

Technical Report
Energy Supply and Demand

Fund for Danish Consultancy Services
Assessment of Least-cost, Sustainable Energy Resources
Maldives

Project INT/99/R11 – 02 MDV 1180

April 2003

Submitted by:

ENERGY NSULTING NETWORK

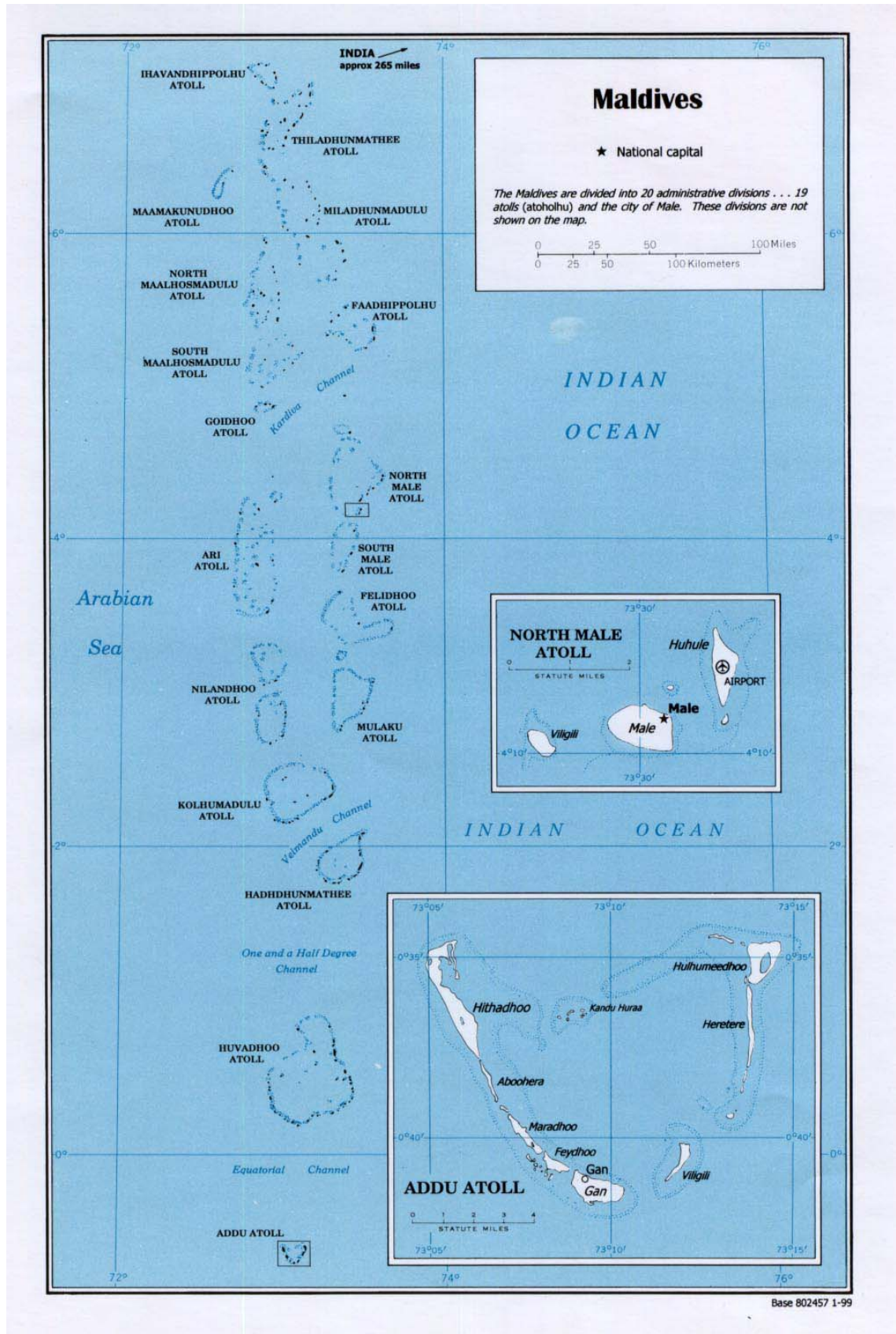
In co-operation with:



GasCon



Map of Location



List of Abbreviations

Abbreviation	Full Meaning
CDM	Clean Development Mechanism
CEN	European Standardisation Body
CHP	Combined Heat and Power
CO2	Carbon Dioxide (one of the so-called "green house gases")
COP	Conference of the Parties to the Framework Convention of Climate Change
DEA	Danish Energy Authority
DK	Denmark
ECN	Energy Consulting Network
elec	Electricity
EU	European Union
EUR	Euro
FCB	Fluidised Bed Combustion
GDP	Gross Domestic Product
GHG	Green house gas (principally CO2)
HFO	Heavy Fuel Oil
IPP	Independent Power Producer
JI	Joint Implementation
Mt	Million ton
Mtoe	Million ton oil equivalents
MCST	Ministry of Communication, Science and Technology
MOAA	Ministry of Atoll Administration
MFT	Ministry of Finance and Treasury
MPND	Ministry of National Planning and Development
NCM	Nordic Council of Ministers
NGO	Non-governmental organization
PIN	Project Identification Note
PPP	Public Private Partnership
PDD	Project Development Document
PSC	Project Steering Committee
QA	Quality Assurance
R&D	Research and Development
RES	Renewable Energy Sources
STO	State Trade Organisation
STELCO	State Electric Company Ltd.
ToR	Terms of Reference
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change
UNOPS	United Nations Office for Projects Services
UNDP	United Nation Development Programme
VAT	Value Added Tax

Units

Given the variety and general in-consequence regarding the use of energy units when referring to energy resources and utilisation of resources found in the available literature, we have chosen to use the following units, which in relation to the physical units are based on the SI-system.

Measure	Unit	Conversion
Energy contents	Joule (J)	1 PJ = 10^{15} J = 0.278 TWh = 0.239 million Geal 1 TWh = 10^9 kWh = 0.860 million Geal = 3.6 PJ 1 PJ = 23,900 tonnes oil equivalent (toe)
Capacity	Watt (W)	
Temperature	Celcius (°C)	
Currency	Euro (EUR or €)	

Prefix

The following prefixes have been used to indicate powers of 10:

Number	Prefix	Abbreviation
10^{15}	Peta	P
10^{12}	Tera	T
10^9	Giga	G
10^6	Mega	M
10^3	Kilo	k

Energy carriers characteristics / Assumptions

Energy carrier	Density (ton/m ³)	Heat value (GJ/ton)	Toe conversion factors (toe/ton)
Diesel oil / gas oil	0.84	42.7	1.035
Petrol/motor gasoline	0.75	43.8	1.070
Jet petrol (JP 1)	0.80	43.5	1.070
Aviation gasoline	0.71	43.8	1.070
Kerosene	0.80	43.5	1.045
LPG	0.54	46.0	1.130

Source: toe conversion factors from IEA, Density and heat value from Danish Energy Balance 2002

Table of Contents

1	INTRODUCTION.....	6
2	WHY SUPPLY AND DEMAND ANALYSES?	7
3	ENERGY BALANCE METHODOLOGY	8
3.1	PRINCIPLE OF BALANCE.....	8
3.2	UNIT OF ENERGY – TONS OIL EQUIVALENT (TOE)	9
4	DATA AVAILABILITY AND SOURCES	10
4.1	CUSTOMS SERVICES	10
4.2	STATE TRADE ORGANISATION	10
4.3	STELCO.....	10
4.4	MINISTRY OF TRANSPORT AND CIVIL AVIATION.....	10
4.5	ADB-STUDY	10
4.6	SURVEY QUESTIONNAIRE	10
4.7	CONCLUSION	11
5	ENERGY BALANCE	12
5.1	RESOURCE	12
5.1.1	<i>Diesel</i>	12
5.1.2	<i>Petrol</i>	13
5.1.3	<i>LPG</i>	13
5.1.4	<i>Kerosene</i>	14
5.1.5	<i>Jet A1</i>	14
5.1.6	<i>Biomass</i>	15
5.1.7	<i>Solar heat</i>	15
5.1.8	<i>Electricity</i>	16
5.1.9	<i>Landfill gas</i>	16
5.2	CONVERSION	17
5.2.1	<i>Diesel to electricity</i>	17
5.2.2	<i>Other</i>	21
5.3	DEMAND.....	22
5.3.1	<i>Household, Manufacturing and Public sector</i>	22
5.3.2	<i>Water supply and desalination</i>	24
5.3.3	<i>Resorts</i>	25
5.3.4	<i>Fishing</i>	25
5.3.5	<i>Travel person/freight related to Islands</i>	26
6	ENERGY BALANCE OVERVIEW	29
7	CONCLUSION AND RECOMMENDATIONS	31
7.1	SOURCES OF INFORMATION	31
7.2	PURPOSE OF ENERGY BALANCE.....	31
7.3	PRIMARY ENERGY CONSUMPTION	31
7.4	CONVERSION	31
7.5	FINAL ENERGY DEMAND	32
7.6	EMISSION.....	32
7.7	RECOMMENDATIONS FOR FUTURE ENERGY BALANCES	32
8	DATA ANNEX.....	33

1 INTRODUCTION

This report is prepared for the Maldivian Ministry of Communication, Science and Technology (MCST) supported by United Nations Office for Projects Service (UNOPS), Nordic Funds, as part of the United Nations Development Programme (UNDP) for Maldives, in an effort to prepare an "Assessment of Least-cost, Sustainable Energy Resources". The report is prepared by Energy Consulting Network, supported by Tech-Wise, Danish Technological Institute, and GasCon.

The project "Assessment of Least-cost, Sustainable Energy Resources" shall contribute to the efforts to exploit the renewable energy potential in the Maldives. The work in the project includes a solar, wind, landfill gas and biomass and biogas resource assessment, and well as an analysis of present situation and prospects and possibilities as regards production and use of renewable energy.

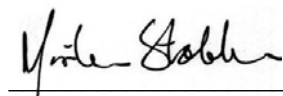
The result of the project will be used in the planning of future energy sector of the Maldives.

The project was started in May 2003, and will run until end 2004.

This report is prepared as a result of energy supply and demand survey, which was conducted in October 2003.

For and on behalf of Energy Consulting Network, we would like to take this opportunity to thank everyone who has provided assistance, information and ideas for the work process involved in producing this report.

Copenhagen 2004-05-04



Morten Stobbe
Project manager



Kaj Leonhart Petersen
Quality assurance

2 WHY SUPPLY AND DEMAND ANALYSES?

The energy sector is a significant factor in relation to the national balance of trade and national economic budget. Furthermore, a steady and secure of supply of energy is a basic need for the development and operation of any nation.

Supply and demand analyses are essential in order to understand the characteristics of the national energy balance and the energy market dynamics.

By establishing realistic and operational supply and demand analyses a national energy balance can be developed. A reliable energy balance is the fundamental requirement for establishing reliable modelling of the potential energy market development, and the effects of any given market intervention.

So, in essence an energy balance is necessary to provide an understanding of the complexity of the energy sector and to assess the social, legal, technological, financial and economic effects of any measure of intervention into the energy sector.

Different types national energy modelling tools have been used for decades in Europe. The use of energy statistics and balances provides for development of powerful energy and national policy assessment tools, such as:

- Modelling and impact analyses in relation to strategy development, and action planning
- Benchmarking (regional, sectoral and technology comparison, international comparison)
- Development of policy indicators (energy intensity, price elasticity, etc)

This present very first attempt to establish an energy balance reveals very clearly that this indeed can be done, and that the overview, which an energy balance provides, can be an “eye-opener”, and hopefully give some additional perspective to the on-going energy political debate.

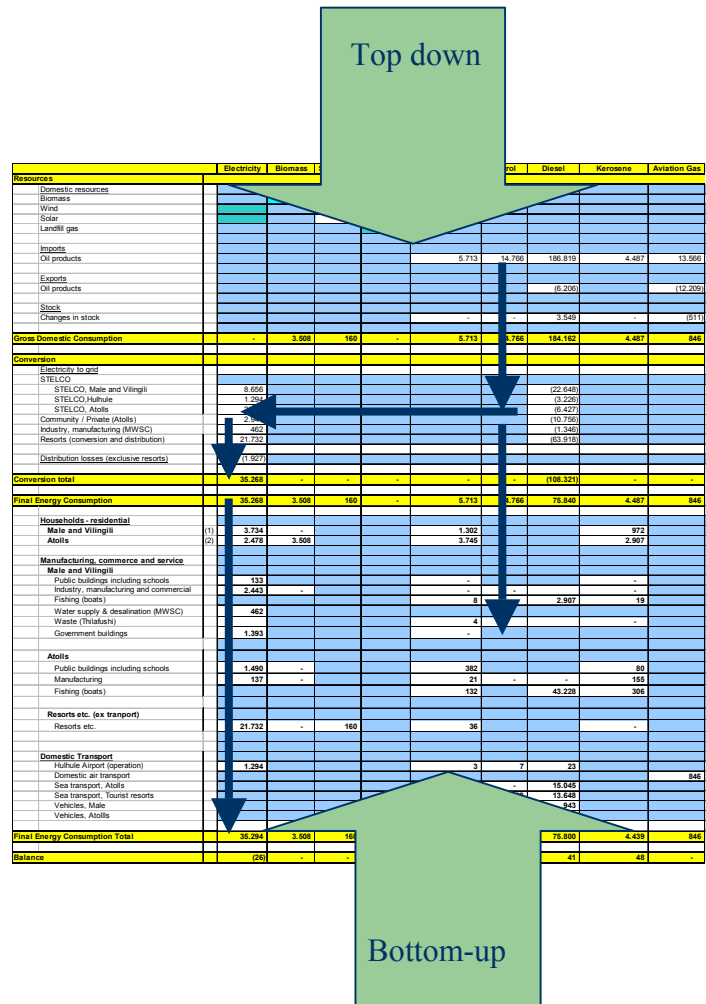
3 ENERGY BALANCE METHODOLOGY

3.1 Principle of balance

An energy balance can assume many forms and shapes, but the most commonly used format and methodology refers to the model set-up, which is used by e.g. IEA and OECD.

The basic principle is that the balance is divided into three parts:

1. Primary energy - imported and indigenous energy in its raw forms)
2. Conversion of primary energy into electricity (and thermal energy)
3. Final energy demand at the point of end use.



It is, in principle, possible to follow the energy flow through the balance, from import/inland resource over conversion to distribution among types of end-users (illustrated by arrows on the figure).

The calculation and development of the figures is an interlinked exercise, as the balance is 0 at the bottom. It is only possible to spend the energy that has entered the system. The interlink is both on the vertical and horizontal level. This means that changes in place has effects in other places – if you spend more one place you have to spend less in other places.

To make sure that there is consistency in the figures, most analyses and data are checked with both top-down (if official data exist) and cross checked with bottom-up analyses.

3.2 Unit of energy – tons oil equivalent (toe)

It is impossible to “add apples and pears”, so therefore we re-calculate into one common unit of measure, which is “ton oil equivalent”, or toe. One toe is the same energy unit as a ton of standard crude oil, and is defined as 11,630 kWh.

All energy forms in the balance is re-calculated into this format. This ensures:

- National comparability between energy carriers, fuels, and energy types
- International comparison and benchmarking

The basic characteristics and toe conversion factors are shown in the table below.

Energy carrier	Density (ton/m ³)	Heat value (GJ/ton)	Toe conversion factors (toe/ton)
Diesel oil / gas oil	0.84	42.7	1.035
Petrol/motor gasoline	0.75	43.8	1.070
Jet petrol (JP 1)	0.80	43.5	1.070
Aviation gasoline	0.71	43.8	1.070
Kerosene	0.80	43.5	1.045
LPG	0.54	46.0	1.130

4 DATA AVAILABILITY AND SOURCES

4.1 Customs Services

The Maldives Customs Service (MCS) has accurate and comprehensive data on imports of fossil fuels (oil, LPG, kerosene, petrol, aviation gas and aviation jet kerosene, etc.).

The data has been available in electronic form (excel spreadsheet) on an annual basis, but can be broken down into monthly data.

4.2 State Trade Organisation

The State Trade Organisation (STO) has information on bunkering and stock levels of oil, LPG and other oil products.

4.3 STELCO

The State Electricity Company (STELCO) has over the years developed quite elaborate and informative statistics covering the islands that they supply with power.

4.4 Ministry of Transport and Civil Aviation

The Ministry of Transportation and Civil Aviation (MTCA) has been most helpful with the available information regarding the transport sector. Full-scale transport studies have not yet been conducted, and a master plan for the transport sector is under development. Therefore, the actual level of available details has been scarce.

4.5 ADB-study

The ADB-report on electricity supply, distribution and demand has provided important insights. A lot of changes in the electricity demand have taken place since 1999 and it seems, therefore, necessary to update the information, as the electricity demand and supply situation seems to be changing rapidly.

4.6 Survey questionnaire

In order to acquire a first hand impression of the energy demand pattern, in particular relating to the non-electrical demand in the islands it has been necessary to establish an energy survey.

In September 2003 a comprehensive questionnaire was designed in co-operation with the Ministry of Communication, Science and Technology (MCST). This was sent out to all inhabited islands in the Maldives, asking about end-use of energy, and available biomass resources. In total 72 islands out of 204 inhabited islands have reported back on the questionnaire. The material, which has been received back from the islands represents approximately 82,000 inhabitants out of a total of 201,000 inhabitants in the Islands (not including Male and resorts), or 41%.

An additional survey questionnaire was sent out to 10 selected resort islands (out of a total of 90-100 resort islands).

Male has not been included in the questionnaire, as this area is covered by the official statistics and other previously developed survey and reports.

4.7 Conclusion

There are some good and solid sources of information, which are able to provide reliable data. In order to accommodate the collection of the necessary information required to establish an annual energy balance some initiatives are necessary. This include:

- Establish regular collection/reporting routines of standardised information from all islands
- Establish regular collection/reporting routines of standardised information from all resorts
- Establish regular reporting of statistics from MCS, STO, MTCA, etc.
- Establish a permanent working group in the MCST to review, analyse and adapt information and prepare energy balance.

5 ENERGY BALANCE

5.1 Resource

In relation to the data on the resources (primary fuel) used in the Maldives, these data has mainly been obtained from official sources (MCS and STO). This suggests a certain solidity and reliability in the national energy balance as the “input” part of the balance to the Maldives thus is relatively well documented.

5.1.1 Diesel

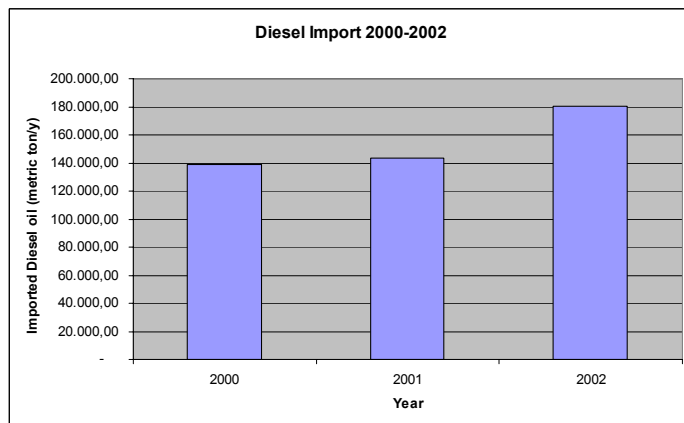
Diesel is the main imported energy carrier. Imports are dominated by State Trade Organisation (STO), which imports 60-70%. Three smaller importers do the rest of the imports.

Maldives Customs Service registers the import, and reliable data can be obtained from their office. The total diesel imported to the Maldives has increased significantly in 2002 compared to the years before.

The import in 2002 is 180,501 metric tonnes, equivalent to 186,819 toe.

In addition to the import the balance consist of net storage of diesel oil, and bunkering.

