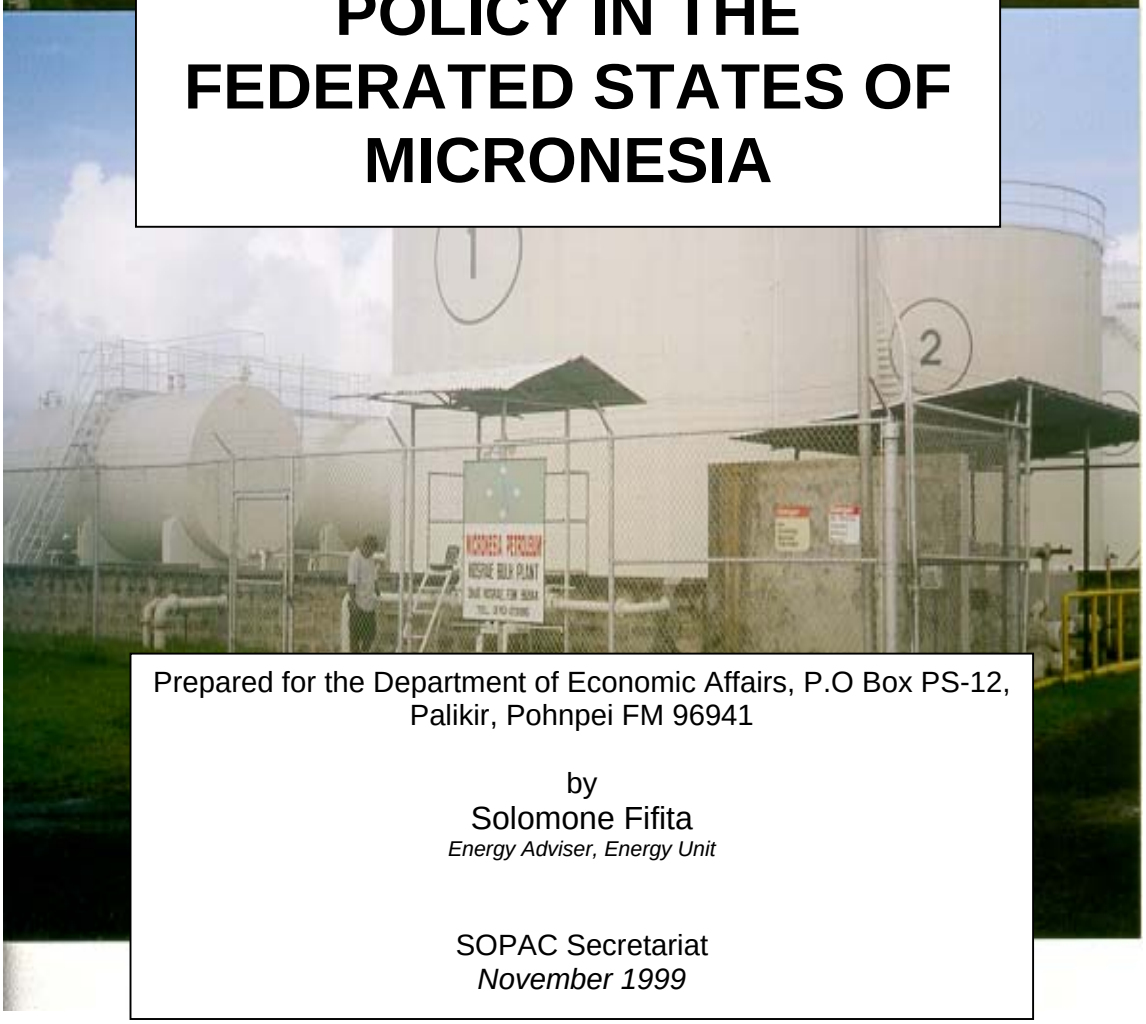
THE NATIONAL ENERGY POLICY IN THE FEDERATED STATES OF MICRONESIA



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ABBREVIATIONS USED

ADO	Automotive Diesel Oil
BES	Bi-annual Energy Summit
DoE	Department of Energy
DEA	Department of Economic Affairs
DSM	Demand Side Management
EPA	Environment Protection Authority
ESCOs	Energy Service Companies
EFP	Energy Focal Point
FSM	Federated States of Micronesia
GDP	Gross Domestic Product
LPG	Liquefied Petroleum Gas
MOMI	Mobil Oil Micronesian Islands
MPC	Micronesia Petroleum Corporation
NEC	National Energy Committee
OMIP	Operation and Maintenance Improvement Program
OTEC	Ocean Thermal Energy Conversion
PICCAP	Pacific Islands Climate Change Action Program
PREA	Pacific Regional Energy Assessment
PUC	Pohnpei Utility Corporation
PV	Photovoltaic
ROI	Return on Investment
SPREP	South Pacific Regional Environment Program
US	United States

