAKA) (kt/yr)	STELCO and FENAKA	N/A					

	Solar generation (STELCO + FENAKA) (kWh/yr)	STELCO and FENAKA	N/A					
	Total installed capacity by type (STELCO + FENAKA) (MW/yr)	STELCO and FENAKA	N/A					
	Total losses (kWh/yr)	STELCO and FENAKA	N/A					
	Thermal generation in resorts (kWh/yr)	1) kWh and bednights of five resorts 2) Total bednights per yr in the Statistical Pocket book 2023	Actual generation (kWh)	Thermal electricity generation = diesel kWh/bednight * total bednights	1) kWh and bednights of five resorts 2) Total bednights per yr in the Statistical Pocket book 2023	kWh/bdnt is representative of all resorts	Actual production data (kWh) and capacities and fuel consumption should be regularised through a mandatory energy reporting mechanism, imposed through regulations.	1) Impose regulations for mandatory energy reporting. 2) Data collection should commence in the immediate aftermath.
	Diesel consumption in thermal generation in resorts (kt/yr)	Thermal generation in resorts (kWh/yr)	Actual diesel generation	Estimate the diesel consumption based on known efficiencies of generators	Efficiencies of generators were derived from STELCO and FENAKA data	1) Resorts have their own generators. 2) They have the same average efficiencies as in that of STELCO and FENAKA		

	Solar generation in resorts (kWh/yr)	1) kWh and bednights of five resorts 2) Total bednights per yr in the Statistical Pocket book 2023	Actual generation (kWh)	Solar electricity generation = solar kWh/bednight * total bednights	1) kWh and bednights of five resorts 2) Total bednights per yr in the Statistical Pocket book 2023	Consumption = production	Actual production data (kWh) and capacities and fuel consumption should be regularised through a mandatory energy reporting mechanism, imposed through regulations.	1) Impose regulations for mandatory energy reporting. 2) Data collection should commence in the immediate aftermath.
	Thermal generation in the airport	STO data on diesel supply to MACL	Actual generation of the airport	Estimated the electricity generation based on known efficiencies of generators	Efficiencies of generators were derived from STELCO and FENAKA data	Diesel supplied to the MACL was solely used for power generation.	Actual production data (kWh) and capacity and fuel consumption should be obtained from the MACL.	2025 onwards
	Thermal generation in desalination plants (GWh/yr)	Generation from RO plants	N/A					
	Diesel consumed for power generation in RO plants (kt/yr)	Diesel consumption in RO plants	N/A					
End use								

<b>Industry</b>								
	Electricity consumption (kWh) of RO plants	Electricity production = consumption	1) The list of RO plants may not be complete. 2) Total water purified	Moved ahead with the available data		Electricity production in RO plants = consumption	1) Should obtain the total qty of water purified (m3) 2) Should obtain an average value for electricity consumption/ m3	2025 onwards (data should be captured from 2018 onwards)
<b>Transport</b>								
	Road fleet - vehicles by category (Nos.)	Statistical Pocket Book (data was available up to 2018 - 2020) Motor cars, motor cycles and the total land fleet inclusive of these categories was available from 2010 - 2020	Motor cars for 2020 - 2022, Motor cycles for 2020 - 2022 and Total (other) vehicles for 2020 - 2022	Estimated using past data. MS excel forecast formula was used to estimate The breakdown of the vehicle fleet for the period 2010 - 2012 was obtained from the Supply and Demand Study for Maldives 2012 The proportions of lorries, vans/ buses, jeeps/ pickups and balance was calculated	Data from the Statistical Pocket Book 2023 The breakdown of the vehicle fleet for the period 2010 - 2012 was obtained from the Supply and Demand Study for Maldives 2012	The vehicle breakdown by type followed the pattern in previous years	Actual data on the active fleet is required - Ministry of Transport .	2025 onwards.



				from the 'Other vehicle' totals for 2010 – 2012				
	Breakdown of petrol and diesel vehicles (Nos.)	The breakdown of petrol and diesel vehicles (Nos.) in the Demand and Supply Study 2010 – 2012	Breakdown of petrol and diesel vehicles from 2018 – 2022	1) The breakdown was derived from the Demand and Supply Study 2010 – 2012 2) Values/ proportions were applied to the current vehicle fleet	Demand and Supply Study for Maldives 2010 – 2012	The vehicle breakdown by type followed the pattern in previous years	Actual data on the active fleet is required – Ministry of Transport .	2025 onwards.
	Number of km per day and km per litre	Number of km per day and km per litre in the Demand and Supply Study 2010 – 2013	Number of km per day and km per litre for vehicles from 2018 – 2022	1) These values were derived from the Demand and Supply Study 2010 – 2012 2) Values/ proportions were applied to the current vehicle fleet	Demand and Supply Study for Maldives 2010 – 2012	The vehicle breakdown by type followed the pattern in previous years	Actual data on the active fleet is required – Ministry of Transport	2025 onwards.