According to STO the stock level was:



Fuel stock changes		2002	2003	Change	Density	Mass	Conversion	Net stored	
		01-jan-02	01-jan-03		t/m3	t	toe/unit	toe	
Diesel	liters	14.065.421,00	10.378.284,00	(3.687.137,00)	0,84	(3.097,20)	1,035	(3.205,60)	
	STO	liters	7.018.047,62	9.189.119,05	2.171.071,43	0,84	1.823,70	1,035	1.887,53
	Maldives Airport Co.	liters	359.610,00	216.600,00	(143.010,00)	0,84	(120,13)	1,035	(124,33)
	Others ??	liters	6.687.763,38	972.564,95	(5.715.198,43)	0,84	(4.800,77)	1,035	(4.968,79)

The bunkering was:

Bunkring - diesel		Sold to vessels	Density	Mass	Conversion	Net stored
		liters diesel	t/m3	t	toe/unit	toe
STO	Number of vessels catered	9645952	0,93	8971	1,035	9285
Fuel Supplies Maldives	Number of vessels catered	3447720	0,93	3206	1,035	3319
	Average bunkring, toe				15,6	206
Hakata	Number of vessels catered	2000000	0,93	1860	1,035	1925
	Average bunkring, toe				9,0	206
Villa	Number of vessels catered	1000000	0,93	930	1,035	963
	Average bunkring, toe				4,5	206
Total				5996		6206

Bunkering of diesel oil constitutes 6,206 toe.

The net use of diesel oil in 2002 can be calculated as the imports adjusted for the changes in stock and bunkering:

	<i>Diesel oil toe</i>
Import	186,819
- Net stored	3,206
- Bunkered	- 6,206
Gross domestic consumption	183,818

5.1.2 Petrol

Petrol is the second largest imported energy carrier. The Maldives Customs Service registers the import, and reliable data can be obtained from their office.

The import in 2002 is 13,800 metric tonnes, equivalent to 14,766 toe. In addition to the import the balance consist of net storage of petrol. According to STO, and other petrol importers, the stock level was:

<i>Stock Level</i>	<i>Petrol Litres</i>	<i>Petrol toe</i>
1 January 2002	1,294,530	
1 January 2003	2,173,097	
Net stored	878,557	705

The net use of diesel oil in 2002 can be calculated as the imports adjusted for the changes in stock.

	<i>Petrol toe</i>
Import	14,766
- Net stored	-705
Gross domestic consumption	14,701

5.1.3 LPG

The Maldives Customs Service registers the import, and reliable data can be obtained from their office. LPG is bottled in the Maldives. The import in 2002 is 5,056 metric tonnes, equivalent to 5,713 toe.

In addition to the import the balance consist of net storage of LPG. According to STO, the stock level was:

<i>Stock Level</i>	<i>LPG Litres</i>	<i>LPG toe</i>
1 January 2002	1,338,889	
1 January 2003	577,778	
Net stored	- 761,111	464

The net use of LPG in 2002 can be calculated as the imports adjusted for the changes in stock.

	<i>LPG</i> <i>toe</i>
Import	4,630
- Net stored	464
Gross domestic consumption	5,094

5.1.4 Kerosene

The Maldives Customs Service registers the import of “kerosene” and “lamp oil”, and reliable data can be obtained from their office. Lamp oil is included in the kerosene figure as the two products are quite similar. Lamp oil import is 177,739 litres in 2003, and the import of kerosene is 4,152 metric tonnes. Adding the two together, the equivalent energy content is 4,487 toe.

In addition to the import the balance consist of net storage of kerosene. According to STO, and other kerosene importers, the stock level was:

<i>Stock Level</i>	<i>Kerosene</i> <i>Litres</i>	<i>Kerosene</i> <i>toe</i>
1 January 2002	501,788	
1 January 2003	761,188	
Net stored	-259,400	-217

The net use of kerosene in 2002 can be calculated as the imports adjusted for the changes in stock.

	<i>Kerosene</i> <i>toe</i>
Import	4,487
- Net stored	- 217
Gross domestic consumption	4,270

5.1.5 Jet A1

The Maldives Customs Service registers the import of Jet A1 as “aviation gas” and “kerosene”, and reliable data can be obtained from their office. Additional data on stock levels is obtained from Maldives Airport Company.

The import cleared through customs for domestic flights in 2002 is 12,678 metric tonnes, equivalent to 13,566 toe. In addition to the import the balance consist of net storage of aviation gas. According to STO, and other kerosene importers, the stock level was:

<i>Stock Level</i>	<i>Aviation gas</i> <i>m3</i>	<i>Aviation gas</i> <i>toe</i>
1 January 2002	6,915	
1 January 2003	8,784	
Net stored	1,870	1,601

The net use of aviation gas in 2002 can be calculated as the imports adjusted for the changes in stock.

	<i>Aviation toe</i>
Import	13,566
- Net stored	1,601
Gross domestic consumption	11,965

5.1.6 Biomass

In September 2003 a comprehensive questionnaire was sent out to all inhabited islands in the Maldives, asking about use of energy, and available biomass resources. Additionally, the Consultant made a series of site visits to 7 small communities on seven different islands in October 2003.

Please also refer to “Technical Report - Biomass Survey”, Assessment of Least-cost, Sustainable Energy Resources, Maldives (Project INT/03/R11 – 02 MDV 1180) for more details on the biomass potential and utilisation.

Potential for use	Potential toe/year	Used toe/year	Potential for use toe/year
<u>Inhabited Islands</u>			
Solid agro waste	7,964	4,626	3,337
Animal waste	-	-	-
Household waste	588	-	588
Landfill gas	-	-	-
<u>Male Villingili</u>			
Solid agro waste	517	-	517
Organic waste	3,760	-	3,760
Landfill gas	900	-	900
<u>Un-inhabited islands</u>			
Solid agro waste	5,556	-	5,556
Organic waste	-	-	-
Total without uninhabited islands	~ 19,500	4,626	~ 14,900

The use of biomass on the Maldives differs very much from island to island, but generally fuel wood is the main consumer of biomass for energy; fuel for cooking and for smoking of fish.

In many cases the coconut fibres have been reported used for rope, some traditional houses with roof and walls made from palm leaves are still seen in some remote communities.

5.1.7 Solar heat

In relation to the present use of solar heating, this technology it is primarily used in resorts for heating of water. Based on the questionnaire survey sent out to selected resorts a qualified estimation is made, based on the following assumptions.

Assumptions

Number of resorts		87
Bed capacity		16,400
of which with solar hot water		50%
of which with solar hot water		8,200
Bed Capacity Utilization Rate (%) (2002)		68.9%
Total number of bednights		4,066,000
Number of solar m ² per bed		0.5
Number of m ² solar collector in use		2,825
Average daily heat produced by solar, per bed		0.9 kWh
Average yearly production by solar, per bed		329 kWh
Solar heat utilised /year		1,856 MWh
Solar heat utilised /year		160 toe
Volume of water heated	22 C, /day/ bed	35.1 Liter
Estimated demand for hot water per bed night		60.0 Liter
Volume of water heated per year		72,310 m ³
Yearly demand for hot water		243,960 m ³
Covered by solar heating		30%

The use of solar heating in 2002 expresses the net utilised energy on the user side, i.e. in the showers.

	<i>Solar heat toe</i>
Gross domestic consumption	160

5.1.8 Electricity

On the resource side the only electricity aspect could be wind or PV based production of electricity, which at the moment is not performed on any scale of significance.

The only primary production of electricity is conducted by the telecommunication company Dhiraagu, which have some PV panels in use to supply their masts with power for stand-alone operation in remote locations.

5.1.9 Landfill gas

Landfill gas is not extracted. The first demonstration has been established at the landfill location serving Male and Villingili.

5.2 Conversion

The by far most significant energy conversion is the process of converting oil products to electricity. In future, there might also be potential for conversion between landfill gas and electricity.

Some of the conversion factors, especially those related to STELCO (diesel to electricity in STELCO operated areas), are well documented. However, the part covering the islands outside STELCO, and the resorts are more difficult to assess. These areas are covered by the surveys, and the results from these surveys, have been extrapolated to national scale.

5.2.1 Diesel to electricity

All the electricity production is based on diesel generators. The electricity production is decentralised, and based on production units of various size.

STELCO supplied area

The State owned electricity company STELCO provides a little more than 1/3 of the electricity produced in the Maldives. STELCO serves Male/Vilingili/Hulhule plus additional networks on other 21 locations in the Islands (22-24 islands). STELCO has good quality data material providing details on each of their networks regarding production of electricity, and consumption of diesel.

Production

Electricity production data is provided in the data annex. From the annex it seems evident that the production is almost constant over the year (from month to month). Production for Male/Vilingili/Hulhule islands represents approximately 82% of the total STELCO production of 140,849 MWh in 2002.

The use of diesel oil for electricity production is available from official statistics (see also data annex). Combining this information with the production data, and the electricity utilisation data, it is possible to analyse and calculate the conversion efficiency for all STELCO served area, and the distribution loss for Male specifically. The conversion efficiency varies between 25-40%, depending on the size, and operation of the installation.

Distribution

Distribution loss Male:	11%
Distribution loss on Vilingili:	Same as Male (11%)
Distribution loss on Hulhule:	Less than Male (5%)
Distribution loss remaining STELCO area:	13%

The distribution loss assumed to be 13% in the islands served by STELCO is estimated on basis of data from 8 sample islands and Male analysed in the "Preparing for Outer Island Electrification Project", 2000 ADB.

Private/Community supplied area

The remaining inhabited islands are served by private and/or community owned electricity producers.

Data material from these islands is difficult to obtain, and the consumption has been analysed and estimated based on the following methodology:

- Sample island analysis => electricity sales => specific electricity sales (kWh/capita) => extrapolation to all atoll islands (outside STELCO) => re-calculation via distribution and loss => electricity production => re-calculation via conversion loss => diesel oil requirement

Sample island analysis

Sample islands (outside Stelco area)	Electricity sales 1999 (from ADB study) (kWh/year)	Electricity sales 2002 (from UNDP study) (kWh/year)
Nolhivaramu	53,172	54,540
Neykurendhoo	24,336	53,698
Vaikaradhoo	119,652	217,518
Funadhoo	70,836	234,591
Mulah	157,416	286,170
Muli	219,564	326,000
Total	646,975	1,172,518

The amount of inhabitants on the 6 islands in 2002 was 6,685, which provides an average specific electricity demand per capita of 175 kWh/cap/year

Distribution

On the basis of the analysis in the “Preparing for Outer Island Electrification Project”, 2000 ADB, we have assumed the distribution loss to be 24%.

Production

By extrapolating the specific electricity demand to all non-Stelco supplied islands using the amount of inhabitants, and compensating for the distribution loss, the total electricity production can be calculated.

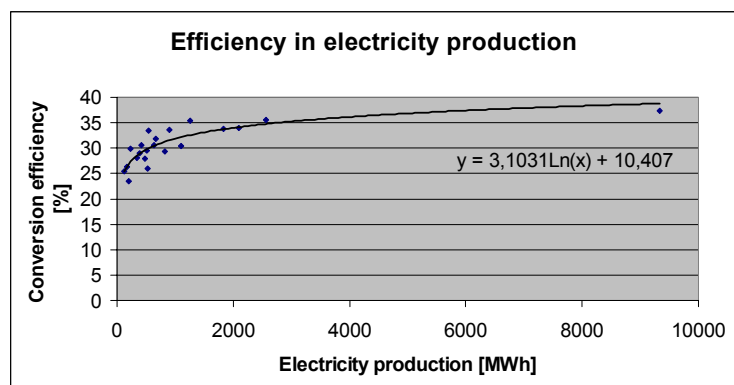
As the conversion efficiency of the diesel gen-set varies with the size of the production installation and the general maintenance level, this has been analysed and incorporated into the survey.

Based on the known conversion efficiency of a number of production units in the Maldives it has been

possible to establish a satisfactory relation between the expected production efficiency based on the total production of an installation. The assumption that the efficiency is relative to the total electricity production is reasonable from the following point of view:

- An increasing production requires a larger production unit which increase efficiency
- An increasing production requires that the existing unit run for more hours which increase efficiency

The conversion efficiency (y) has been modelled based on the analysis to be $y = 3.1031\ln(x) + 10.407$, where (x) is the electricity production, and the minimum efficiency is set at 25%.



This methodology provides a reasonable result, which can compensate for the difference in size of installations.

The table below indicate the methodology used.

<i>Atoll islands (outside Stelco supply area)</i>	<i>Population 2002</i>	<i>Specific electricity utilisation</i>	<i>Total electricity utilisation</i>	<i>Electricity distribution loss</i>	<i>Total electricity production</i>	<i>Fuel conversion efficiency</i>	<i>Oil input</i>	<i>Oil input</i>
	<i>Both sexes</i>	<i>kWh/cap/y</i>	<i>kWh/y</i>	<i>%</i>	<i>kWh/y</i>	<i>%</i>	<i>kWh/y</i>	<i>toe/y</i>
Berinmadhoo	127	175	22,361	24%	29,423	25%	117,690	10
Hathifushi	154	175	27,050	24%	35,592	25%	142,367	12
Mulhadhoo	271	175	47,608	24%	62,642	25%	250,566	22
Ihavandhoo	2,120	175	371,844	24%	489,269	30%	1,651,583	142
Kelaa	1,230	175	215,677	24%	283,785	28%	1,015,914	87
Vashafaru	614	175	107,658	24%	141,655	26%	549,523	47
Filladhoo	678	175	118,839	24%	156,367	26%	599,462	52
Maarandhoo	535	175	93,773	24%	123,385	25%	486,737	42
Thakandhoo	521	175	91,428	24%	120,300	25%	476,044	41
Utheemu	600	175	105,314	24%	138,571	26%	538,985	46
etc...								
etc..								
Total (for all islands)					34,238,536			10,756

The main result for the islands supplied from community/privately owned production units can be summarised as:

<i>Oil / Electricity</i>	<i>Total toe</i>
Total oil consumption	10,756
Electricity production	2,944

Resorts

All tourist resort islands have their own private electricity production. Detailed data covering all of these islands has not been available. A data questionnaire has been issued to produce a reliable basis for analysis of the resort consumption. There were in total 87 resorts registered in 2002 in the Maldives.

Production

Based on an analysis of the replies, it can be established that the average use of diesel for electricity production is 3,807.5 kg/bed.

Using “bed” as the unit of scaling instead of “bednight” is based on the fact that by far the main part of the electricity demand is constant, as the A/C system and water pumps are in operation in all rooms/guest facilities regardless if there is guests or not.

<i>Oil / Electricity</i>	<i>Unit</i>	<i>Comments</i>	<i>Total</i>
Oil consumption for electricity	kg/bed		3,807.5
Total beds	beds	In 2002	16,400
Total oil consumption	toe		63,918 toe
Electricity production	toe	Conversion efficiency 34%	21,732 toe

The average conversion efficiency of 34% is based on information from selected resorts, and site visit experience with the level of maintenance and operation of the diesel gensets.

Distribution

Because of the special nature of the end-use, the distribution loss is perceived as included in the end-use.

Industrial

The desalination company (Maldives Sewage and Water Company) serving in Male and Vilingili have their own electricity production, which is utilised for desalination. All data from this production has been made available.

	<i>Male</i>	<i>Vilingili</i>	<i>Total</i>
Yearly diesel consumption	1,255 toe	90 toe	1,346 toe
Yearly electricity production and end-use			462 toe

Source: MWSC

Additionally, there is some industrial activity in connection to freezing/cooling storage facilities for fish. There is in total three installations, and one, which additionally produces, canned fish. The demand for diesel oil for electricity and steam production at the three industrial plants is provided by MifCo.

		<i>Fish canning</i>	<i>Freezing plant</i>	<i>Freezing plant</i>	<i>Total</i>
Diesel consumption per day	ton/day	7.5	4.5	4.5	16.5
Days of production per year	365				
Diesel consumption per year	ton/year	2,738	1,643	1,643	6,023
Annual diesel consumption	toe/year	2,833	1,700	1,700	6,233
Efficiency in electricity production		28%	28%	28%	
Electricity production	toe/year	793	476	476	1,745
Efficiency in steam production		50%			
Steam use	toe/year	1,417			1,417

Overview

The table below provides an overview of the produced electricity, steam and use of diesel use.

	<i>Electricity production toe</i>	<i>Steam production toe</i>	<i>Diesel toe</i>
Electricity to grid			
STELCO			
STELCO, Male and Vilingili	8.656		22.648
STELCO, Hulhule	1.294		3.226
STELCO, Islands	2.107		6.427
Community / Private (Islands)	2.944		10.756
Industry, manufacturing (MWSC)	462		1.346
Industry, cold stores and canning	1,745	1,417	6,233
Resorts	21,732		63,918
Distribution losses (excl resorts)	- 1,927		
Total electricity demand	37,013		114,555

1

5.2.2 Other

No other forms of conversion of energy have been identified.

5.3 Demand

In the following the energy demand is analysed and described.

5.3.1 Household, Manufacturing and Public sector

The break down on households for Male and Vilingili can be established from combining the information regarding electricity production, distribution losses (from STELCO), and population with information on from the 2000 census on electrical appliances and utilisation in the household sector.

The break down on public and manufacturing for Male and Vilingili can be established from combining the information regarding electricity production, distribution losses (from STELCO), and population with information from the official 2002 statistics on electrical utilisation.

Looking at electricity alone there are significant differences in the consumption pattern between Male and Islands (approximately a factor 5). The difference between the Stelco supplied areas and the private/community-supplied areas is ascribed to the more developed and stable supply in Stelco's areas. A stable supply provides for larger consumption.

Area	Specific electricity demand kWh/capita/year
Male & Villingili	1,131
Islands (average)	234
- Stelco production areas	333
- Private/community owned production areas	175

The specific energy demand per capita (kWh/capita) is seen below for Male & Vilingili and for Islands, the total energy demand per capita being close to 90% higher in Male & Vilingili than in the Islands or 60% higher when not including the consumption of the Government Buildings.

If looking solely at the consumption in households the consumption per capita is 33% higher for Male & Vilingili than for Atolls.

Male&Vilingili	Population: 79191			
kWh/capita	Electricity	Biomass	LPG	Kerosene
Households	548,4	0,0	136,7	129,5
Lightning	132,1			0,1
Appliances & AC	414,6			0
Cooking and smoking	1,7	0,0	136,7	129,4
Public	19,5	0	0	0
Lightning	0			0
Appliances & AC	0			0
Manufacturing&commerce	358,8			
Government buildings	204,5	0	0	0
Total	1131,2	0,0	136,7	129,5

The breakdown regarding electricity, biomass, LPG and kerosene on households, public and manufacturing & commerce for the Islands is based on a demand survey, which was issued during September-October 2003, and sent to all inhabited islands. From the response it has been possible to establish a realistic distribution of the energy consumption between the different types of end-use.

Atolls		Population: 201559			
kWh/capita	Electricity	Biomass	LPG	Kerosene	
Households	139,8	168,8	205,2	162,6	
Lightning	64,6			13,6	
Appliances & AC	63,4			0	
Cooking and smoking	9,6	168,8	205,2	149,0	
Others	2,3		0		
Public	86,0	0,0	22,0	4,6	
Lightning	52,2			0	
Appliances & AC	33,7			3,6	
Cooking and smoking	0,0	0,0	22	1,1	
Others	0,0		0	0	
Manufacturing&commerce	7,9	0,0	1,2	8,9	
Lightning	4,0			5,4	
Appliances & AC	3,9			3,6	
Cooking and smoking	0,0		1,2	0	
Others	0,0		0	0	
Total	233,7	168,8	228,4	176,1	

However, some additional investigations and analysis regarding the use of energy for cooking and smoking has been made to supplement the available material.

Cooking

From the 'Population and housing Census, 2000' a lot of useful information has been found. Never the less it has been encountered that some changes in the consumption fuels have taken place since 2000. Wood is used much less for cooking than in 2000 and the use of wood in Male has totally vanished.