ENERGY CONVERSIONS AND MEASUREMENTS

	Unit	Typical Density kg/litre	Typical Density l/tonne	Gross Energy MJ/kg	Gross Energy MJ/litre	Oil Equiv toe/unit (net)
Biomass Fuels						
Fuelwood (5% mcwb)	tonne			18.0		0.42
Coconut residues (air day)[1]						
Shell (15% mcwb)$_{harvested}$	tonne			14.6		.34
Husk (30% mcwb)$_{harvested}$	tonne			12.0		.28
Average (air dry $_{husk\ and\ shell}$)[2]	tonne			14.0		.33
Coconut Palm Wood (air dry)	tonne			11.5		.27
Charcoal	tonne			30.0		.70
Vegetable and Mineral Fuels						
Crude Oil	tonne			42.6		1.00
Coconut Oil	tonne	0.910	1100	38.4		0.90
LPG (propane)	tonne	0.510	1960	50.0	25.5	1.17
Ethanol	tonne			27.0		0.63
Gasoline (Super)	tonne	0.730	1370	46.5	34.0	1.09
Gasoline (Unleaded)	tonne	0.735	1360	46.5	34.2	1.09
Aviation gasoline (Avgas)	tonne	0.695	1440	47.5	33.0	1.12
Lighting Kerosene	tonne	0.790	1270	46.4	36.7	1.09
Power Kerosene (Avtur, DPK)	tonne	0.795	1260	46.4	36.9	1.09
Automotive Diesel (ADO)	tonne	0.840	1190	46.0	38.6	1.08
High Sulfur Fuel Oil (IFO)	tonne	0.980	1020	42.9	42.0	1.01
Low Sulfur Fuel Oil (IFO)	tonne	0.900	1110	44.5	40.1	1.04
Electricity (MWh)						
Fuelwood[3]	MWh					0.93

Fuel Conversion Efficiency

Diesel: Text uses actual where known, otherwise:
Average efficiency for small (<100kW output) diesel engine .46 l/kWh (22%)
Average efficiency for large (>100kW output) modern diesel .284 l/kWh (36%)
Average efficiency of low speed, base load diesel (Pacific region) .30-.33 l/kWh (28–32% eff)

Energy Measurements

Area: 1.0 km^2 = 100 hectares = 0.386m^2
1.0 acre = 0.41 hectares

Mass: 1.0 long tons = 1.016 tonnes

Energy: 1 kWh = 3.6 MJ = 860 kcal = 3412 Btu = 0.086 kgoe
1 toe = 11.83 MWh = 42.6 GJ = 10 million kcal = 39.68 million Btu
1 MJ = 238.8 kcal = 947.8 Btu = 0.024 kgoe = 0.28 kWh

Sources:
Petroleum for Australian Institute of Petroleum, January 1991
Renewable Energy Assessment – An Energy Planners Manual. (Gowan 1985)
Woody & Biomass Use in Agro-Industries. (PEDP, Gilmour, 1987)
Energy Data and Conversion Factors (NZ Energy Research & Development Committee 1984)

[1] Average yield of 2.93 air dry tonnes residues/tonne copra produced (Average NCV 14.0 MJ/kg)
mcwb = moisture content wet basis. NCV = net calorific value
[2] Proportion: kernel 33%, shell 23%, husk 44% by dry weight.
[3] Assumes conversion efficiency of 9% (biomass-fuelled boiler)

ACKNOWLEDGEMENTS

This National Energy Policy document is a product of a National Energy Summit held in Pohnpei on 30 & 31 August 1999. The Summit was an opportunity for delegates from both the States and National governments and the private sector to participate in the formulation of FSM's National energy sector policies based on an earlier draft produced by SOPAC.

The written comments received from the Pohnpei Environmental Protection Agency, the Legislature of the State of Yap, the Micronesian Petroleum Company, the Office of the Governor of Chuuk and the FSM Department of Economic Affairs provided very constructive and productive ideas for the review of this document.

The active and constructive participation of the Summit participants, the assistance of the Secretary and staff of the Department of Economic Affairs particularly that of Messrs Maderson Ramon and Edgar Santos are gratefully acknowledged. Their time and knowledge were very useful in the production of this energy policy document.

Mr Alan Bartmanovich, Petroleum Adviser with the Forum Secretariat, provided very valuable inputs to the National Energy Summit and to the petroleum sections of this report.