	Petrol consumption in land transport (kt)	Petrol vehicle fleet (Nos.), vehicle km by type and litres per km per type	Actual petrol consumption in road transport	Fuel usage (yr) (petrol) = number petrol vehicles (yr) * number of km (yr) / km per litre	Demand and Supply Study for Maldives 2010 - 2012	Petrol is consumed only in transport (water-borne and land)	Actual petrol consumption in land transport - Ministry of Transport	2025 onwards.
	Diesel consumption in land transport (kt)	Diesel vehicle fleet (Nos.), vehicle km by type and litres per km per type	Actual diesel consumption in road transport	Fuel usage (yr) (diesel) = number petrol vehicles (yr) * number of km (yr)/ km per litre	Demand and Supply Study for Maldives 2010 - 2012	Diesel is consumed only in transport, electricity generation and agriculture	Actual diesel consumption in land transport - Ministry of Transport	2025 onwards.
	Petrol consumption in water-borne transport (kt)	Petrol consumption in land transport	Vessel fleet, vessel km by type and litres per km per type	Petrol usage (water) (yr) = imported petrol(yr) - land transport usage (yr)	Demand and Supply Study for Maldives 2010 - 2012	Petrol is consumed only in transport (water-borne and land)	Actual petrol consumption in water-borne transport - Ministry of Transport	2025 onwards.
	Diesel consumption in water-borne transport (kt)	Diesel consumption in land transport, agriculture and power generation		Diesel usage (water) (yr) = imported diesel (yr) - (land transport + electricity + agriculture) usage (yr)	Demand and Supply Study for Maldives 2010 - 2012	Diesel is consumed only in transport, electricity generation and agriculture	Actual diesel consumption in land transport - Ministry of Transport	2025 onwards.
	Aviation gasoline in domestic aviation	MACL records	N/A	Aviation gasoline in domestic aviation = Imported av. gas - av. Gas consumed in foreign aviation	None		Fleet data of air borne vehicles by type, travel km, fuel type by type of vehicle and liters per km per vehicle should be	2025 onwards

							collected - Ministry of Transport	
<b>Household, Commercial and Other</b>								
<b>Agriculture subsector (fisheries)</b>								
	Diesel consumption in the fisheries (kt/yr)	1) Total annual fish catches per yr 2) Fuel usage per fishing trip	Data on fuel consumption and number of fishing trips per	1) The relationship between the two parameters was calculated 2) An average ratio was derived and used to estimate the number of fishing trips from 2018 – 2022 3) Fuel usage (yr) (diesel) = number of fishing trips (yr) * fuel usage per trip (l/trip)	1) Total annual fish catches was obtained from the Statistical Pocket Book 2023 2) Fuel usage per fishing trip was obtained from the Demand and supply study 2010 – 2012	1) The number of fishing trips were proportionate to the fish catch 2) Diesel was the predominant fuel used in fishing vessels 3) Diesel per trip remained the same as in previous studies 4) The usage of LP gas in fishing vessels was not significant 5) Customs records on imported kerosene indicated minimal quantities, therefore, the usage of kerosene in	1) Data should be collected on number of fishing trips annually, if possible 2) In the absence of annual data, number of past fishing trips for at least ten years should be used to derive an average ratio on the number of fishing trips to fish catch 3) Types of fuel and average quantities per trip should be recorded annually	2025 onwards

						fishing vessels was not significant		
<b>Commercial subsector (resorts)</b>								
1	Electricity consumption of resorts (kt/yr)	Electricity generation (estimated in the energy conversion segment)	Actual resort consumption (kWh)	Electricity consumption = electricity generation		All electricity generated in resorts is consumed.		
2	LP gas consumption in resorts (kt/yr)	1) LP gas consumption and benights of 5 resorts 2) Total benights per yr in the Statistical Pocket book 2023	LP gas consumption in resorts	1) Calculate the average LP gas kg/bednight 2) total bednight * Lp gas kg per bednight	1) LP gas and bednights of five resorts 2) Total bednights per yr in the Statistical Pocket book 2023	1) kg/bdnt is representative of all resorts 2) LP gas is used only for cooking	Actual LP gas consumption data should be regularised through a mandatory energy reporting mechanism, imposed through regulations.	1) Impose regulations for mandatory energy reporting. 2) Data collection should commence in the immediate aftermath.
<b>Residential subsector</b>								
	Electricity consumption in the domestic	STELCO and FENAKA	N/A					

	sector (kWh/yr)							
	LP gas consumption in the domestic sector	Total imported LP gas (kt) LP gas consumption in resorts	Residential LP gas consumption	Residential LP gas consumption (kt) = imported LP gas (kt) - Resort LP gas consumption (kt)	Estimated LP g consumption of resorts	LP gas is only used in resorts and other sectors grouped as HH, com & other	Actual LP gas consumption data should be regularised through a mandatory energy reporting mechanism, imposed through regulations.	1) Impose regulations for mandatory energy reporting. 2) Data collection should commence in the immediate aftermath.