The analysis is based on MPND, Population and Housing Census 2000, table H-17: "Households classified by type of living quarters and fuel used for cooking" containing data for the year 2000.

The use of type of fuel for cooking is undergoing changes. The main structural change is a reduction in use of fuel wood and biomass and an increase in use of LPG and electricity see also (Shaheed 2001 RETDAP).

The distribution of fuels has been changed to reflect the expected situation in 2002. As a guide to the magnitude of change, the result of the Biomass Survey, including the survey questionnaire as well as the imports figures of LPG has been used.

Assumptions:

The assumptions made include:

- Utilised energy for cooking (supplied to the pan/pot/oven) is 3.50¹ kWh/day/household
- Efficiency in utilisation of fuels

¹ This is equivalent of 2 average cooking places (each 575 W) used for approx. 3 hours/day.

<i>Fuel</i>	<i>Efficiency²</i>
Firewood	20%
Kerosene oil	50%
LPG	50%
Electricity	95%
Other (not defined – probably biomass)	20%

Changes in use of fuel type

Based on the biomass survey the consumption for 72 out of 202 inhabited islands (representing 82,046 out of the total Atoll population of 201,559) can be established. It is assumed that Male and neighbouring islands does not use fuel wood/biomass.

To establish the consumption for all Maldives an extrapolation has been made. Thus the total consumption of biomass for cooking and smoking is 34,000 MWh/year.

Based on this level of biomass use, and the assumed specific energy use for cooking (3.5 kWh/cap/day) it can be deducted that 13,500 households (out of total 18,887 households) has stopped using biomass for cooking, and is instead using kerosene oil, LPG or electricity.

Moreover, investigations have shown several islands have converted almost totally to electricity for cooking purposes during a very short period (12-24 months). Based on this it is assumed that in total 1,400 households has converted to electricity.

5.3.2 Water supply and desalination

The energy consumption related to water supply and desalination includes the public installations providing water and desalination for Male and Vilingli, serviced by Male Water and Sewage Company (MWSC).

The electricity for the system is produced at diesel gen-sets at the MWSC premises.

	<i>Unit</i>	<i>Male</i>	<i>Vilingli</i>	<i>Total</i>
Water production per day	m ³	4,000	120	4,120
Specific Energy Consumption	kWh/m ³	3.5	6.0	
Daily Consumption	kWh	14,000	720	14,720
Yearly electricity consumption	MWh	5,110	263	5,373
Efficiency in electricity production		0.35	0.25	
Diesel consumption	Litre/year	14,600	1,051	15,651
Yearly diesel consumption	toe	1,255	90	1,346
Yearly electricity production and end-use	toe			462

Source: MWSC

There are also some desalination installations on the resorts, but these have been included in the end-use analysis for resorts.

² ESMAP, Guinea, Household Energy Strategy, Report no 163/94, World Bank 1994

5.3.3 Resorts

As the consumption of energy is significant in the tourist resorts, a specific investigation is prepared for this area. There were in total 87 resorts registered in 2002 in the Maldives.

There is no official information available on the energy consumption in the resorts, and therefore a survey covering a selection of 10 resorts has been conducted during October-December 2003, to establish the level of use of energy resources and consumption pattern.

Based on an analysis of the replies, the following assumptions can be established:

- Use of diesel for electricity production: 3,807.5 kg/bed
- Use of fuel for transportation is dealt with elsewhere.
- Use of LPG for cooking: 0.0078 kg/bed night

Using “bed” as the unit of scaling instead of “bednight” is based on the fact that by far the main part of the electricity demand is constant, as the A/C system and water pumps are in operation in all rooms/guest facilities regardless if there is guests or not.

<i>Oil / Electricity</i>	<i>Unit</i>	<i>Comments</i>	<i>Total</i>
Oil consumption for electricity	kg/bed		3,807.5
Total beds 2002	beds	In 2002	16,400
Total oil consumption	toe		63,918 toe
Electricity production	toe	Conversion efficiency 34%	21,732 toe

The use of LPG for cooking is, on the contrary, related to the amount of meals and therefore to the actual tourist bed nights.

<i>LPG</i>	<i>Unit</i>	<i>Comments</i>	<i>Total</i>
LPG consumption for cooking	kg/bed-night		0.0078
Total bed-nights 2002	bed-night	In 2002	4,066,000
Total LPG consumption	toe		36 toe

5.3.4 Fishing

The analysis of the energy consumption for fishing is based on Statistical yearbook, Table 8.8 : “Fish Catch, Fishing Trips and Catch per Unit Effort by Locality, 2001”. This provides the amount of fishing trips per boat type.

The following assumptions are made:

<i>Engine</i>	<i>Oil consumption</i>	<i>Operation</i>		<i>Total</i>	<i>Distribution of vessels</i>	<i>Total diesel oil</i>
		<i>Hour/day</i>	<i>Days/year</i>			
<i>hp</i>	<i>Litre/hour</i>			<i>Litre/year</i>		
400	80	10	200	160,000	55	8,816,000
240	52	10	150	78,000	249	19,426,056
140	27	9	150	36,450	798	29,081,560
40	12	10	150	18,000	59	1,062,000
Total					1,161	58,385,616

FISHERIES AND AGRICULTURE		2002
Average Number of Vessels Engaged in Fishing (per month)		1,161
	Mechanised Masdhoni	1,102
	Mechanised Vadhu	59
Total Number of Dhonis		
	Mechanised	1.647
	Bond Completed	1.593

	Total liter	toe
Male'	7,909,657	6,877
Atolls	50,475,959	43,884
Total	58,385,616	50,760

5.3.5 Travel person/freight related to Islands

The analysis of the energy consumption for travel and freight transport to and from Islands, and inside Islands is based on the Statistical yearbook, Table 1.5: "Area and Distance to Male' and Atoll Capitals, by Locality, 2001 – 2002".

The following assumptions are made:

- Travel from island to Male: 1 return trip every 2nd week in dhoni
- Travel from Atoll capital to Male: 1,5 return trip per week in small ferry

	Travel km/year	Boat type	Engine hp	Fuel consumption liter/km	Total Liter
Travel islands/Male	2,038,192	Dhoni	150	1.7	3,464,926
Travel Atolls cap/Male	760,240	Smal ferry	1,000	9.1	6,892,843
Total	2,798,432				10,357,769
Total				toe	9,005

Travel person/freight related to/from Resorts

The analysis of the energy consumption for travel and freight transport to and from tourist resorts, based on the Statistical yearbook, Table 10.3: "Bed Capacity of Tourist Resorts and the Distance from the Airport, 1999 – 2002"

The following assumptions are made:

- If the distance between Male/airport and resort is more than 80 km, the passenger transport is primarily airborne and is accounted for elsewhere in the energy balance. However, a high speed ferry trip is included (average 1 trip per week) for the distant resorts.
- The analysis distinguishes between two type of boat travel: collection of passengers, and regular trips. The regular trips include small freight jobs, staff transport, etc.
- It is furthermore assumed that all collection and transfer of passenger is made in speedboats (type Gulfcraft engine 2x200 HP), and that all regular trips is made in lauches (or dhoni type of vessel).

- If the distance between Male/airport is less than 80 km, the passenger collection and regular trips are carried out according to the following assumptions regarding the amount of trips per day:

	<i>Far from Male > 25 km Trips per day</i>	<i>Close to Male < 25 km Trips per day</i>
Collecting passengers		
Large resort > 150 beds	3	3
Small resort < 150 beds	2	2
Regular trips		
Large resort	1	3
Small resort	0 (note 1)	3

Note 1: it is assumed that a small resort far from Male would include all the necessary freight, staff transport etc. in the trips made to collect/deliver passengers/tourists.

Vessel type	Engine	Speed km/h	Fuel l/km	Total	toe
Launch	145 hp inboard	16	1.7 Diesel	9,641,577	8,382
Speedboat Gulfcraft	2 x 200 hp outboard	65	8.5 Petrol	10,686,872	8,576
High speed ferry (100-150pers)	4000 hp in board	65	40.0 Diesel	241,760	217

Vehicles

The analysis of the energy consumption for land transport in vehicles is based on the Statistical yearbook, Table 11.3: “Registered and Newly Registered Vehicles According to Type, 2000 – 2002”, and information directly from the Ministry of Transport.

In the table below the assumptions made regarding the distribution between petrol and diesel fuel is made (based on input from Ministry of Transport), and the average distance and fuel economy.

Type of vehicles	Petrol	Diesel	Avg.	Mileage (km/year)	Fuel economy petrol (km/l)	Fuel economy diesel (km/l)
			Distance (km/day)			
Motor Car	100%	0%	15.00	5,475	12.0	14.0
Motor Cycle/Auto Cycle	100%	0%	15.00	5,475	20.0	25.0
Lorries/Trucks/Tractors	98%	2%	40.00	14,600	5.0	8.0
Van/Bus	28%	72%	30.00	10,950	5.0	8.0
Jeep/Pickup	25%	75%	10.00	3,650	7.0	10.0
Taxi (running in Male')	100%	0%	80.00	29,200	12.0	14.0
Other Vehicles	90%	10%	5.00	1,825	6.0	8.0

This leads to the calculation of the total fuel consumption, based on the amount of registered vehicles, and assuming a distribution between Male and Islands as indicated below:

<i>Type of vehicles</i>	<i>Regi-stered in 2002</i>	<i>Male</i>	<i>Islands</i>	<i>Male diesel (l/year)</i>	<i>Islands Diesel (l/year)</i>	<i>Male petrol (l/year)</i>	<i>Islands petrol (l/year)</i>
Motor Car	1,948	100%	0%	3,475	-	884,721	-
Motor Cycle/Auto Cycle	14,248	95%	5%	-	-	3,705,371	195,020
Lorries/Trucks/Tractors	707	99%	1%	22,410	226	2,007,940	20,282
Van/Bus	613	99%	1%	600,679	6,067	367,959	6,067
Jeep/Landrover/Pickup	1,243	100%	0%	340,271	-	162,034	-
Taxis(running in Male')	567	100%	0%	-	-	1,379,700	-
Other Vehicles	588	99%	1%	13,280	134	159,355	1,610
Total	19,914			980,115	6,428	8,667,079	222,979

6 ENERGY BALANCE OVERVIEW

The table below provides an overview of the energy balance of the Maldives for the year 2002.

Maldives Energy Balance 2002 (Unit: toe)

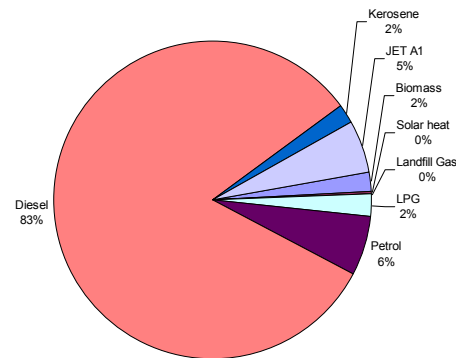
Resources	Electricity	Steam	Biomass	Solar heat	Landfill Gas	LPG	Petrol	Diesel	Kerosene	JET A1	Total
Resources											
Domestic resources											
Biomass			4.626								4.626
Wind											-
Solar				160							160
Landfill gas											-
Imports											
Oil products						4.630	14.742	186.819	4.487	13.566	224.243
Exports											
Oil products								(6.206)		-	(6.206)
Stock											
Changes in stock						464	(705)	3.206	(217)	(1.601)	1.148
Gross Domestic Consumption	-		4.626	160	-	5.094	14.037	183.818	4.270	11.965	223.970
Conversion											
Electricity to grid											
STELCO											-
STELCO, Male and Vilingili	8.656							(22.648)			(13.993)
STELCO, Hulhule airport	1.294							(3.226)			(1.932)
STELCO, Atolls	2.107							(6.427)			(4.320)
Community / Private (Atolls)	2.944							(10.756)			(7.812)
Industry, manufacturing (MWSC)	462							(1.346)			(884)
Industry, cold stores and canning	1.745	1.417						(6.233)			(3.071)
Resorts (conversion and distribution)	21.732							(63.918)			(42.186)
Distribution losses (exclusive resorts)	(1.927)										(1.927)
Conversion total	37.013	1.417	-	-	-	-	-	(114.555)	-	-	(76.124)
Final Energy Consumption	37.013	1.417	4.626	160	-	5.094	14.037	69.264	4.270	11.965	147.846
Households - residential											
Male and Vilingili	3.734		-			931		882			5.547
Atolls	2.423		4.626			3.557		2.817			13.423
Manufacturing, commerce and service											
Male and Vilingili											
Public buildings including schools	133					-		-			133
Industry, manufacturing and commercial	2.443		-			-	-	-			2.443
Fishing (boats)						8	-	6.877	19		6.904
Water supply & desalination (MWSC)	462										462
Waste (Thilafushi)						4		-			4
Government buildings	1.393					-					1.393
Atolls											
Public buildings including schools	1.490		-			382		80			1.952
Manufacturing	137		-			21	-	155			312
Cold stores and canning	1.745	1.417	-			-	-	-			3.162
Fishing (boats)						132		43.884	306		44.322
Resorts etc. (ex tranport)											
Resorts etc.	21.732		-	160		36		-			21.927
Domestic Transport											
Hulhule Airport (operation)	1.294					3	7	23			1.326
Domestic air transport										11.965	11.965
Sea transport, Atolls								9.005			9.005
Sea transport, Tourist resorts							8.576	8.600			17.176
Vehicles, Male							5.293	852			6.145
Vehicles, Atolls							115	6			120
Final Energy Consumption Total	36.985	1.417	4.626	160	-	5.073	13.990	69.245	4.259	11.965	147.721
Balance	28	-	-	-	-	21	47	18	11	-	125

In total the un-accounted part of the energy balance is less than 0.08%, or 0.0008, which is satisfactory.

Primary Energy Consumption

Imported fossil fuels, primarily diesel, totally dominate primary energy consumption, as it constitutes 83% of the total primary energy demand.

Indigenous renewable energy constitutes only approximately 2% of the primary energy use.

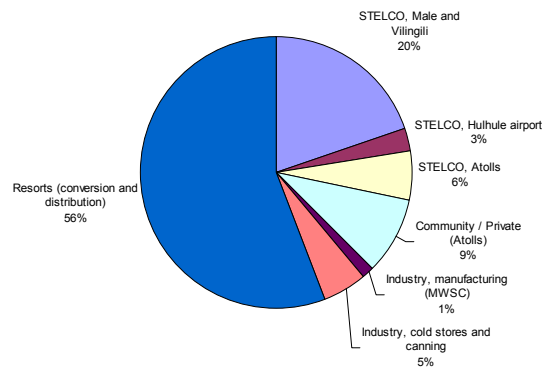


Conversion

Almost 56% of the diesel oil used for electricity production is used in the resorts, 29% is used for electricity production by STELCO, and the remaining 15% is used in the islands and for industrial purposes.

There is definitely room for improvement in the overall system efficiency.

The conversion and distribution losses of the electricity sector are high, especially in islands where the electricity production and distribution is organised by privately/community owned operators.

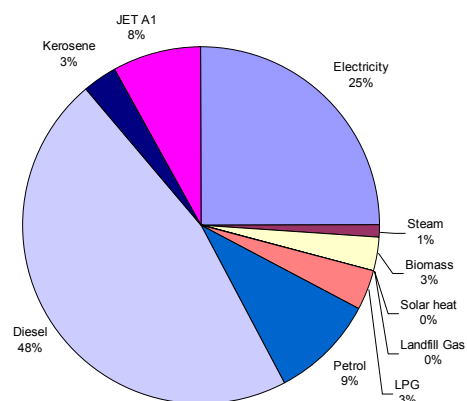


Final Energy Demand

The final energy consumption includes only 3% biomass.

The dominant final use of energy is diesel primarily for fishing and sea-based transport to and from inhabited islands and resorts.

The final electricity demand is primarily used at the resorts (~ 59%).



Emission

The total green house gas emission from the energy supply in the Maldives is concentrated on the emission from the imported fossil fuels, which constitutes approximately 665,000 ton CO₂ per year.

7 CONCLUSION AND RECOMMENDATIONS

This report provides the very first comprehensive energy balance for the Maldives. Earlier attempts have been made in the mid 1980's, but the work from this period was never followed through.

7.1 Sources of information

There are good and solid sources of information, which are able to provide reliable data, available in the Maldives. This includes:

- The Maldives Customs Service (MCS) has accurate and comprehensive data on imports of fossil fuels (oil, LPG, kerosene, petrol, aviation gas and aviation jet kerosene, etc.).
- The State Trade Organisation (STO) has information on bunkering and stock levels of oil, LPG and other oil products.
- The State Electricity Company (STELCO) has over the years developed quite elaborate and informative statistics covering the islands that they supply with power.
- The Ministry of Transportation and Civil Aviation (MTCA) has been most helpful with the available information regarding the transport sector.
- Official statistics from the “2000 Census”, and the annual statistical yearbooks.
- The ADB-report on electricity supply, distribution and demand has provided important in-sights.
- Survey questionnaire has been used to supplement the available sources

7.2 Purpose of Energy Balance

A reliable energy balance is the fundamental requirement for establishing reliable modelling of the potential energy market development, and the effects of any given market intervention.

So, in essence an energy balance is necessary to provide an understanding of the complexity of the energy sector and to assess the social, legal, technological, financial and economic effects of any measure of intervention into the energy sector.

7.3 Primary Energy Consumption

Imported fossil fuels, primarily diesel, totally dominate primary energy consumption, as it constitutes 83% of the total primary energy demand. Indigenous renewable energy constitutes only approximately 2% of the primary energy use.

7.4 Conversion

Almost 56% of the diesel oil used for electricity production is used in the resorts, 29% is used for electricity production by STELCO, and the remaining 15% is used in the islands and for industrial purposes.

7.5 Final Energy Demand

The final energy consumption includes only 3% biomass. The dominant final use of energy is diesel primarily for fishing and sea-based transport to and from inhabited islands and resorts. The final electricity demand is primarily used at the resorts (~ 59%).

7.6 Emission

The total green house gas emission from the energy supply in the Maldives is concentrated on the emission from the imported fossil fuels, which constitutes approximately 665,000 ton CO₂ per year.

7.7 Recommendations for future energy balances

In order to accommodate a systematic collection of the necessary information required establishing an annual energy balance some additional initiatives are necessary. This could include:

- Establish regular collection/reporting routines of standardised energy information from all islands
- Establish regular collection/reporting routines of standardised energy information from all resorts
- Establish regular reporting routines of official statistics from MCS, STO, MTCA, etc.
- Establish a permanent working group in the MCST to review, analyse and adapt information and prepare energy balance.

8 Data Annex

This annex contains all the database and spreadsheet analyses, which has been established in order to provide input for the energy balance.

RESOURCES
OIL PRODUCTS

Assumptions	density	heat value	conversion	heat value
	ton/m ³	GJ/ton	toe/ton	MWh/ton
Diesel oil /gas oil	0,84	42,7	1,035	11,86
Petrol / motor gasoline	0,75	43,8	1,07	12,17
Jet petroleum (kerosene), JP1	0,8	43,5	1,07	12,08
Aviation Gasoline	0,71	43,8	1,07	12,17
JP4	0,76	43,8	1,07	12,17
Kerosene	0,8	43,5	1,045	12,08
LPG	0,54	46	1,13	12,78

Diesel / Marine gas oil				Conversion factor	
<i>Data source: Maldives Customservice, Import statistics, 2002</i>					
Import	180.501,27	Metric Tonne	186.819	toe	1,035 toe per tonne source: IEA
Export	0	Metric Tonne	0	toe	1,035 toe per tonne source: IEA
Use:	Diesel is used as fuel for automobiles and marine outboard engines in the transportation sector, and it is also consumed by ocean-going ships calling at Male'. Finally, diesel is used in industries (e.g., sea water desalination in Male' and the cement and LPG bottling industry in Thilafushi island near Male').				