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EXECUTIVE SUMMARY

The absence of a national energy sector policy has been identified as a major constraint to the effective development and management of the energy sectors of Pacific Island Countries. The energy sector policy is supposed to represent a government's vision for the development of its energy sector in the medium to long term. It will thus give confidence and minimize the risks to both public and private sector participation in the sector.

The drafting of FSM's energy policy involved an overview of the energy sector so as to identify the major constraints to the pursuance of the sector's objective(s). The major constraints in the sector were identified to be:

- a relatively small but fragmented energy sector;
- an environment which is not too conducive to promoting private sector participation and competition;
- lack of capacity to plan and manage the sector;
- a highly subsidized power sector operation;
- absence of any national standards and networking in the power and petroleum sectors;
- inadequate fire fighting capacity for possible fire hazards;
- no clear oil industry commitment for the disposal of waste and used oil;
- need for the development of a long term sustainable development plan;
- absence of any long term data on the country's renewable energy potentials;
- high capital costs of renewable energy systems;
- disposal of used batteries;
- and the non-sustainability of the existing rural electrification projects

In the absence of a current objective for the energy sector, this study recommends the objective: **"Promoting the sustainable social and economic development of FSM through the provision and utilization of cost-effective, safe, reliable and sustainable energy services"** be adopted. Based on the identified constraints and the recommended energy sector objective, the recommended policy has been formulated based on Five Star policy elements. These policy elements are:

- an effective, coordinated, resilient and dynamic joint States and National energy sector;
- a safe, reliable, cost-effective and sustainable energy supply;
- an efficient, attentive, responsive and competitive energy sector;
- a diversified energy resource base; and
- the environmentally sound and efficient use of energy.

Out of the National Energy Summit, an energy policy matrix was produced and presented to the FSM Second Economic Summit, which was held during 13-17 September 1999. The matrix was discussed at the Summit's transportation, communication and infrastructure committee's meeting. The committee's report and the revised energy policy matrix are attached as **Annex 1**. It should be noted that the revised energy policy matrix is now a part of the National Energy Policy matrix, which would be submitted to the FSM Congress for adoption.

INTRODUCTION

The global economic scene is undergoing major transformations and Pacific Island countries would have to adjust to these changes. This adjustment would, among other things, entail the formulation of comprehensive national and sectoral policies, which represent their respective socio-economic and political aspirations.

In October 1998, the Department of Economic Affairs in FSM requested assistance from SOPAC to draft its national energy sector policy. This assistance is to complement other public sector and economic reform programs that are currently being studied and/or implemented in FSM.

The assistance delivered by SOPAC involved in-country consultations to collect data and information and to seek the views of relevant authorities in FSM on the subject matter. In collaboration with the Petroleum Adviser at the Forum Secretariat, a draft national energy policy document was produced and circulated for the comments of the relevant organizations in both the States and National governments.

A National Energy Summit was then convened in Pohnpei in which delegates from both the States and National governments were given the opportunity to formulate the energy policy statements independently of the SOPAC-produced draft. A participatory approach was adopted in which participants first identified what they see as the most appropriate national objective(s) for the energy sector. Based on this objective, participants identified what they see as the objectives of the major areas in the energy sector, viz, power, petroleum, renewable energy and institutional. Having identified the objectives, participants identified the major issues and constraints in the four broad areas, which are hindering the progress towards the respective objectives. They also identified the opportunities, which should be exploited to assist in the progress towards the objectives. Strategies for addressing these issues as well as those for exploiting the opportunities were identified. These energy strategies were then grouped and in line with the identified energy objectives, general policy statements were formulated as a representation of what is envisaged

that the energy sector should be in the years to come. **Annex 2** shows a matrix of how the policy statements were derived.

The policy statements in themselves are necessary but not sufficient. There must be a long-term political commitment to adopt it, to review and to comply with it. National consensus is therefore critical to the effectiveness of the recommended policy. The National Energy Summit was fully aware of this and took it up to the FSM Second Economic Summit, which was convened on 13-17 September 1999. In this Economic Summit, the energy policy matrix from the Energy Summit was revised and included in the National Economic policy matrix **(see Annex 1)**. The National Economic policy matrix is to be submitted to the FSM Congress for adoption.