Aviation Gas				Conversion factor	
<i>Data source: Maldives Customservice, Import statistics, 2002</i>					
Import	12.678,08	Metric Tonne	13.566	toe	1,07 toe per tonne source: IEA
Export	11.537,05	Metric Tonne	12.345	toe	1,07 toe per tonne source: IEA
Use:	90% of the imported aviation gas and jet kerosine is used for international aviation bunkering 10% of the imported aviation gas and jet kerosine is used finsode Maldives ("First National Communication of the Rep. Of Maldives to UNFCCC", 2001)				

Kerosine Oil & Lamp Fuel				Conversion factor	
<i>Data source: Maldives Customservice, Import statistics, 2002</i>					
Import	4.294,12	Metric Tonne	4.487	toe	1,045 toe per tonne source: IEA
Export	-	Metric Tonne	-	toe	1,045 toe per tonne source: IEA
Use:	Use for cooking				

Petrol / gasoline				Conversion factor	
<i>Data source: Maldives Customservice, Import statistics, 2002</i>					
Import	13.777,70	Metric Tonne	14.742	toe	1,07 toe per tonne source: IEA
Export	0	Metric Tonne	0	toe	1,07 toe per tonne source: IEA
Use:	Diesel is used as fuel for automobiles and marine outboard engines in the transportation sector.				

LPG				Conversion factor	
<i>Data source: Maldives Customservice, Import statistics, 2002</i>					
Import	4.097,00	Metric Tonne	4.630	toe	1,13 toe per tonne source: IEA
Export	0	Metric Tonne	0	toe	
Use:	LPG is used for cooking, a very rarely for some vehicles				

IMPORTS OF LPG FOR THE YEAR 2002
 Information Technology & Statistics
 MALDIVES CUSTOMSSERVICE

IMPORT OF SELECTED ITEMS IN 2002

MONTH	CODE	DESCRIPTION	UNIT	QUANTITY	CIF (Rf)
1	2710001000	Marine Gas Oil (Diese	M/T	17.415,81	40.071.142,13
2	2710001000	Marine Gas Oil (Diese	M/T	19.225,88	45.573.335,32
3	2710001000	Marine Gas Oil (Diese	M/T	16.708,19	42.273.252,03
4	2710001000	Marine Gas Oil (Diese	M/T	9.059,97	24.859.491,00
5	2710001000	Marine Gas Oil (Diese	M/T	7.384,64	21.337.656,57
6	2710001000	Marine Gas Oil (Diese	M/T	18.276,03	53.410.283,79
7	2710001000	Marine Gas Oil (Diese	M/T	20.286,59	57.883.198,69
8	2710001000	Marine Gas Oil (Diese	M/T	6.980,91	20.251.411,87
9	2710001000	Marine Gas Oil (Diese	M/T	16.857,30	51.194.935,22
10	2710001000	Marine Gas Oil (Diese	M/T	12.131,52	39.837.852,45
11	2710001000	Marine Gas Oil (Diese	M/T	10.423,55	34.373.878,11
12	2710001000	Marine Gas Oil (Diese	M/T	25.750,88	77.259.100,98
		Marine Gas Oil (Diesel) Total		#####	508.325.538,16
1	2710001100	Aviation Gas	M/T	1.267,51	3.269.547,06
2	2710001100	Aviation Gas	M/T	1.435,30	3.277.899,56
3	2710001100	Aviation Gas	M/T	1.395,97	3.151.703,32
4	2710001100	Aviation Gas	M/T	1.127,38	2.300.577,14
5	2710001100	Aviation Gas	M/T	1.036,80	2.357.363,73
6	2710001100	Aviation Gas	M/T	1.342,51	3.587.457,73
7	2710001100	Aviation Gas	M/T	623,20	1.479.765,13
8	2710001100	Aviation Gas	M/T	698,15	1.715.426,55
9	2710001100	Aviation Gas	M/T	991,39	2.427.446,98
10	2710001100	Aviation Gas	M/T	866,20	2.225.643,13
11	2710001100	Aviation Gas	M/T	931,11	2.606.130,86
12	2710001100	Aviation Gas	M/T	962,56	2.811.843,55
		Aviation Gas Total		12.678,08	31.210.804,74
1	2710001200	Kerosine Oil	M/T	310,53	767.903,15
4	2710001200	Kerosine Oil	M/T	225,58	662.755,58
5	2710001200	Kerosine Oil	M/T	408,49	1.199.466,17
7	2710001200	Kerosine Oil	M/T	492,50	1.476.846,52
8	2710001200	Kerosine Oil	M/T	433,99	1.358.889,17
9	2710001200	Kerosine Oil	M/T	1.000,56	3.390.211,77
11	2710001200	Kerosine Oil	M/T	881,11	2.985.901,57
12	2710001200	Kerosine Oil	M/T	399,17	1.318.252,20
		Kerosine Oil Total		4.151,93	13.160.226,13
1	2710009910	Lamp Fuel	Ltr	1.614,00	51.959,00
2	2710009910	Lamp Fuel	Ltr	5.671,47	207.484,05
3	2710009910	Lamp Fuel	Ltr	25.155,65	387.728,08
4	2710009910	Lamp Fuel	Ltr	16.328,56	131.690,28
5	2710009910	Lamp Fuel	Ltr	17.915,22	397.710,88
6	2710009910	Lamp Fuel	Ltr	7.564,73	165.399,61
7	2710009910	Lamp Fuel	Ltr	67.124,42	740.947,42
8	2710009910	Lamp Fuel	Ltr	7.421,59	104.858,38
9	2710009910	Lamp Fuel	Ltr	12.592,70	201.635,45
10	2710009910	Lamp Fuel	Ltr	10.105,75	170.089,34
11	2710009910	Lamp Fuel	Ltr	5.056,81	102.168,90
12	2710009910	Lamp Fuel	Ltr	1.188,22	16.574,12
		Lamp Fuel Total		#####	2.678.245,51
1	2710009916	Lubricating Oil	Ltr	97.775,68	1.400.530,70
2	2710009916	Lubricating Oil	Ltr	96.027,91	1.214.021,14
3	2710009916	Lubricating Oil	Ltr	#####	3.335.984,52
4	2710009916	Lubricating Oil	Ltr	#####	2.915.916,56
5	2710009916	Lubricating Oil	Ltr	74.541,10	1.097.348,47
6	2710009916	Lubricating Oil	Ltr	#####	2.004.062,13
7	2710009916	Lubricating Oil	Ltr	84.851,92	1.160.218,65
8	2710009916	Lubricating Oil	Ltr	#####	1.936.807,01
9	2710009916	Lubricating Oil	Ltr	#####	1.586.660,87
10	2710009916	Lubricating Oil	Ltr	#####	2.845.271,82
11	2710009916	Lubricating Oil	Ltr	94.723,31	1.351.619,46
12	2710009916	Lubricating Oil	Ltr	#####	2.507.582,95
		Lubricating Oil Total		#####	23.356.024,28
1	2711191010	Petrol	M/T	961,41	2.808.652,90
2	2711191010	Petrol	M/T	1.075,07	2.647.185,58
3	2711191010	Petrol	M/T	1.992,94	6.298.396,53
4	2711191010	Petrol	M/T	992,87	3.764.134,05
6	2711191010	Petrol	M/T	1.769,28	6.660.264,99
7	2711191010	Petrol	M/T	1.508,75	5.336.359,18
9	2711191010	Petrol	M/T	2.115,63	7.589.455,30
10	2711191010	Petrol	M/T	404,05	1.348.844,07
11	2711191010	Petrol	M/T	1.480,25	5.324.228,91
12	2711191010	Petrol	M/T	1.499,80	5.443.225,30
		Petrol Total		13.800,05	47.220.746,81
	CODE	DESCRIPTION	UNIT	QUANTITY	CIF (Rf)
	2711120000	Propane, Liquefied	M/T	0,01	362,37
	2711120000	Propane, Liquefied	M/T	2.706,11	12.352.963,94
	2711120000	Propane, Liquefied	M/T	2.000,00	6.502.100,00
	2711120000	Propane, Liquefied	M/T	350,01	1.709.610,52
	2711120000	Propane, Liquefied	M/T	0,05	576,92
	total	LPG Total		5.056,18	20.565.613,75

RESOURCES

OIL BUNKRING & STOCK

Assumptions	density	heat value	conversion	heat value
	ton/m3	GJ/ton	toe/ton	MWh/ton
Diesel oil /gas oil	0,84	42,7	1,035	11,86
Petrol / motor gasoline	0,75	43,8	1,07	12,17
Jet petroleum (kerosene), JP1	0,8	43,5	1,07	12,08
Aviation Gasoline	0,71	43,8	1,07	12,17
JP4	0,76	43,8	1,07	12,17
Kerosene	0,8	43,5	1,045	12,08
LPG	0,54	46	1,13	12,78

Fuel stock changes			2002	2003	Change	Density	Mass	Conversion	Net stored
			01-jan-02	01-jan-03		t/m3	t	toe/unit	toe
Jet A1	Maldives Airport Co.	m3	6.914,58	8.784,41	1.869,83	0,80	1.495,86	1,070	1.600,57
Diesel		liters	14.065.421,00	10.378.284,00	(3.687.137,00)	0,84	(3.097,20)	1,035	(3.205,60)
	STO	liters	7.018.047,62	9.189.119,05	2.171.071,43	0,84	1.823,70	1,035	1.887,53
	Maldives Airport Co.	liters	359.610,00	216.600,00	(143.010,00)	0,84	(120,13)	1,035	(124,33)
	Others ??	liters	6.687.763,38	972.564,95	(5.715.198,43)	0,84	(4.800,77)	1,035	(4.968,79)
Gasolin, petrol			1.294.530,00	2.173.096,67	878.566,67		658,93		705,05
	STO	liters	1.293.360,00	2.171.226,67	877.866,67	0,75	658,40	1,070	704,49
	Maldives Airport Co.	liters	1170	1870	700,00	0,75	0,53	1,070	0,56
Kerosene	STO	liters	501.787,50	761.187,50	259.400,00	0,80	207,52	1,045	216,86
LPG	STO	liters	1.338.888,89	577.777,78	(761.111,11)	0,54	(411,00)	1,130	(464,43)

Bunkring - diesel		Sold to vessels	Density	Mass	Conversion	Net stored
		liters diesel	t/m3	t	toe/unit	toe
STO	Number of vessels catered	9645952	0,93	8971	1,035	9285
Fuel Supplies Maldives	Number of vessels catered	3447720	0,93	3206	1,035	3319
	Average bunkring, toe				15,6	16,1
Hakata	Number of vessels catered	2000000	0,93	1860	1,035	1925
	Average bunkring, toe				9,0	9,3
Villa	Number of vessels catered	1000000	0,93	930	1,035	963
	Average bunkring, toe				4,5	4,7
Total				5996		6206

RESOURCES

SOLAR

Assumptions	density	heat value	conversion	heat value
	ton/m3	GJ/ton	toe/ton	MWh/ton
Diesel oil /gas oil	0,84	42,7	1,035	11,86
Petrol / motor gasoline	0,75	43,8	1,07	12,17
Jet petroleum (kerosene), JP1	0,8	43,5	1,07	12,08
Aviation Gasoline	0,71	43,8	1,07	12,17
JP4	0,76	43,8	1,07	12,17
Kerosene	0,8	43,5	1,045	12,08
LPG	0,54	46	1,13	12,78

Solar heat on resorts

Data source:

Estimation for 2002 by project team

Use: Solar heat is used on many resorts for production of hot water for showers

Number of resorts		87
Bed capacity		16.400
of which with solar hot water		50 %
of which with solar hot water		8200
Bed Capacity Utilization Rate (%)		68,9
Average number of beds in use, supplied with solar		5650 in 2002
Total number of bednights		4.066.000
Number of bednights supplied with solar hot water		1.400.737
Number of solar m2 per bed		0,5
Number of m2 solar collector in use		2824,9
Average daily heat produced by solar, per bed		0,9 kWh
Average yearly production by solar, per bed		329 kWh
Solar heat utilised /year		1856 MWh
Solar heat utilised /year		159,6 toe
Volume of water heated	22 C, /day/ bed	35,1 liter
Estimated demand for hot water per bed night		60,0 liter
Volume of water heated per year		72310 m3
Total Yearly demand for hot water		243960 m3
Covered by solar heating		29,6%
<u>Special assumptions and calculations:</u>	1 kWh =	3600 kJ
	1 toe =	11,63 MWh
	Density	1 kg/l
	delta Degree heating	22 K
	Heat coefficient	4,2 kJ/kgC
	Energy	92,4 kJ
	Energy	0,0257 kWh

EMISSION

<i>Assumptions</i>	<i>density</i>	<i>heat value</i>	<i>conversion</i>	<i>heat value</i>
	<i>ton/m3</i>	<i>GJ/ton</i>	<i>toe/ton</i>	<i>MWh/ton</i>
Diesel oil /gas oil	0,84	42,7	1,035	11,86
Petrol / motor gasoline	0,75	43,8	1,07	12,17
Jet petroleum (kerosene), JF	0,8	43,5	1,07	12,08
Aviation Gasoline	0,71	43,8	1,07	12,17
JP4	0,76	43,8	1,07	12,17
Kerosene	0,8	43,5	1,045	12,08
LPG	0,54	46	1,13	12,78

	<i>LPG</i>	<i>Petrol</i>	<i>Diesel</i>	<i>Kerosene</i>	<i>JET A1</i>	<i>Total</i>
toe	5.094	14.037	183.818	4.270	11.965	223.970
ton	4.508	13.119	177.602	4.087	11.182	210.498
GJ	207.368	574.602	7.583.609	177.767	486.426	9.029.773
ton CO2	13.479	41.946	561.187	13.155	35.996	665.762

<i>Fuel</i>	<i>CO2 contents</i>
LPG	65 kg/GJ
Petrol	73 kg/GJ
Diesel	74 kg/GJ
Kerosene	74 kg/GJ
Jet fuel	74 kg/GJ

CONVERSION DESALINATION

<i>Assumptions</i>	<i>density ton/m3</i>	<i>heat value GJ/ton</i>	<i>conversion toe/ton</i>	<i>heat value MWh/ton</i>
Petrol / motor gasoline	0,75	43,8	1,07	12,17
Jet petroleum (kerosene), JP1	0,8	43,5	1,07	12,08
Aviation Gasoline	0,71	43,8	1,07	12,17
JP4	0,76	43,8	1,07	12,17
Kerosene	0,8	43,5	1,045	12,08
LPG	0,54	46	1,13	12,78

Desalination

		<i>Male</i>	<i>Vilingli</i>	<i>Total</i>
Production per day	m3	4000	120	4120
Specific Energy Consumption	kWh/m3	3,5	6,0	0
Daily Consumption	kWh	14000	720	14720
Yearly electricity consumption	MWh	5110	262,8	5372,8
Efficiency in electricity production		0,35	0,25 -	
Diesel consumption		14600	1051	15651
Yearly diesel consumption	toe	1255	90	1346
Yearly electricity consumption	toe	-	-	462

CONVERSION

Industry

<i>Assumptions</i>	<i>density</i>	<i>heat value</i>	<i>conversion</i>	<i>heat value</i>
	<i>ton/m3</i>	<i>GJ/ton</i>	<i>toe/ton</i>	<i>MWh/ton</i>
Diesel oil /gas oil	0,84	42,7	1,035	11,86
Petrol / motor gasoline	0,75	43,8	1,07	12,17
Jet petroleum (kerosene), JI	0,8	43,5	1,07	12,08
Aviation Gasoline	0,71	43,8	1,07	12,17
JP4	0,76	43,8	1,07	12,17
Kerosene	0,8	43,5	1,045	12,08
LPG	0,54	46	1,13	12,78

Industry

		<i>Fish canning</i>	<i>Freezing</i>	<i>Freezing</i>	<i>Total</i>
Diesel consumption per day	ton/day	7,5	4,5	4,5	16,5
Days of production per year	365				
Diesel consumption per year	ton/year	2.738	1.643	1.643	6.023
Annual diesel consumption	toe/year	2.833	1.700	1.700	6.233
Efficiency in electricity production		28%	28%	28%	
Electricity production	toe/year	793	476	476	1.745
Efficiency in steam production		50%			
Steam use		1.417			1.417

**CONVERSION
FUEL FOR ELEC.**

Assumptions	density heat value		onversion heat value	
	ton/m3	GJ/ton	toe/ton	MWh/ton
Diesel oil /gas oil	0,84	42,7	1,035	11,86
Petrol / motor gasoli	0,75	43,8	1,07	12,17
Jet petroleum (keros)	0,8	43,5	1,07	12,08
Aviation Gasoline	0,71	43,8	1,07	12,17
JP4	0,76	43,8	1,07	12,17
Kerosene	0,8	43,5	1,045	12,08
LPG	0,54	46	1,13	12,78

Table 12.3 : MONTHLY CONSUMPTION OF FUEL FOR ELECTRICITY GENERATION IN SELECTED LOCALITIES BY PUBLIC SECTOR, 2002

(In '000 litres)

Locality	Total	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Total	37.529	2.733	2.844	3.236	3.254	3.278	3.213	3.314	3.151	3.188	3.256	3.037	3.024
HA. Dhidhdhoo	207	16	15	18	18	17	16	18	16	17	18	19	19
HA. Hoarafushi	205	18	15	18	17	18	17	17	15	17	18	17	17
HA. Thuraakunu	49	5	4	5	4	4	4	4	4	4	4	4	4
H.Dh. Hanimaadhoo	120	10	9	10	10	10	9	10	10	10	10	11	10
H.Dh. Kulhudhuffushi	717	63	50	64	63	52	59	61	59	60	63	62	61
Sh. Milandhoo	66	5	5	6	5	6	5	6	6	6	6	6	6
N. Velidhoo	164	13	13	14	14	14	13	14	13	14	14	14	13
R. Hulhudhuffaaruu	78	6	6	8	6	6	6	6	6	7	7	7	6
B. Eydhafushi	282	21	22	24	23	24	23	25	24	25	25	24	23
Lh. Naifaru	364	29	27	29	30	33	30	32	30	31	31	32	31
K.Male'	25.336	2.028	1.906	2.170	2.201	2.196	2.162	2.246	2.111	2.135	2.199	1.997	1.986
K.Vilingili	1.004	75	76	93	93	94	91	88	81	80	79	79	77
K.Hulhule	3.752	33	314	349	350	360	351	348	333	347	342	316	310
K. Himmafushi	83	-	-	-	-	5	10	11	11	11	12	12	12
K. Guraidhoo	173	14	12	14	14	14	14	14	14	15	15	16	16
K. Kaashidhoo	133	10	9	11	11	12	11	13	11	11	11	12	11
K. Maafushi	355	29	27	30	29	32	30	28	28	30	31	30	30
K.Thulusdhoo	172	14	13	15	14	15	14	15	14	14	14	15	15
G.A. Vilingili	208	16	16	16	18	18	18	17	18	18	17	19	18
G.Dh. Gadhdhoo	137	12	11	12	11	11	11	11	11	11	11	12	13
G.Dh.Thinadhoo	544	43	39	45	44	47	46	46	48	47	44	47	48
S. Central Powerhouse	2.493	203	187	212	205	214	202	210	213	207	213	208	219
S. Hulhudhoo-Meedhoo	269	22	21	23	22	23	22	23	23	22	22	24	23
Gn. Fuvahmulah	618	49	47	52	51	52	50	51	52	51	51	55	56

Source: State Electric Company Limited

**CONVERSION
PRODUCTION OF ELEC.**

Assumptions	density heat value onversion heat value			
	ton/m3	GJ/ton	toe/ton	MWh/ton
Diesel oil /gas oil	0,84	42,7	1,035	11,86
Petrol / motor gasoli	0,75	43,8	1,07	12,17
Jet petroleum (kero:	0,8	43,5	1,07	12,08
Aviation Gasoline	0,71	43,8	1,07	12,17
JP4	0,76	43,8	1,07	12,17
Kerosene	0,8	43,5	1,045	12,08
LPG	0,54	46	1,13	12,78

Table 12.2 : MONTHLY ELECTRICITY PRODUCTION IN LOCALITIES BY PUBLIC SECTOR, 2002

(In ' 000 Kwh)

Locality	Total	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Total	140.849	11.329	10.337	11.904	12.146	12.176	11.949	12.381	11.786	11.692	11.909	11.631	11.609
HA. Dhidhdhoo	633	52	48	56	55	53	49	54	49	51	53	55	57
HA. Hoarafushi	531	46	38	45	46	47	41	44	41	45	45	47	45
HA. Thuraakunu	125	11	10	11	11	11	10	10	10	10	10	11	11
H.Dh. Hanimaadhoo	337	26	23	28	29	29	26	28	27	30	29	32	31
H.Dh. Kulhudhuffushi	2555	204	185	219	218	221	203	220	207	218	226	219	217
Sh. Milandhoo	174	12	13	15	15	16	14	15	15	15	16	16	15
N. Velidhoo	548	43	43	49	46	47	45	49	44	47	47	47	42
R. Hulhudhuffaaruu	233	16	22	19	22	21	20	20	20	17	18	19	19
B. Eydhafushi	826	61	63	72	68	71	67	73	68	73	73	70	67
Lh. Naifaru	1106	89	81	94	96	101	91	85	90	95	94	99	91
K. Male'	97480	7850	7025	8231	8437	8319	8386	8687	8191	8075	8272	8010	7997
K. Vilingili	3184	231	247	232	314	327	289	285	254	249	261	260	234
K. Hulhule	15048	1259	1189	1322	1319	1366	1223	1280	1230	1247	1260	1165	1188
K. Guraidhoo	511	42	37	40	42	43	41	42	43	43	44	48	47
K. Himmafushi	195	0	0	0	0	11	23	26	26	27	27	27	28
K. Kaashidhoo	386	27	25	33	32	33	34	33	31	34	33	37	34
K. Maafushi	1255	93	92	102	100	110	106	109	105	109	109	111	109
K. Thulusdhoo	479	39	37	41	41	43	41	41	40	39	39	40	39
G.A. Vilingili	661	50	49	50	50	56	57	57	57	59	56	61	58
G.Dh. Gadhdhoo	420	34	36	32	33	33	33	35	35	35	34	40	40
G.Dh. Thinadhoo	1837	143	135	154	152	160	152	159	159	158	149	158	157
S. Central Powerhouse	9329	758	708	801	770	801	756	781	798	775	774	793	815
S. Hulhudhoo-Meedhoo	905	74	71	78	74	78	74	77	76	74	74	80	76
Gn. Fuvahmulah	2093	169	161	179	176	179	170	172	173	168	167	187	192

Source: State Electric Company Limited

**CONVERSION
Distribution and
Conversion loss**

Assumptions	density at value nversion heat value			
	ton/m3	GJ/ton	toe/ton	MWh/ton
Diesel oil /gas oil	0,84	42,7	1,035	11,86
Petrol / motor gasoline	0,75	43,8	1,07	12,17
Jet petroleum (kerosene), JP	0,8	43,5	1,07	12,08
Aviation Gasoline	0,71	43,8	1,07	12,17
JP4	0,76	43,8	1,07	12,17
Kerosene	0,8	43,5	1,045	12,08
LPG	0,54	46	1,13	12,78

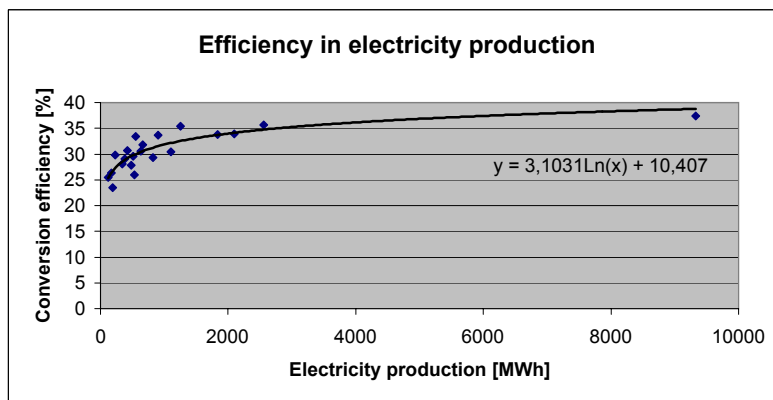
Conversion loss analysis

Locality	Diesel	Diesel	Electricity	LN function	Diesel (LN)	Distribution	Electricity	Electric	Electric			
	(In '000 litres	[MWh]	production						Efficiency,%	loss,%	Consumption	Capacit
Total	37529	375290	140851	37,53		374599		128936			13700	
HA. Dhidhdhoo	207	2070	633	30,58	30,4	2081	13%	632	4	24	510	
HA. Hoarafushi	205	2050	531	25,90	29,9	1777	13%	530	2	24	500	
HA. Thuraakunu	49	490	125	25,51	25,4	492	13%	125	2	24	74	
H.Dh. Hanimaadhoo	120	1200	337	28,08	28,5	1184	13%	337	2	24	325	
H.Dh. Kulhudhuffushi	717	7170	2555	35,63	34,8	7352	13%	2552	3	24	1170	
Sh. Milandhoo	66	660	174	26,36	26,4	659	13%	174	3	24	185	
N. Velidhoo	164	1640	548	33,41	30,0	1828	13%	547	3	24	336	
R. Hulhudhuffaarau	78	780	233	29,87	27,3	853	13%	233	3	24	174	
B. Eydhafushi	282	2820	826	29,29	31,2	2643	13%	825	3	24	225	
Lh. Naifaru	364	3640	1106	30,38	32,2	3440	13%	1105	4	24	600	
K. Himmafushi	83	830	195	23,49	26,8	728	13%	195	2	24	562	
K. Guraidhoo	173	1730	511	29,54	29,8	1717	13%	510	3	24	550	
K. Kaashidhoo	133	1330	386	29,02	28,9	1336	13%	385	3	24	598	
K. Maafushi	355	3550	1255	35,35	32,5	3856	13%	1253	2	24	278,4	
K.Thulusdhoo	172	1720	479	27,85	29,6	1621	13%	478	3	24	260	
G.A. Vilingili	208	2080	661	31,78	30,6	2163	13%	660	3	24	623	
G.Dh. Gadhdhoo	137	1370	420	30,66	29,2	1441	13%	419	3	24	300	
G.Dh.Thinadhoo	544	5440	1837	33,77	33,7	5446	13%	1835	4	24	1576	
S. Central Powerhouse	2493	24930	9329	37,42	38,8	24061	13%	9317	2	24	3050	
S. Hulhudhoo-Meedhoc	269	2690	905	33,64	31,5	2870	13%	904	3	24	495	
Gn. Fuvahmulah	618	6180	2093	33,87	34,1	6132	13%	2090	4	24	1309	
K.Male'	25336	253360	97480	38,47		253360	11,06	86702				
K.Vilingili	1004	10040	3184	31,71		10040	11,06	2832				
K.Hulhule	3752	37520	15048	40,11		37520	5,0	14296				
Weithed Male and Vilingi	1006640	26340		38,22								

Source: State Electric Company Limited
Calibration 1,00184

10 kWh per liter

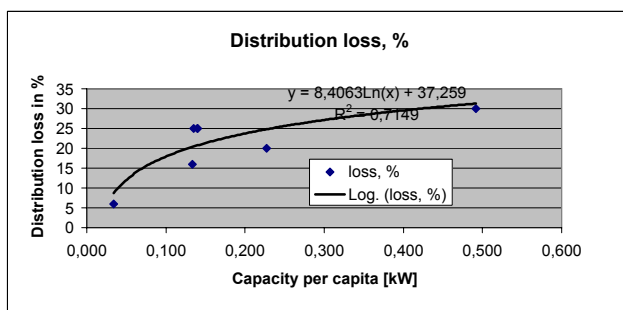
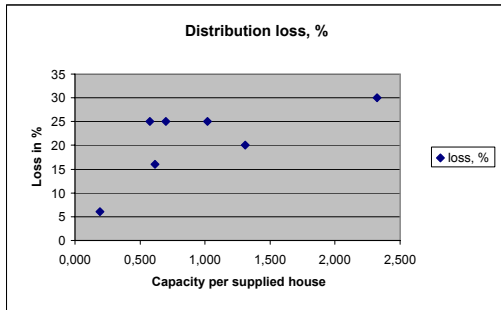
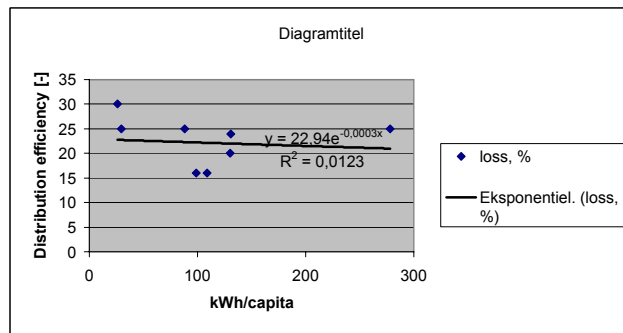
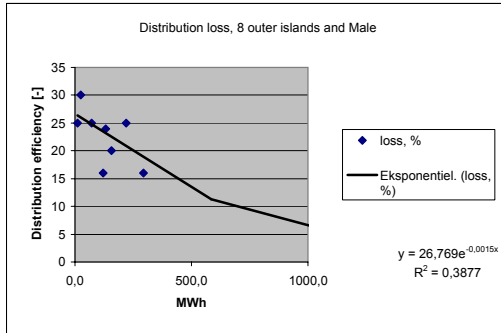
13



Distribution loss analysis

Locality (1999)	loss, %	Provider	Generator cap. kW	Sales/month		Consumption MWh	Population	Number of houses	% houses with elec.	Consumption per capita		supplied house		supplied cap.	
				no	MWh/month					kWh	loss, %	kW	loss, %	kW	
Haa Alifu Dhidh	16	Stelco			24,584	295,0	2712			109	16				
Haa Dhaalu Va	16	NGO	137	3	9,971	119,7	1210	262	85	99	16	0,615	16	0,133	
Haa Dhaalu No	6	IDC	48	1	4,431	53,2	1553	275	92	34		0,190	6	0,034	
Haa Dhaalu Ne	30	P	97	3	2,028	24,3	940	199	21	26	30	2,321	30	0,491	
Haa Dhaalu Ha	24	Stelco			10,983	131,8	1010			130	24				
Shaviyani Funz	25	IDC	112	4	5,903	70,8	801	194	100	88	25	0,577	25	0,140	
Meemu Muli	25	IDC	96	2	18,297	219,6	789	153	90	278	25	0,697	25	0,135	
Meemu Mulah	20	IDC	236	3	13,118	157,4	1208	210	86	130	20	1,307	20	0,227	
Meemu Veyvah					0,912	10,9	182								
Meemu Naalaa	25	IDC	55	1	0,965	11,6	394	54	100	29	25	1,019	25	0,140	
Male	11	Stelco				86702									11,07

12



**CONVERSION
PRODUCTION OF ELECTRICITY**

Assumptions	density ton/m3	heat value GJ/ton	conversion factor	heat value MWh/ton
Coal	1.3	29.3	0.35	10.26
Diesel oil (gas oil)	0.84	42.7	1.035	11.83
Petrol / motor gasoline	0.75	43.8	1.07	12.17
Jet (petroleum/kerosene), JP1	0.8	43.5	1.07	12.08
Aviation Gasoline	0.71	43.8	1.07	12.17
JP4	0.76	43.8	1.07	12.17
Kerosene	0.8	43.5	1.045	12.08
LPG	0.54	46	1.13	12.78

Region	Oil input		Electricity production		Distribution Loss	
	tooyear	tooyear	MWh	tooyear	MWh	tooyear
Republic	42,009	42,009	170,752	146,554,591	22,406,118	192,707
Stalo, Total	32,302.0	32,302.0	149,223	129,567,872	15,969	132
Stalo, Male	22,848	22,848	100,864	86,564,602	11,130	96
Stalo, Huilue	3,236	3,236	15,048	12,918,999	752	6
Stalo, Abala	6,427	6,427	29,508	24,077,379	3,188	27
Stalo total check	32,301.9	32,301.9	149,221	129,566,781	15,968	131
Community / Private (Atolls)	10,758	10,758	34,238	2944	8217	70
Others	9,707	9,707	39,577	2829	2387	20
				Check	12069	201

CHECK primary energy	tooyear	tooyear	tooyear
26340000	26340000	26340000	26340000
3730000	3730000	3730000	3730000
7437000	7437000	7437000	7437000
37629000	37629000	37629000	37629000
			99,491

Locality	2000					2002					Electricity provider	Specific electricity utilisation kWh/capita/year	Total electricity utilisation kWh/year	Electricity generated n loss kWh/year	Electricity distribution loss kWh/year	Total electricity production kWh/year	Fuel conversion efficiency Steco %	Fuel conversion efficiency Estimated %	Oil input MWh/year	Oil output MWh/year
	Population		Number of		Average	Population (corrected)		Annual growth rate												
	Both Sexes	Male	Female	Households	Household Size	%	Both sexes	%	%											
Republic	270,701	137,200	132,601	40,912	6.6						250,775	141,385,728	22,406,118	170,751,852	100,664,000	38.2%	25%	488,563,160	42,009	
Atoll	74,069	38,559	35,510	9,700	7.6	74,069	38,559	35,510	9,700	7.6	3.40%	1131	89,533,582	11,130,418	100,664,000	38.2%	25%	263,400,000	22,408	
Hanuya	18,100	9,259	8,841	2488	7.3	18,100	9,259	8,841	2488	7.3	3.40%									
Galolhu	13,878	7,107	6,771	1813	7.7	13,878	7,107	6,771	1813	7.7	3.40%									
Machchangotli	13,599	6,940	6,640	1748	7.8	13,599	6,940	6,640	1748	7.8	3.40%									
Maafanu	22,372	11,344	11,028	2928	7.6	22,372	11,344	11,028	2928	7.6	3.40%									
Villingili	4,291	2,174	2,117	601	7.1	4,291	2,174	2,117	601	7.1	3.40%									
Others	1,638	1,726	1,914	122	6.1	1,638	1,726	1,914	122	6.1	3.40%									
North Thlaadhunmatshi	14,161	6,637	7,524	2,351	6.0	14,161	6,637	7,524	2,351	6.0	1.40%									
Thunakuthu	412	180	232	61	6.1	412	180	232	61	6.1	1.40%	333	141,220	13%	21,102	162,322	25.0%	25%	636,303	54.7
Uligamu	326	156	170	57	5.7	326	156	170	57	5.7	1.40%	175	58,788	24%	18,565	77,353	24%	25%	309,412	27
Berimadho	124	55	69	21	5.9	124	55	69	21	5.9	1.40%	127	22,281	24%	7,091	28,423	25%	170,690	10	
Hithafushi	160	74	86	27	4.7	160	74	86	27	4.7	1.40%	175	22,050	24%	8,542	29,592	25%	142,367	12	
Muthadhoo	284	112	152	63	4.2	284	112	152	63	4.2	1.40%	271	47,608	24%	15,034	62,642	25%	219,566	22	
Haarufushi	2,221	1,044	1,177	341	6.5	2,221	1,044	1,177	341	6.5	1.40%	333	761,297	13%	113,755	875,042	25.0%	30%	3,378,222	280.5
Vaaradhoo	2,082	995	1,087	283	6.2	2,082	995	1,087	283	6.2	1.40%	175	371,844	24%	117,425	489,269	30%	1,951,983	145	
Kaela	1,196	583	613	245	4.9	1,196	583	613	245	4.9	1.40%	129	215,877	24%	68,108	284,785	25%	1,015,914	87	
Vashidaru	567	284	313	86	6.0	567	284	313	86	6.0	1.40%	175	107,658	24%	33,937	141,655	26%	549,353	47	
Dhidhidoo	2,768	1,293	1,473	438	6.3	2,768	1,293	1,473	438	6.3	1.40%	333	948,095	13%	141,669	1,089,764	30.6%	3,563,984	306.4	
Filadhoo	659	316	343	120	5.5	659	316	343	120	5.5	1.40%	175	118,339	24%	37,528	156,367	25%	599,482	52	
Maaradhoo	820	242	278	94	5.5	820	242	278	94	5.5	1.40%	333	93,773	24%	29,612	123,385	25%	488,737	42	
Thakandoo	507	224	283	114	4.4	507	224	283	114	4.4	1.40%	121	91,428	24%	28,872	120,300	25%	476,044	41	
Utheemu	584	285	319	99	5.9	584	285	319	99	5.9	1.40%	175	105,314	24%	33,257	138,571	25%	538,985	46	
Muraradhoo	483	195	288	98	4.9	483	195	288	98	4.9	1.40%	175	87,100	24%	27,556	114,656	26%	496,226	39	
Basarh	1,270	620	650	228	5.6	1,270	620	650	228	5.6	1.40%	175	229,021	24%	72,323	301,344	25%	1,071,623	92	
Others	26	19	19	1	2.0	26	19	19	1	2.0	1.40%	175	7,807	24%	2,139	4,746	25%	18,982	2	
South Thlaadhunmatshi	16,856	7,973	8,883	2,937	6.8	16,856	7,973	8,883	2,937	6.8	1.40%									
Fardhoo	159	62	97	38	4.4	159	62	97	38	4.4	1.40%	175	28,673	24%	9,055	37,727	25%	150,909	13	
Kondidoo	1,009	466	543	198	5.1	1,009	466	543	198	5.1	1.40%	333	336,368	13%	50,262	386,630	28.1%	1,378,724	118.4	
Hanimadho	327	138	189	71	4.6	327	138	189	71	4.6	1.40%	175	57,355	24%	18,111	75,466	25%	301,850	26	
Finay	1,001	469	532	198	5.1	1,001	469	532	198	5.1	1.40%	175	62,256	24%	20,276	82,532	25%	432,928	37	
Hirimaradhoo	57	216	199	59	6.4	57	216	199	59	6.4	1.40%	386	65,770	24%	20,769	86,539	25%	348,159	30	
Nobivaramu	418	162	256	72	5.8	418	162	256	72	5.8	1.40%	175	73,392	24%	23,151	96,483	25%	385,851	33	
Neladhoo	749	334	415	138	5.5	749	334	415	138	5.5	1.40%	175	131,365	24%	41,484	172,848	25%	654,841	56	
Nobivaramu	1,556	775	781	221	5.7	1,556	775	781	221	5.7	1.40%	1,800	272,902	24%	86,179	359,081	28.7%	1,262,715	108	
Kumbi	463	230	233	82	6.8	463	230	233	82	6.8	1.40%	175	81,204	24%	25,643	106,847	25%	427,390	37	
Kunburadhoo	241	118	123	50	4.8	241	118	123	50	4.8	1.40%	248	42,288	24%	13,348	55,616	25%	222,484	19	
Kulhudhuffushi	6,861	3,331	3,530	1018	6.0	6,861	3,331	3,530	1018	6.0	1.40%	333	2,189,894	13%	327,823	2,517,717	35.6%	7,078,599	608.8	
Kumundu	963	419	544	181	5.3	963	419	544	181	5.3	1.40%	175	188,897	24%	53,338	242,233	27%	817,777	70	
Naykuradhoo	950	465	485	190	5.0	950	465	485	190	5.0	1.40%	175	186,817	24%	52,616	239,433	27.1%	1,007,991	89	
Vahadhoo	1,210	596	614	206	5.9	1,210	596	614	206	5.9	1.40%	175	212,016	24%	64,267	276,283	28%	1,071,420	86	
Maavadhoo	320	141	179	71	4.5	320	141	179	71	4.5	1.40%	175	58,124	24%	17,723	75,847	25%	296,388	25	
Maakudhoo	1,073	532	541	185	5.8	1,073	532	541	185	5.8	1.40%	1,103	188,190	24%	59,428	247,618	26%	900,072	77	
Others	98	39	59	3	3.0	98	39	59	3	3.0	1.40%	175	68,311	24%	21,452	89,763	25%	365,847	31	
North Mithaadhunmatshi	11,402	5,424	5,982	2,002	5.9	11,402	5,424	5,982	2,002	5.9	1.40%									
Kandhivaru	1,332	624	708	169	6.1	1,332	624	708	169	6.1	1.40%	175	189,780	24%	59,927	249,707	28%	906,767	78	
Noonsara	465	207	258	87	5.3	465	207	258	87	5.3	1.40%	175	81,555	24%	25,754	107,309	25%	429,236	37	
Goidhoo	437	199	238	88	5.0	437	199	238	88	5.0	1.40%	175	78,844	24%	24,203	103,047	25%	403,389	35	
Foydhoo	687	298	389	142	4.9	687	298	389	142	4.9	1.40%	333	219,023	13%	32,728	251,751	37.4%	677,466	57	
Fevah	696	328	368	131	5.3	696	328	368	131	5.3	1.40%	175	122,099	24%	38,548	160,617	25%	613,799	53	
Bilialthi	451	237	214	93	4.8	451	237	214	93	4.8	1.40%	464	78,089	24%	24,979					

Naanigili	1 561	721	830	204	7.8	1.40%	1 866	175	272,026	24%	85,908	397,507	29%	1,249,124	107
Others	1 183	1 167	16	17	69.6	1.40%	1 218	175	207,482	24%	65,521	273,003	29%	981,539	64
Falidhu Atoll	1 753	992	771	280	6.3	1.40%	1 802								
Falidhu	1 136	134	134	50	6.8	1.40%	334	175	51,230	24%	17,688	74,539	25%	286,157	28
Thinadhoo	114	48	66	32	3.6	1.40%	117	175	19,994	24%	6,314	26,308	25%	105,232	9
Falidhu	469	264	205	75	6.3	1.40%	462	175	82,256	24%	29,976	108,232	29%	432,528	37
Koyyathoo	506	253	253	83	6.1	1.40%	615	175	89,746	24%	32,026	119,771	29%	463,773	40
Rakeedho	237	125	112	38	6.2	1.40%	244	175	41,567	24%	13,128	54,693	25%	218,772	19
Others	109	109	1	2	6.8	1.40%	189	175	16,240	24%	5,760	20,900	25%	98,001	8
Makushahhu	5 094	2 499	2 595	767	5.6	1.40%	5 227								
Raaymadhoo	171	83	88	33	5.2	1.40%	176	175	29,991	24%	9,471	39,462	25%	157,848	14
Madifushi	122	56	66	24	5.1	1.40%	125	175	21,397	24%	6,737	28,134	25%	112,617	10
Veyyah	182	92	90	28	6.5	1.40%	187	175	31,920	24%	10,080	41,999	25%	168,002	14
Mulah	1 200	575	625	165	7.3	1.40%	1 234	175	210,484	24%	66,462	276,928	26%	994,062	85
Mul	787	374	413	119	6.6	1.40%	809	175	139,029	24%	43,588	181,617	26%	694,083	60
Naalafushi	295	147	148	47	6.3	1.40%	303	175	51,739	24%	16,339	68,078	25%	272,311	23
Kaafushahi	936	439	497	150	6.2	1.40%	962	175	164,162	24%	51,841	216,003	27%	797,438	69
Dhiggaaru	876	435	441	140	6.3	1.40%	901	175	153,839	24%	48,517	202,156	27%	752,028	65
Maduvvari	451	234	217	79	5.7	1.40%	464	175	79,099	24%	24,979	104,078	25%	416,313	36
Others	64	64	2	2	32.0	1.40%	66	175	11,226	24%	3,646	14,796	25%	59,078	5
North Nandha Atoll	8 857	1 932	1 895	553	6.9	1.40%	9 353								
Feaali	799	390	409	128	6.2	1.40%	822	175	140,134	24%	44,253	184,387	27%	693,288	60
Sileedhithoo	807	419	408	136	6.1	1.40%	850	175	145,045	24%	45,804	190,849	27%	714,711	61
Magoodhoo	422	188	234	73	5.8	1.40%	434	175	74,013	24%	23,373	97,386	25%	389,543	33
Dharm aboodhoo	227	125	102	38	5.0	1.40%	233	175	39,813	24%	12,572	52,385	25%	208,541	18
Nandha	1 504	762	742	177	6.5	1.40%	1 548	175	263,782	24%	83,259	347,041	29%	1,215,322	104
Others	48	48	1	1	48.0	1.40%	49	175	8,419	24%	2,658	11,077	25%	44,308	4
South Nandha Atoll	5 987	2 962	2 505	812	6.2	1.40%	6 211								
Meedhoo	908	476	432	124	7.3	1.40%	934	175	159,251	24%	50,290	209,541	27%	778,284	67
Ban'dhidoo	578	283	285	77	7.5	1.40%	594	175	101,373	24%	32,013	133,386	26%	521,218	45
Riun'dhidoo	420	193	227	82	6.6	1.40%	432	175	75,662	24%	24,262	99,924	25%	387,097	33
Hulhideli	524	240	284	97	5.4	1.40%	539	175	91,903	24%	29,022	120,924	26%	478,210	41
Gaamadhidoo	528	146	176	62	5.2	1.40%	531	175	85,475	24%	27,834	74,309	25%	297,234	26
Vaani	346	168	178	59	5.9	1.40%	356	175	60,884	24%	19,163	79,847	25%	319,388	27
Maara'boodhoo	597	293	304	99	6.0	1.40%	614	175	104,706	24%	33,065	137,771	26%	538,249	46
Kaafushahhu	1 232	613	619	199	6.2	1.40%	1 261	175	218,076	24%	69,235	288,311	28%	1,017,587	87
Others	140	140	0	3	46.7	1.40%	144	175	24,554	24%	7,754	32,308	26%	129,232	11
Koibumadulu	9 305	4 608	4 797	1 572	5.9	1.40%	9 567								
Buruni	1 130	530	574	79	6.3	1.40%	1 179	175	83,318	24%	16,837	70,155	25%	280,819	24
Vilufushi	1 155	556	599	186	6.2	1.40%	1 188	175	202,572	24%	63,970	266,542	26%	960,875	83
Madifushi	604	292	372	104	6.4	1.40%	638	175	116,457	24%	38,776	155,233	26%	588,865	50
Dhiyamiigili	484	249	235	97	5.0	1.40%	498	175	84,887	24%	28,906	113,793	25%	446,052	38
Guraadhoo	1 433	703	730	198	7.2	1.40%	1 473	333	477,716	13%	71,383	549,099	29.0%	1,898,985	169.8
Kaaf'oodhoo	390	188	202	81	4.8	1.40%	401	175	69,401	24%	21,600	91,001	25%	360,004	31
Vandhoo	273	141	132	47	5.8	1.40%	281	175	47,881	24%	15,120	62,991	25%	252,003	22
Hiriadhoo	759	369	390	123	6.2	1.40%	780	175	133,118	24%	42,037	175,156	26%	662,500	57
Gaadhifushi	1 314	637	614	219	6.1	1.40%	1 333	175	24,721	24%	7,260	72,001	25%	288,003	25
Thimara'fushi	1 537	782	755	250	6.1	1.40%	1 580	175	269,569	24%	85,127	354,696	29%	1,239,099	107
Weymandoo	763	369	394	137	5.8	1.40%	785	175	133,820	24%	42,259	176,079	26%	665,531	57
Kiibidhoo	833	398	437	138	6.0	1.40%	866	175	148,097	24%	46,138	192,235	27%	719,292	62
Omadhoo	395	198	199	78	5.1	1.40%	406	175	69,278	24%	21,877	91,155	25%	364,620	31
Others	3	3	2	1	1.5	1.40%	3	175	528	24%	166	692	25%	2,768	2
Hadhdhummathi	11 888	5 843	5 745	1 852	6.1	1.40%	11 915								
Bidhoo	1 432	688	744	257	5.6	1.40%	1 472	175	251,154	24%	79,312	330,466	26%	1,163,343	100
Dhaan'bidhoo	601	293	318	106	5.7	1.40%	616	175	105,407	24%	33,267	138,674	26%	539,468	46
Maab'idhoo	793	413	380	113	7.0	1.40%	815	175	139,082	24%	43,921	183,002	27%	698,688	59
Mundoo	617	294	253	80	6.5	1.40%	632	175	90,873	24%	28,634	119,507	25%	472,802	41
Kaah'idhoo	433	225	208	71	6.1	1.40%	445	175	75,942	24%	23,982	99,924	25%	399,697	34
Gamu	2 244	1 176	1 068	337	6.7	1.40%	2 307	175	393,588	24%	124,285	517,873	30%	1,737,735	149
Maavah	1 351	637	714	231	6.2	1.40%	1 389	175	238,947	24%	74,825	313,773	26%	1,194,955	95
Foaadhoo	1 740	904	838	282	6.8	1.40%	1 789	175	305,173	24%	96,370	401,543	29%	1,384,104	119
Gaadhoo	208	124	144	65	4.1	1.40%	276	175	47,004	24%	14,843	61,847	25%	247,387	21
Maamadhdhoo	896	442	454	151	5.9	1.40%	921	175	157,148	24%	49,625	206,772	27%	767,198	66
Hiridhoo	694	348	348	135	5.1	1.40%	714	175	121,718	24%	38,437	160,156	26%	612,244	53
Kuramadhdhoo	528	250	278	98	6.0	1.40%	543	175	92,694	24%	29,243	121,938	26%	481,412	41
Others	91	89	2	5	18.2	1.40%	94	175	15,960	24%	5,040	21,000	25%	84,001	7
North Huvadhu Atoll	8 249	4 123	4 126	1 412	5.8	1.40%	8 482								
Koibumadulu	1 130	560	576	184	6.2	1.40%	1 177	175	189,785	24%	63,084	252,869	29%	949,045	82
Viligi	2 261	1 129	1 132	384	6.2	1.40%	2 326	333	753,745	13%	112,829	866,573	31.8%	2,728,258	234.4
Maa'andhdoo	886	427	459	160	5.5	1.40%	911	175	155,393	24%	48,071	204,464	26%	759,817	65
Nilandhoo	432	214	218	82	5.3	1.40%	444	175	75,787	24%	23,928	99,714	27%	398,774	34
Dhaan'dhdoo	1 150	556	594	189	6.1	1.40%	1 182	175	201,895	24%	63,693	265,588	26%	857,180	82
Divaadhoo	588	301	297	124	4.7	1.40%	605	175	103,127	24%	32,957	136,084	26%	529,135	45
Kodiy	260	133	127	49	5.3	1.40%	267	175	45,601	24%	14,400	60,001	25%	240,003	21
Dhiyadhoo	139	71	68	27	5.1	1.40%	143	175	24,379	24%	7,699	32,077	25%	128,309	11
Gaamadhdhu	899	448	451	163	5.5	1.40%	924	175	157,673	24%	49,791	207,464	27%	789,471	66
Kandhuhudhdoo	375	172	203	69	5.4	1.40%	386	175	65,770	24%	20,769	86,539	25%	348,158	30
Others	120	112	8	10	100.0	1.40%	123	175	21,048	24%	6,848	27,896	25%	110,771	10
South Huvadhu Atoll	11 888	5 725	6 161	2 177	9.5	1.40%	12 221								
Madavelli	639	462	477	188	5.0	1.40%	655	175	164,888	24%	52,007	216,895	27%	799,701	69
Headhdhdoo	823	241	221	127	4.1	1.40%	936	175	91,727	24%	28,966	120,694	26%	477,410	41
Nadafaa	699	307	362	134	4.9	1.40%	678	175	115,580	24%	36,499	152,079	26%	584,958	50
Raafandhdoo	1 701	779	822	343	5.0	1.40%	1 749	333	867,059	13%	84,733	951,792	30.7%	2,126,082	182.8
Raafandhdoo	610	307	303	134	4.6	1.40%	627	175	109,986	24%	33,785	143,771	26%	546,094	47
Vaadhdoo	733	335	398	146	5.0	1.40%	754	175	128,558	24%	40,597	169,156	26%	642,483	55
Fiyaa	847	398	459	168	5.0</										

DEMAND SURVEY

Specific energy demand - 2002

Male&Vilingili	Population: 79191				
kWh/capita	Electricity	Biomass	LPG	Kerosene	Total
Households	548,4	0,0	136,7	129,5	815
Lightning	132,1			0,1	
Appliances & AC	414,6			0	
Cooking and smoking	1,7	0,0	136,7	129,4	
Public	19,5	0	0	0	20
Lightning	0			0	
Appliances & AC	0			0	
Manufacturing&commerce	358,8				359
Government buildings	204,5	0	0	0	205
Total	1131,2	0,0	136,7	129,5	1397

Male&Vilingili	Breakdown on fuels				%
kWh/capita	Electricity	Biomass	LPG	Kerosene	Total
Households	67				100
Lightning					
Appliances & AC					
Cooking and smoking					
Public	100				100
Lightning					
Appliances & AC					
Manufacturing&commerce	100				100
Government buildings	100				100
Total	100				100

Atolls	Population: 201559				
kWh/capita	Electricity	Biomass	LPG	Kerosene	Total
Households	139,8	168,8	205,2	162,6	676,4
Lightning	64,6			13,6	78,2
Appliances & AC	63,4			0	63,4
Cooking and smoking	9,6	168,8	205,2	149,0	532,6
Others	2,3		0		2,3
Public	86,0	0,0	22,0	4,6	112,6
Lightning	52,2			0	52,2
Appliances & AC	33,7			3,6	37,3
Cooking and smoking	0,0	0,0	22	1,1	23,1
Others	0,0		0	0	0,0
Manufacturing&commerce	7,9	0,0	1,2	8,9	18,0
Lightning	4,0			5,4	9,3
Appliances & AC	3,9			3,6	7,5
Cooking and smoking	0,0		1,2	0	1,2
Others	0,0		0	0	0,0
Total	233,7	168,8	228,4	176,1	807,1

Atolls	Breakdown on fuels				%
kWh/capita	Electricity	Biomass	LPG	Kerosene	Total
Households	21	25,0	30,3	24,0	100
Lightning	83				100
Appliances & AC	100				100
Cooking and smoking	2				100
Others	100				100
Public	76	0,0	19,6	4,1	100
Lightning	100				100
Appliances & AC	90				100
Cooking and smoking	0				100
Others	#DIVISION/0!				#DIVISION/0!
Manufacturing&commerce	44	0	6,6	49,7	100
Lightning	42				100
Appliances & AC	53				100
Cooking and smoking	0				100
Others	#DIVISION/0!				#DIVISION/0!
Total	29	20,9	28,3	21,8	100

Atolls	Share of total keyfigure				%
kWh/capita	Electricity	Biomass	LPG	Kerosene	Total
Households	59,8	100,0	89,8	92,3	83,8
Lightning	27,6			0,0	9,7
Appliances & AC	27,1			2,0	7,9
Cooking and smoking	4,1	100,0	89,8	84,6	66,0
Others	1,0	0,0	0,0	0,0	0,3
Public	36,8	0,0	9,6	2,6	14,0
Lightning	22,4			0,0	6,5
Appliances & AC	14,4			2,0	4,6
Cooking and smoking	0,0	0,0	9,6	0,6	2,9
Others	0,0	0,0	0,0	0,0	0,0
Manufacturing&commerce	3,4	0,0	0,5	5,1	2,2
Lightning	1,7			3,1	1,2
Appliances & AC	1,7			2,0	0,9
Cooking and smoking	0,0	0,0	0,5	0,6	0,1
Others	0,0	0,0	0,0	0,0	0,0
Total	100	100	100	100	100

Male&Vilingili	%	Breakdown on purpose		
kWh/capita	Electricity	Biomass	LPG	Kerosene
Households	48			
Lightning				
Appliances & AC				
Cooking and smoking				
Public	2			
Lightning				
Appliances & AC				
Manufacturing&commerce	32			
Government buildings	18			
Total	100			

Male&Vilingili	toe	Population: 79191			Total
toe	Electricity	Biomass	LPG	Kerosene	Total
Households	3734	0	931	882	5547
Lightning	900	0	0	1	
Appliances & AC	2823	0	0	0	
Cooking and smoking	12	0	931	881	
Public	133	0	0	0	133
Lightning	0	0	0	0	
Appliances & AC	0	0	0	0	
Manufacturing&commerce	2443	0	0	0	2443
	0	0	0	0	
Government buildings	1393	0	0	0	1393
Total	7702	0	931	882	9515

Atolls	%	Breakdown on purpose		
kWh/capita	Electricity	Biomass	LPG	Kerosene
Households	59,8			
Lightning	27,6			
Appliances & AC	27,1			
Cooking and smoking	4,1			
Others	1,0			
Public	36,8			
Lightning	22,4			
Appliances & AC	14,4			
Cooking and smoking	0,0			
Others	0,0			
Manufacturing&commerce	3,4			
Lightning	1,7			
Appliances & AC	1,7			
Cooking and smoking	0,0			
Others	0,0			
Total	29,0			

Atolls **toe** **Population:** 201559

toe	Electricity	Biomass	LPG	Kerosene	Total
Households	2423	2926	3557	2817	11724
Lightning	1120	0	0	235	1355
Appliances & AC	1099	0	0	0	1099
Cooking and smoking	166	2926	3557	2582	9231
Others	39	0	0	0	39
Public	1490	0	382	80	1952
Lightning	905	0	0	0	905
Appliances & AC	584	0	0	62	646
Cooking and smoking	0	0	382	18	400
Others	0	0	0	0	0
Manufacturing&commerce	137	0	21	155	312
Lightning	68	0	0	93	162
Appliances & AC	68	0	0	62	130
Cooking and smoking	0	0	21	18	39
Others	0	0	0	0	0
Total	4050	2926	3959	3052	13987

Electricity from Survey

	kWh/cap	Share	Share of total keyfigure	
Household	133,0	100%	58,6%	
Lighting	64,6	48,6%		28,5%
Appliances + A/C	63,4	47,7%		28,0%
Cooking + smoking	2,7	2,0%		1,2%
Others	2,3	1,7%		1,0%
Public	86,0	100%	37,9%	
Lighting	52,2	60,8%		23,0%
Appliances + A/C	33,7	39,2%		14,9%
Cooking + smoking	0,0	0,0%		0,0%
Others	0,0	0,0%		0,0%
Manufacturing	7,9	100%	3,5%	
Lighting	4,0	50,1%		1,7%
Appliances + A/C	3,9	49,9%		1,7%
Cooking + smoking	0,0	0,0%		0,0%
Others	0,0	0,0%		0,0%
Total	226,8		100,0%	100,0%

DEMAND

Cooking

LPG Kerosene
20,95522299 11,06295348

Assumptions	density	heat value	conversion	heat value
	ton/m3	GJ/ton	toe/ton	MWh/ton
Diesel oil /gas oil	0,84	42,7	1,035	11,86
Petrol / motor gasoline	0,75	43,8	1,07	12,17
Jet petroleum (kerosene), JP1	0,8	43,5	1,07	12,08
Aviation Gasoline	0,71	43,8	1,07	12,17
JP4	0,76	43,8	1,07	12,17
Kerosene	0,8	43,5	1,045	12,08
LPG	0,54	46	1,13	12,78
Utilised energy for cooking (energy to pot) - kWh/day/household				3,5

All figures includes cooking on boats used for living

Locality and fuel used for cooking	House-holds 2000	Change in Structures	House-holds 2002	Total %	Relative Efficiency	kWh/day primary demand	MWh/year primary demand	Total %	MWh/year Adjusted	toe/year	Population	Per capita kWh/year
Republic	44744		44744	100			128562	100,0	128562		280.751	457,9
Fire wood	19.120		19.120	42,7			33918	26,4	34014			121,2
Oil	18.979		18.979	42,4			40175	31,2	40289			143,5
Gas	6.323		6.323	14,1			52050	40,5	52198			185,9
Electricity	133		133	0,3			2056	1,6	2062			7,3
Other	189		189	0,4			363	0,3				
Total (ex other)	44.744						128199					
Male'	9556		9556	100			21211	100,0	21211	1823,8	79.191	267,8
Fire wood	233	-233	0	2,4	35	9,9	0	0,0	0	0,0		0,0
Oil	4.197	117	4.314	43,9	53	6,5	10250	48,3	10250	881,3		129,4
Gas	4.955	204	5.159	51,9	60	5,8	10827	51,0	10827	931,0		136,7
Electricity	83		83	0,9	78	4,4	134	0,6	134	11,5		1,7
Other	88	-88	0	0,9	20	17,3	0	0,0				
Total (ex other)	9.556						21211					
Atolls	35188		35188	100			107351	100,0	107351	9230,5	201.559	532,6
Fire wood	18.887	-13.500	5.387	53,7	20	17,3	33918	31,6	34033	2926,3		168,8
Oil	14.782	-2.900	11.882	42,0	50	6,9	29925	27,9	30026	2581,8		149,0
Gas	1.368	15.000	16.368	3,9	50	6,9	41223	38,4	41363	3556,6		205,2
Electricity	50	1.400	1.450	0,1	95	3,6	1922	1,8	1929	165,8		9,6
Other	101	0	101	0,3	35	9,9	363	0,3				
Total (ex other)	35.188						106988			0,726		

Locality and fuel used for cooking	Structures	Total %	MWh/year primary demand	MWh/year Adjusted	Total, toe	Per capita kWh/cap
Fire wood	19.120	42,7	33918	34014	2924,7	120,8
Oil (Kerosene)	18.979	42,4	40175	40289	3464,2	143,1
Gas (LPG)	6.323	14,1	52050	52198	4488,2	185,4
Electricity	133	0,3	2056	2062	177,3	7,3
Other	189	0,4	363			1,3
Total	44744	100,0	128562	128562		
Total, toe					11054	

128199

Ministry of Planning and National Development
Population and housing census, 2000.
Table 11.1: Structures classified by type of fuel for cooking

Cooking 2926,3
Smoking 1699,7

Atoll, Public cooking	18,4 toe
	214,0 MWh
	1,1 kWh/cap

RESORTS

kg/liter: 0,84

Energy supply 2002	Start ope	Beds	Tourists	Tourist bednights	Bed util. rate	Distance from Male	Own Ton LFO	External Ton LFO	total Ton LFO	Electricity Ton LFO	Hot water Ton LFO	Steam Ton LFO	LPG kg
						km							
1 Vilu Reef Beach and Spa Resorts	1998	136	4941	46916	0,945	128,7	46,9	17	63,9	503,3			102,92
3 Fullmoon Beach Resort Maldives	1973	312	15738	77603	0,681	5,6	332,8		332,8	1440,0	36	81	603
4 Giravadu Island Resort	1980	132	4337	32936	0,684	11,3	25,8		25,8	374,4			
5 Bandos Island	1972	450		113.168	0,689	8			0	1604,1			
		1030	25016	270623,25			405,52272	17	422,52272	3921,70244	36,04104	80,88192	0 705,92

	transport Kg LFO/ bednight	electricity Kg LFO/ bednight	hot water Kg LFO/ bednight	steam Kg LFO/ bednight	cooking kg LPG/ bednight
1 Vilu Reef Beach and Spa Resorts	1,00	10,7	0	0	0,0022
3 Fullmoon Beach Resort Maldives	4,29	18,6	0,46	1,04	0,0078
4 Giravadu Island Resort	0,78	11,4	0	0	0,0000
5 Bandos Island	0,00	14,2	0	0	0,0000
		14,5			

kg LPG Total	toe/ton	toe LPG Total
31594,114	1,13	35,701348

	transport Kg LFO/ bed	electricity Kg LFO/ bed	hot water Kg LFO/ bed	steam Kg LFO/ bed	cooking kg LPG/ bed
1 Vilu Reef Beach and Spa Resorts	345,0	3700,7	0,0	0,0	0,76
3 Fullmoon Beach Resort Maldives	1066,7	4615,4	115,5	259,2	1,93
4 Giravadu Island Resort	195,4	2836,0	0,0	0,0	0,00
5 Bandos Island	0,0	3564,6	0,0	0,0	0,00
Average		3807,5			

Fishing

Assumptions	density ton/m3	heat value GJ/ton	conversion toe/ton	heat value MWh/ton
Diesel oil /gas oil	0,84	42,7	1,035	11,86
Petrol / motor gasoline	0,75	43,8	1,07	12,17

Diesel

Table 8.8 : FISH CATCH, FISHING TRIPS AND CATCH PER UNIT EFFORT BY LOCALITY, 2001

Locality	Fish Catch (metric tonnes)				Fishing Trips				Catch per unit effort (kgs)						No. of Boats	fishing trips per boat
	Mechanised Masdhonis	Sailing Masdhonis	Mechanised vadhu dhonis	Sailing vadhu dhonis	Rowing boats	mechanise Masdhonis	Sailing adhu dhoni	Mechanised vadhu dhonis	Sailing adhu dhoni	Rowing boats	Mechanised Masdhonis	Mechanised Masdhonis	Sailing vadhu dhonis	Sailing vadhu dhonis		
Republic	123442	430	340	154	73	205897	9508	8751	5522	2729	600	45	39	28	27	
Male'	10863	1	48	2	64	12839	20	1785	56	2145	846	50	27	32	30	
Atolls	112578	429	292	152	9	193058	9488	6966	5466	584	583	45	42	28	15	
Total																

Source: Ministry of Fisheries, Agriculture and Marine Resources

	Big boats	Small boats
Male'	12839	1785
Atolls	193058	6966
Total	205897	8751

Use of kerosene in fishing boats		1,045 toe/ton						
For lighting	number of nights	no. of mecnised boats	liter per night	liters	ton	toe	Population	kWh/cap
	Male	20	182	5,0	18200	18,2	19,0	79191
Atolls	40	1465	5,0	293000	293	306,2	201559	17,67
LPG in fishing boats		1,13 toe/ton						
For cooking	number of times	no. of mecnised boats	kg per time	ton	toe	Population	kWh/cap	
	Male	80	182	0,5	7,28	8,2	79191	1,21
Atolls	160	1465	0,5	117,2	132,4	201559	7,64	

Engine hp	Oil consumption Litre/hour	Operation Hour/day	Total f vessels		Total diese oil		
			Days/year	itre/year operation		l/year	
400	80	10 h/d	200	160000	55	5%	8.816.000
240	52	10 h/d	150	78000	249	23%	19.426.056
140	27	9 h/d	150	36450	798	72%	29.081.560
40	12	10 h/d	150	18000	59		1.062.000
Total						100%	58.385.616

FISHERIES AND AGRICULTURE		2002
Average Number of Vessels Engaged in Fishing (per month)		
Mechanised Masdhoni		1.102
Sail Masdhoni		90
Mechanised Vadhu		59
Sailing Vadhu		9
Trolling Vessels		-
Rowing Boats		16
Total Number of Dhonis		
Mechanised		1.647
Bond Completed		1.593
Total Annual Lease of Uninhabited Islands(in'000 Rf)		1.579

	Big boats	Small boats	Total liter	toe
Male'	6%	20%	7.909.657	6.877
Atolls	94%	80%	50.475.959	43.884
Total	100%	100%	58.385.616	50.760

TRAVEL Atolls

Bandos	Bandos
150 hp	150 hp
0,5 hour	8 km
27 l/hour	1,7 l/km
13,5 l/tour	13,6

Table 1.5 : AREA AND DISTANCE TO MALE' AND ATOLL CAPITALS, BY LOCALITY, 2001 - 2002

Area	Year 2001		Year 2002		
	Distance to Male' (in km)	Distance to Atoll Capital (in km)	Area (in hectares)	Distance to Male' (in km)	Distance to Atoll Capital (in km)
Republic					
Male'	0	-	197	0	-
Villingili	2,8	-	26,9	2,8	-
Atolls					
North Thiladhunmathi (HA)					
Thurakunu	33,3	33,3	22	33,3	33,3
Uligamu	29,6	29,6	112,7	329,7	29,6
Berimadhoo	23,2	23,2	14,6	324,9	23,2
Hathifushi	34,3	34,3	4,1	325,1	34,3
Mulhadhoo	18,7	18,7	118,2	320,6	18,7
Hoarafushi	26	26	63,1	319,5	26
Ihavandhoo	21,8	21,8	60,5	315,8	21,8
Kelaa	13,5	13,5	213,4	311,4	13,5
Vashafaru	5,2	5,2	31,4	305,5	5,2
Dhidhdhoo *	305,1	0	50,6	305,1	0
Filladhoo	13	13	225,6	302,9	13
Maarandhoo	14,8	14,8	41,1	303,6	14,8
Thakandhoo	14	14	45	302,4	14
Uttheemu	5,8	5,8	47	299,3	5,8
Muraidhoo	8,1	8,1	49,5	298,7	8,1
Baarah	13,2	13,2	248,8	295,9	13,2
South Thiladhunmathi (H.Dh)					
Faridhoo	18,3	18,3	23,3	294,9	18,3
Hanimaadhoo (Airport)	19	19	259,5	289,9	19
Finney	13,8	13,8	118,4	290,4	13,8
Naivaadhoo	20,3	20,3	25,7	293	20,3
Hirimaradhoo	12,5	12,5	42,9	288,8	12,5
Nolhivaranfaru	10,2	10,2	150,2	284,1	10,2
Nellaidhoo	17	17	29,7	289,4	17
Nolhivaramu	4,6	4,6	221,1	280,7	4,6
Kuribi	9,4	9,4	31,6	282,8	9,4
Kuburudhoo	6,1	6,1	41,8	281,4	6,1
Kulhudhuffushi *	276,6	0	172,2	276,6	0
Kumundhoo	6	6	178,4	271,5	6
Neykurendhoo	13,4	13,4	163	269,6	13,4
Vaikaradhoo	15,3	15,3	96,5	271	15,3
Maavaidhoo	12,2	12,2	36,5	265,1	12,2
Makunudhoo	46,7	46,7	60,7	263,6	46,7
North Miladhunmadulu (Sh)					
Kaditheemu	52,4	52,4	89,8	260,2	52,4
Noomaraa	40,2	40,2	35,4	255,9	40,2
Goldhoo	51,1	51,1	106,2	258,9	51,1
Feydhoo	35,7	35,7	81,7	248,3	35,7
Feevah	24,2	24,2	79,2	244,1	24,2
Bilehifahi	40,6	40,6	58,4	247,8	40,6
Foakaidhoo	25,2	25,2	55,6	242,6	25,2
Narudhoo	15,3	15,3	41,8	234,5	15,3
Maakandoodhoo	9,9	9,9	90,7	230,5	9,9
Maroshi	26	26	26,7	231,5	26
Lhaimagu	4,6	4,6	37,4	222,9	4,6
Firubaidhoo	7,8	7,8	14,2	218,1	7,8
Komandoo	27,8	27,8	6	215,2	27,8
Maugoodhoo	12,3	12,3	26,7	208,5	12,3
Funadhoo *	220,6	0	86,4	220,6	0
Milandhoo	16,2	16,2	125,5	236,5	16,2
South Miladhunmadulu (N)					
Hebadhoo	25,2	25,2	19,7	201,5	25,2
Kedhikoludhoo	20,8	20,8	218,7	197,6	20,8
Maalendhoo	15,3	15,3	33,6	192,2	15,3
Kudafari	13,1	13,1	22,5	190	13,1
Landhoo	14,4	14,4	81,2	189,6	14,4
Maafaru	10,9	10,9	114,3	184,3	10,9
Lhohi	6,8	6,8	35,2	182,9	6,8
Miladhoo	6,2	6,2	18,1	180,2	6,2
Magoodhoo	5,7	5,7	30,5	178,7	5,7
Manadhoo *	177	0	92,2	177	0
Holhudhoo	16,7	16,7	17,2	177,9	16,7
Fodhdhoo	22	22	24,6	177,4	22
Velidhoo	22,1	22,1	42,6	168,2	22,1
North Maalhosmadulu (I)					
Alifushi	34,2	34,2	45,6	208,5	34,2
Vaadhoo	21,3	21,3	31,3	195,5	21,3
Rasgetheemu	15,7	15,7	30,4	190	15,7
Agolitheemu	14,1	14,1	31,7	188,4	14,1
Ugulaaru *	174,4	0	28,1	174,4	0
Kadhuludhoo	19,8	19,8	11,2	176	19,8
Maakurathu	7,1	7,1	43,4	167,3	7,1
Rasmaadhoo	11,7	11,7	22,7	162,9	11,7
Innamaadhoo	13,2	13,2	27,8	161,4	13,2
Maduvvari	25	25	16,4	160,7	25
Iguraidhoo	21,2	21,2	35,8	154,1	21,2
Fainu	22,7	22,7	50,1	152,7	22,7
Meedhoo	24,7	24,7	30,6	155,4	24,7
Kinolhas	24,3	24,3	44,9	151,5	24,3

Travel Public, Atolls

	Travel km/year	Boat type	Engine hp	Fuel consumption liter/km	Total Liter
Travel Atolls/Male	2.038.192	Dhoni	150	1,7	3.464.926
Travel Atolls/Male	760.240	Smal ferry	1000	9,1	6.892.843
Total	2.798.432				10.357.769
				toe	9.005

Travel from islands to Male			Travel from Atolls to Male		
Trips from islands to Atoll capital per week	Total return trips per year	Total distance per year	Trip from Atoll Capital to Male per week	Total trips per year	Total distance per year
Return trip/week	Trip per year	km/y	Return trip/week	Trip per year	km/y
0,50			1,50		
	4.680	2.038.192		2.080	760.240
1	26	17.295			
1	26	17.144			
1	26	16.895			
1	26	16.905			
1	26	16.671			
1	26	16.614			
1	26	16.422			
1	26	16.193			
1	26	15.886			
			2	78	47.596
1	26	15.751			
1	26	15.787			
1	26	15.725			
1	26	15.564			
1	26	15.532			
1	26	15.387			
1	26	15.335			
1	26	15.075			
1	26	15.101			
1	26	15.236			
1	26	15.018			
1	26	14.773			
1	26	15.049			
1	26	14.596			
1	26	14.706			
1	26	14.633			
			2	78	43.150
1	26	14.118			
1	26	14.019			
1	26	14.092			
1	26	13.785			
1	26	13.707			
1	26	13.530			
1	26	13.307			
1	26	13.463			
1	26	12.912			
1	26	12.693			
1	26	12.886			
1	26	12.615			
1	26	12.194			
1	26	11.986			
1	26	12.038			
1	26	11.591			
1	26	11.341			
1	26	11.190			
1	26	10.842			
			2	78	34.414
1	26	12.298			
1	26	10.478			
1	26	10.275			
1	26	9.994			
1	26	9.880			
1	26	9.859			
1	26	9.584			
1	26	9.511			
1	26	9.370			
1	26	9.292			
			2	78	27.612
1	26	9.251			
1	26	9.225			
1	26	8.746			
1	26	10.842			
1	26	10.166			
1	26	9.880			
1	26	9.797			
			2	78	27.206
1	26	9.152			
1	26	8.700			
1	26	8.471			
1	26	8.393			
1	26	8.356			
1	26	8.013			
1	26	7.940			
1	26	8.081			
1	26	7.878			

Hulhuhuffaar	48,6	185,2	10,8	48,6	185,2	10,8
South Maalhosmadulu (B)						
Kudarikilu	13,7	134,5	22,1	13,7	134,5	22,1
Kamadho	16,2	130,1	21,3	16,2	130,1	21,3
Kendhoo	14,5	134,4	20,4	14,5	134,4	20,4
Kihaadhoo	26,4	123,4	13,9	26,4	123,4	13,9
Dhonfanu	12,6	120,7	11,2	12,6	120,7	11,2
Dharavandhoo	45,5	117,2	9	45,5	117,2	9
Maalhos	23,2	115,7	5,5	23,2	115,7	5,5
Eydhafushi *	22,2	114,2	0	22,2	114,2	0
Thulhaadhoo	5	120,1	26,8	5	120,1	26,8
Hithaadhoo	25,2	113,3	19,6	25,2	113,3	19,6
Fulhaadhoo	31,5	101,7	28,6	31,5	101,7	28,6
Fehendhoo	20,6	99,1	27,2	20,6	99,1	27,2
Goldhoo	113,5	96,2	26,7	113,5	96,2	26,7
Faadhippolhu (Lh)						
Hinnavaru	7,2	147	7,5	12,6	147	7,5
Nalifar *	14,3	142,1	0	14,3	142,1	0
Kurendhoo	19,7	129	16,4	19,7	129	16,4
Oihuvelfushi	19,9	123,5	31,9	19,9	123,5	31,9
Maafiaafushi	49,2	132,5	10,7	49,2	132,5	10,7
Male Atoll (K)						
Kaashidhoo	276,5	87,1	66	276,5	87,1	66
Gaafuru	10	62,6	41,9	10	62,6	41,9
Dhiffushi	13,2	37,2	8,9	18,8	37,2	8,9
Thulusdhoo *	33,5	28,6	0	33,5	28,6	0
Huraa	18,8	20,3	8,4	18,8	20,3	8,4
Himmafushi	24,8	16,5	12,5	24,8	16,5	12,5
Gulhi	5,5	20,5	47,2	5,5	20,5	47,2
Maafushi	23,3	26	53,1	23,3	26	53,1
Guraidhoo	18,2	30,7	58	18,2	30,7	58
North Ari Atoll (AA)						
Thoddo	140,5	67,3	19,8	142,2	67,3	19,8
Rasdhoo *	16,5	57,4	0	16,5	57,4	0
Ukulhas	17,4	71,4	15,7	17,4	71,4	15,7
Mathiveri	18,5	84,5	29,1	20,2	84,5	29,1
Bodufolhudhoo	6,9	81,6	26,5	6,9	81,6	26,5
Feridhoo	43,2	87,9	38,3	43,2	87,9	38,3
Maalhos	23,2	90,2	43,9	23,2	90,2	43,9
Himandhoo	16,4	89,5	47,5	16,4	89,5	47,5
South Ari Atoll (A.dh)						
Hangnameedhoo	17,3	70,7	10,5	17,3	70,7	10,5
Omadhoo	19	73,6	4	21,1	73,6	4
Kuburudhoo	4,9	78,1	5,5	4,9	78,1	5,5
Mahibadhoo *	17,7	75,3	0	17,7	75,3	0
Mandhoo	28,8	103,5	30,5	28,8	103,5	30,5
Dhagethi	21,4	87,9	16,8	21,4	87,9	16,8
Dhigurah	42,8	96,5	25,8	42,8	96,5	25,8
Fenfushi	16,5	110,8	36,4	16,5	110,8	36,4
Dhidhdhoo	13,4	103,7	32	13,4	103,7	32
Maamigili	74,9	107,6	34,6	74,9	107,6	34,6
Felidhu Atoll (V)						
Fulidhoo	9,7	55,8	27,2	9,7	55,8	27,2
Thinadhoo	9,1	76,1	2	9,1	76,1	2
Felidhoo *	11,8	77,9	0	11,8	77,9	0
Keyodhoo	7,3	79,1	1,3	7,3	79,1	1,3
Rakeedhoo	4	95,5	19,6	4	95,5	19,6
Mulakatholhu (M)						
Raiymandhoo	21,6	121,4	19,8	21,6	121,4	19,8
Madifushi	10,9	122,3	18,9	10,9	122,3	18,9
Veyvah	34,5	135,7	4,4	34,5	135,7	4,4
Mulah	57,8	136,5	3	57,8	136,5	3
Muli *	27,3	139,4	0	28,9	139,4	0
Naalaafushi	8,9	142,2	2,8	8,9	142,2	2,8
Kolhufushi	75,6	155,1	23,3	75,6	155,1	23,3
Dhiggaru	4,6	118,2	21,2	7,3	118,2	21,2
Maduvvari	3,1	118,9	20,5	3,7	118,9	20,5
North Nilandhe Atoll (F)						
Feeali	13,6	115,1	26,8	13,6	115,1	26,8
Biledhdhoo	29,5	130,9	12,6	29,5	130,9	12,6
Magoodhoo	17,7	135,9	8,6	17,7	135,9	8,6
Dharaboodhoo	36,5	139,2	4,2	36,5	139,2	4,2
Nilandhoo *	49	141,9	0	49	141,9	0
South Nilandhe Atoll (C)						
Meedhoo	8,9	142,2	38,3	8,9	142,2	38,3
Badidhoo	19,9	149,1	31,4	19,9	149,1	31,4
Ribudhoo	16,1	154,5	28,2	16,1	154,5	28,2
Hulhudheli	15,5	163,5	21,4	15,5	163,5	21,4
Gemendhoo	4,7	162	20,4	4,7	162	20,4
Vaanee	10,9	170,3	13,7	10,9	170,3	13,7
Maaebodhoo	17,6	175	8,2	17,6	175	8,2
Kudahuvadhoo *	64,2	180,4	0	67	180,4	0
Kolhumadulu (Th)						
Buruni	30,5	184,9	42,3	30,5	184,9	42,3
Vilufushi	13,5	186,8	43,2	13,5	186,8	43,2
Madifushi	15,2	202,7	34,9	17,7	202,7	34,9
Dhiyamigili	12	204,9	32	23,5	204,9	32
Guraidhoo	16,9	206,7	29,6	26,9	206,7	29,6
Kadoodhoo	78,2	216,1	25,3	78,2	216,1	25,3
Vandhoo	23,2	218,5	21	23,2	218,5	21
Hirilandhoo	25,1	220,8	21	25,1	220,8	21
Gaadhiffushi	11	216,3	15,3	11	216,3	15,3
Thimarafushi	14,5	223,4	5,7	14,5	223,4	5,7
Veymandoo *	40,8	226,5	0	40,8	226,5	0
Kibidhoo	30,8	229	3,8	30,8	229	3,8
Omadhoo	32,8	230	8	32,8	230	8
Hadhdhunmathi (L)						
Isdhoo	293,7	228,3	32,7	293,7	228,3	32,7
Dhabidhoo	46,6	231	29,4	46,6	231	29,4
Maabaidhoo	43,3	238,3	22	43,3	238,3	22
Mundhoo	19,7	240,1	20,3	19,7	240,1	20,3
Kathaidhoo	17,5	242,5	18	24,8	242,5	18
Gan	516,6	251	10,3	516,6	251	10,3
Maavah	31,8	255,9	29,3	31,8	255,9	29,3
Fonadhoo *	159,2	260	0	159,2	260	0
Gaadhoo	69,4	261,6	4,1	69,4	261,6	4,1
Maamendhoo	18,8	261,9	12,7	18,8	261,9	12,7
Hithadhoo	106,5	264,1	12,9	108,7	264,1	12,9
Kunahandhoo	81,3	266,5	16	81,3	266,5	16
North Huvadhoo Atoll (G)						
Kolamaafushi	20,3	372,4	29,2	20,3	372,4	29,2
Viligili *	52,6	379,7	0	55	379,7	0

1	26	9.630				
		-				
1	26	6.994				
1	26	6.765				
1	26	6.989				
1	26	6.417				
1	26	6.276				
1	26	6.094				
1	26	6.016				
		-	2	104		23.754
1	26	6.245				
1	26	5.892				
1	26	5.288				
1	26	5.153				
1	26	5.002				
		-				
1	26	7.644				
		-	2	104		29.557
1	26	6.708				
1	26	6.422				
1	26	6.890				
		-				
1	26	4.529				
1	26	3.255				
1	26	1.934				
		-	5	260		14.872
1	26	1.056				
1	26	858				
1	26	1.066				
1	26	1.352				
1	26	1.596				
		-				
1	26	3.500				
		-	3	156		17.909
1	26	3.713				
1	26	4.394				
1	26	4.243				
1	26	4.571				
1	26	4.690				
1	26	4.654				
		-				
1	26	3.676				
1	26	3.827				
1	26	4.061				
		-	3	156		23.494
1	26	5.382				
1	26	4.571				
1	26	5.018				
1	26	5.762				
1	26	5.392				
1	26	5.595				
		-				
1	26	2.902				
1	26	3.957				
		-	3	156		24.305
1	26	4.113				
1	26	4.966				
		-				
1	26	6.313				
1	26	6.360				
1	26	7.056				
1	26	7.098				
		-	2	104		28.995
1	26	7.394				
1	26	8.065				
1	26	6.146				
1	26	6.183				
		-				
1	26	5.985				
1	26	6.807				
1	26	7.067				
1	26	7.238				
		-	2	104		29.515
		-				
1	26	7.394				
1	26	7.753				
1	26	8.034				
1	26	8.502				
1	26	8.424				
1	26	8.856				
1	26	9.100				
		-	2	78		28.142
		-				
1	26	9.615				
1	26	9.714				
1	26	10.540				
1	26	10.655				
1	26	10.748				
1	26	11.237				
1	26	11.362				
1	26	11.482				
1	26	11.248				
1	26	11.617				
		-	2	78		35.334
1	26	11.908				
1	26	11.960				
		-				
1	26	11.872				
1	26	12.012				
1	26	12.392				
1	26	12.485				
1	26	12.810				
1	26	13.052				
1	26	13.307				
		-	2	78		40.560
1	26	13.603				
1	26	13.619				
1	26	13.733				
1	26	13.858				
		-				
1						

Maamendhoo	48,5	384	4,3	48,5	384	4,3
Nilandhoo	56,7	392,5	12,9	56,7	392,5	12,9
Dhaandhoo	12,6	394,1	14,7	12,6	394,1	14,7
Dheevadhoo	20,5	402,7	30,7	20,5	402,7	30,7
Kodey	104,4	408,2	31,4	104,4	408,2	31,4
Dhiyadhoo	48,8	410,4	33,7	48,8	410,4	33,7
Gemanafushi	47,2	414,3	37,7	47,2	414,3	37,7
Kanduhulhudhoo	25,2	424,4	46,3	25,2	424,4	46,3
South Huvadhu Atoll (G.Dh)						
Madeveli	33,8	416,5	7,7	33,8	416,5	7,7
Hoadeddhoo	85,5	418	9,2	88,1	418	9,2
Nadallaa	41,4	434	26,3	41,4	434	26,3
Gadhdhoo	22,2	431,5	57,4	22,2	431,5	57,4
Rathafandhoo	35,2	438	32,1	35,2	438	32,1
Vaadho	167,3	437,2	43,9	167,3	437,2	43,9
Fiyoori	72,6	440,9	37,2	72,6	440,9	37,2
Maathodaa	15,6	442,7	41,6	15,6	442,7	41,6
Fares	21,6	443,1	42,4	21,6	443,1	42,4
Thinadhoo *	58,1	409	0	104,4	409	0
Fuvahmulah (Gn)						
Fuvahmulah *	420	497	0	420	497	0
Addu Atoll (S)						
Feydhoo	49,2	541,1	9,3	49,2	541,1	9,3
Hithadhoo *	467,3	533,7	0	467,3	533,7	0
Hulhudhoo	151,8	530,7	15,5	151,8	530,7	15,5
Meedhoo	166	529,8	15,9	166	529,8	15,9
Maradhoo	74,9	539,6	7	74,9	539,6	7
Maradhoo-Feydhoo	31,4	540,3	7,9	31,4	540,3	7,9

* Atoll capital
1_/As of May 2003
Source : Ministry of Planning and National Development

1	26	19.968			
1	26	20.410			
1	26	20.493			
1	26	20.940			
1	26	21.226			
1	26	21.341			
1	26	21.544			
1	26	22.069			
		-			
1	26	21.658			
1	26	21.736			
1	26	22.568			
1	26	22.438			
1	26	22.776			
1	26	22.734			
1	26	22.927			
1	26	23.020			
1	26	23.041			
		-	2	78	63.804
		-			
		-	2	78	77.532
		-			
1	26	28.137			
		-			
		-	2	78	83.257
1	26	27.596			
1	26	27.550			
1	26	28.059			
1	26	28.096			

Vaadhoov Diving Paradise	1978	18	8	8	66	1
Vilivaru Island Resort	1981	120	29	29	120	0.7
North Ari Atoll						
Bathala Island Resort	1983	20	48.3	48.3	90	0.5
Ellaidhu Tourist Resort	1985	32	54	54	156	1
Fesdhu Fun Island	1982	90	72.4	72.4	110	0.7
Gangehi Island Resort	1987	50	77.2	77.2	50	0.3
Halaveli Holiday Village	1982	30	36	36	112	0.7
Kuramathi Tourist Resort	1977	48	56.3	56.3	580	3.5
Maayafushi Tourist Resort	1983	48	63	63	120	0.7
Madogali Resort	1989	70	77.2	77.2	112	0.7
Nika Hotel	1983	30	69.2	69.2	56	0.3
Ranveli Village	1991	112	77	77	112	0.7
Velidhu Island Resort	1989	22	80.5	0	200	1.2
Veligandhu Island	1984	34	51	51	146	0.9
South Ari Atoll						
Angaga Island Resort	1989	100	85	0	100	0.6
Ari Beach Resort	1988	180	104	0	282	1.7
Athurugau Island Resort	1990	79	90	0	92	0.6
Hilton Maldives Resort & Spa Ran	1992	80	96.6	0	304	1.9
Holiday Island	1994	284	93	0	284	1.7
Kuda Rah Island Resort	1984	50	88.5	0	60	0.4
Lily Beach Resort	1994	168	95	0	170	1
Machchufushi Island Resort	1992	96	95	0	128	0.8
Mirith Marina Luxury Resort	1989	36	112.6	0	72	0.4
Moofushi Island Resort	1990	84	80	0	120	0.7
Sun Island Resort / Nalaguraidhoo	1998	700	99.8	0	700	4.3
Thundufushi Island Resort	1990	74	80.5	0	94	0.6
Twin Island	1991	60	54.7	0	76	0.5
Vakanafushi Island Resort	1994	100	90	0	100	0.6
Vilamendhoo Island Resort	1994	200	48.3	0	282	1.7
Felidhu Atoll						
Almatha Aquatic Resort	1975	20	48	48	204	1.2
Dhiggiri Tourist Resort	1982	50	32	32	90	0.5
Mulakatholhu						
Hakuraa Club	1999	72	128.7	0	140	0.9
Medhufushi Island resort	2000	240	128.7	0	240	1.5
North Nilandhe Atoll						
Filtheyo Island Resort	1999	250	120.7	0	250	1.5
South Nilandhe Atoll						
Velavaru Island Resort	1998	50	125	0	168	1
Vilu Reef Resort / Meedhufushi	1998	136	128.7	0	136	0.8

0	0	0	2	0	0	0	3	-	-	-	11.680	-	-	-	17.520	1.7	8.5	49.640	-
0	0	3	0	0	0	3	0	-	-	63.510	-	-	-	63.510	-	1.7	8.5	215.934	-
0	0	0	2	0	0	0	3	-	-	-	-	-	-	-	-	1.7	8.5	-	-
0	0	3	0	0	0	3	0	-	-	105.777	-	-	-	105.777	-	1.7	8.5	359.642	-
3	0	0	0	1	0	0	0	-	-	118.260	-	-	-	39.420	-	1.7	8.5	67.014	1,005.210
0	0	3	0	0	0	3	0	-	-	158.556	-	-	-	158.556	-	1.7	8.5	539.090	-
0	0	3	0	0	0	3	0	-	-	169.068	-	-	-	169.068	-	1.7	8.5	574.831	-
0	0	3	0	0	0	3	0	-	-	78.840	-	-	-	78.840	-	1.7	8.5	268.056	-
3	0	0	0	1	0	0	0	-	-	123.297	-	-	-	41.099	-	1.7	8.5	69.868	1,048.025
0	0	3	0	0	0	3	0	-	-	137.970	-	-	-	137.970	-	1.7	8.5	469.098	-
0	0	3	0	0	0	3	0	-	-	169.068	-	-	-	169.068	-	1.7	8.5	574.831	-
0	0	3	0	0	0	3	0	-	-	151.548	-	-	-	151.548	-	1.7	8.5	515.263	-
0	0	3	0	0	0	3	0	-	-	168.630	-	-	-	168.630	-	1.7	8.5	573.342	-
3	0	0	0	1	0	0	0	-	-	-	-	-	-	-	-	1.7	8.5	-	-
0	0	3	0	0	0	3	0	-	-	111.690	-	-	-	111.690	-	1.7	8.5	379.746	-
0	0	0	2	0	0	0	3	-	-	-	-	-	-	-	-	1.7	8.5	-	-
0	0	3	0	0	0	3	0	-	-	-	-	-	-	-	-	1.7	8.5	-	-
3	0	0	0	1	0	0	0	-	-	-	-	-	-	-	-	1.7	8.5	-	-
0	0	3	0	0	0	3	0	-	-	-	-	-	-	-	-	1.7	8.5	-	-
3	0	0	0	1	0	0	0	-	-	-	-	-	-	-	-	1.7	8.5	-	-
3	0	0	0	1	0	0	0	-	-	-	-	-	-	-	-	1.7	8.5	-	-
0	0	3	0	0	0	3	0	-	-	-	-	-	-	-	-	1.7	8.5	-	-
0	0	3	0	0	0	3	0	-	-	119.793	-	-	-	119.793	-	1.7	8.5	407.296	-
0	0	3	0	0	0	3	0	-	-	-	-	-	-	-	-	1.7	8.5	-	-
3	0	0	0	1	0	0	0	-	-	105.777	-	-	-	35.259	-	1.7	8.5	59.940	899.105
0	0	0	2	0	0	0	3	-	-	-	-	-	-	-	-	1.7	8.5	-	-
3	0	0	0	1	0	0	0	-	-	105.120	-	-	-	35.040	-	1.7	8.5	59.568	893.520
0	0	3	0	0	0	3	0	-	-	70.080	-	-	-	70.080	-	1.7	8.5	238.272	-
0	0	0	2	0	0	0	3	-	-	-	-	-	-	-	-	1.7	8.5	-	-
0	0	3	0	0	0	3	0	-	-	-	-	-	-	-	-	1.7	8.5	-	-
3	0	0	0	1	0	0	0	-	-	-	-	-	-	-	-	1.7	8.5	-	-
0	0	0	2	0	0	0	3	-	-	-	-	-	-	-	-	1.7	8.5	-	-
3	0	0	0	1	0	0	0	-	-	-	-	-	-	-	-	1.7	8.5	-	-
0	0	0	2	0	0	0	3	-	-	-	-	-	-	-	-	1.7	8.5	-	-
3	0	0	0	1	0	0	0	-	-	-	-	-	-	-	-	1.7	8.5	-	-
0	0	0	2	0	0	0	3	-	-	-	-	-	-	-	-	1.7	8.5	-	-
3	0	0	0	1	0	0	0	-	-	-	-	-	-	-	-	1.7	8.5	-	-
0	0	3	0	0	0	3	0	-	-	-	-	-	-	-	-	1.7	8.5	-	-
0	0	3	0	0	0	3	0	-	-	-	-	-	-	-	-	1.7	8.5	-	-

0	0	1	-
0	0	1	-
0	0	1	-
0	0	1	-
0	0	1	-
0	0	1	-
0	0	1	-
0	0	1	-
0	0	1	-
0	0	1	-
80.5	1	6.440	-
0	0	1	-
0	0	1	-
85	1	8.800	-
104	1	8.320	-
90	1	7.200	-
96.6	1	7.728	-
93	1	7.440	-
88.5	1	7.080	-
95	1	6.800	-
95	1	7.600	-
112.6	1	9.008	-
0	0	1	-
99.8	1	7.984	-
80.5	1	6.440	-
0	0	1	-
90	1	7.200	-
0	0	1	-
0	0	1	-
0	0	1	-
128.7	1	10.296	-
128.7	1	10.296	-
0	0	1	-
120.7	1	9.656	-
0	0	1	-
125	1	10.000	-
128.7	1	10.296	-

Vehicles

Table 11.3 : REGISTERED AND NEWLY REGISTERED VEHICLES ACCORDING TO TYPE, 2000 - 2002

Type of vehicles	2002	Fuel			Avg. Dist	Mileage	Fuel economy petrol	Fuel economy diesel	Total petrol	Total diesel	
	Registered	Petrol	Diesel	Total	km/day	km/year	km/liter	km/liter	Liter	Liter	
All Types	19.914										
Motor Car	1.948	100%	0%	100%	15,00	5.475	12,0	14,0	884.721	3.475	
Motor Cycle/Auto Cycle	14.248	100%	0%	100%	10,00	3.650	22,0		2.363.873		
Lorries/Trucks/Tractors	707	98%	2%	100%	40,00	14.600	6,0	8,0	1.690.185	22.636	
Van/Bus	613	28%	72%	100%	30,00	10.950	7,0	8,0	265.483	606.747	
Jeep/Landrover/Pickup	1.243	25%	75%	100%	10,00	3.650	7,0	10,0	162.034	340.271	
Taxis(running in Male')	567	100%	0%	100%	70,00	25.550	12,0	14,0	1.207.238	-	
Other Vehicles	588	90%	10%	100%	5,00	1.825	6,0	8,0	160.965	13.414	
<i>Source: Ministry of Transport and Civil Aviation</i>											
Total									6.734.498	986.543	
									toe	5.404	858

Type of vehicles	2002	Male	Atolls	Total petrol	Total diesel	Male diesel	Atolls Diesel	Male petrol	Atolls petrol	
	Registered			Liter	Liter					
All Types	19.914									
Motor Car	1.948	100%	0%	884.721	3.475	3.475	-	884.721	-	
Motor Cycle/Auto Cycle	14.248	95%	5%	2.363.873	-	-	-	2.245.679	118.194	
Lorries/Trucks/Tractors	707	99%	1%	1.690.185	22.636	22.410	226	1.673.283	16.902	
Van/Bus	613	99%	1%	265.483	606.747	600.679	6.067	262.828	6.067	
Jeep/Landrover/Pickup	1.243	100%	0%	162.034	340.271	340.271	-	162.034	-	
Taxis(running in Male')	567	100%	0%	1.207.238	-	-	-	1.207.238	-	
Other Vehicles	588	99%	1%	160.965	13.414	13.280	134	159.355	1.610	
<i>Source: Ministry of Transport and Civil Aviation</i>										
Total				6.734.498	986.543	980.115	6.428	6.595.138	142.773	
						toe	852	6	5.293	115

Info from Ministry of Transport

Type of vehicles	petrol	diesel	petrol	diesel
All Types				
Motor Car	873	4	99,5%	0,5%
Motor Cycle/Auto Cycle	8693	0	100,0%	0,0%
Lorries/Trucks/Tractors	56	1	98,2%	1,8%
Van/Bus	67	175	27,7%	72,3%
Jeep/Landrover/Pickup				
Taxis(running in Male')				
Other Vehicles				

LPG for Thilafushi						
	number of times per day	kg per time	kg/year	ton	toe	
For cooking etc	1	10	3650	3,65	4,1	
LPG for Airport			10,81339713 kWh/kg		1,13 toe/ton	
	Daily Average kW	Yearly consumption kWh		ton	toe	
For cooking etc	3	26280	2430,318584	2,430318584	2,75	
					1,13 toe/ton	

Diesel for Airport							
km/operation	flights	operations	km/year	n/liter	liters	ton	toe
5	8703	17406	87030	4	21758	21,8	22,5
						1,035 toe/ton	

Petrol for Airport							
km/operation	flights	operations	km/year	er/km	liters	ton	toe
4	8703	17406	69624	11	6329	6,3	6,8
						1,07 toe/ton	