People Consulted during the Field Mission

1.	Mr Sebatian Anefal	Secretary, Department of Economic Affairs (DoEA)
2.	Mr Maderson Ramon	Administrator, Commerce & Industry, DoEA
3.	Mr Marcelino Actouka	General Manager, Pohnpei Utility Corporation
4.	Mr Killeusa. L. Isaac	Pohnpei Environmental Protection Agency
5.	Mr Elden Hellan	Pohnpei Environmental Protection Agency
6.	Mr Sylvester Hadley	Acting Secretary, Dept of Finance and Administration
7.	Mr Breeman E Obed	Customs Specialist, Finance and Administration
8.	Mr William Iriarte	General Manager, Mobil Oil
9.	Mr Robert Hadley	Assistant Secretary, Transportation & Communication
10.	Mrs Tina Takashy	Head, Aid Coordination Unit, DoEA
11.	Mr William Ladore	Business Development Officer, DoEA
12.	Mr Nelson	Administrator, Fisheries, DoEA
13.	Mr Weiner Hadley	Administrator, Transportation and Communication
14.	Mr Mark Sturton	Consultant, EMPAT
15.	Mr Steven Joseph	Pohnpei Branch Manager, FSM Bank
16.	Mr Augustin Garae	President, FSM Development Bank
17.	Mr Peter Sitan	President, National Fisheries Corporation
18.	Mr Milan Kamber	Caroline Fisheries Corporation
19.	Mr Timothy Cole	Australian Ambassador for FSM, Palau and RMI
20.	Mr Hostino E. Livaie	Operations Manager, Micronesian Petroleum Company
21.	Mr Bellarmin Ioannis	Deputy Secetary, DoEA

ECONOMIC BACKGROUND

The Federated States of Micronesia (FSM) was formed in May 1979 and is made up of the four States of Chuuk, Kosrae, Pohnpei and Yap. FSM was once administered as a US Trust Territory, however, it gained its independence in 1986 under an agreement with the US, known as the Compact of Free Association[4]. This agreement sets out the economic and political ties between

[4] The Compact of Free Association grants full political independence with the exception of matters relating to security and defence. Some of the grant assistance includes Section 211, which grants $60 million annually for the first five years (1986/87 – 1990/91); $51 million annually for the subsequent five years and $40 million for the final five years. Not less than 40% of these must be allocated to capital projects set out in development plans prepared by the FSM. Section 214(a) is an annual grant of $3 million for a 14-year period to improve energy self-sufficiency. In addition, program assistance that was available under the Trust Territory status would be provided at no cost. Other services not included in the Compact are also made available. One of these is the programs and services of the Rural Electrification Administration.

the two nations over the fifteen-year period of 1986-2001. The system of government in the FSM is based on the US model with each State having a high degree of autonomy based on their respective constitutions.

The growth of the FSM economy has been volatile due largely to shifts in fiscal policy. For example, in 1990 and 1992 it was obvious that the step down in Compact funding led to substantial declines in government current expenditures. This was to be expected given that between 1987 – 1995, total government expenditures averaged 88% of the GDP.

Total external grants fell by 20% between 1990/91 and 1991/92 as a result of the first step down in Compact funding. The further step down during the 1996/97 period was expected to be equivalent to a 15% reduction in external grants and it is expected that a very significant reduction in funding will occur in 2001. As FSM moves toward financial independence from the Compact funding, growth is expected to correspondingly remain low.

Marine products, mostly tuna exports to the Japanese sashimi markets, dominate export from FSM. Between 1992-96, Pohnpei was the major exporter. Over the same period, food has been the major import item followed by petroleum products. While Pohnpei has been the major exporting State, it has also been the major importer and thus the major contributor to the trade imbalance. **Figures 1** and **2** show the exports and imports by States for 1992-96.

FSM has had only two national development plans, the first for the 1985-89 period and the second being for 1992-96. These plans were a necessity under the Compact agreement. The major themes in the second development plan were:

- creation of additional employment and income earning opportunities in the private sector;
- human resources development;
- more effective unity and cooperation at all levels of government;
- improving the efficiency of government through commercialization and the privatization of some of its activities;
- promotion and the preservation of the nation's rich cultural heritage;
- equitable distribution of opportunities; and
- the promotion of appropriate social and health services and the provision of appropriate services for the nation's youths.

OVERVIEW OF THE ENERGY SECTOR

The Energy Sector Objectives

FSM's Second National Development Plan (1992-96) contains the latest national objectives for its energy sector. They were to:

- improve the system of petroleum supply, pricing and quality control;
- provide cost efficient power service for existing state centres and evaluate and implement cost-effective energy sources for rural areas and outer islands;
- improve the reliability and efficiency of electric power generation and distribution;
- improve the financial management of power utilities by reducing government subsidies;
- examine the feasibility, implementation and evaluation of renewable energy projects, particularly small photovoltaic systems for isolated insular areas;
- ensure adequate generation capacity is available to meet the requirements of economic development projects and programs giving due attention that the design of these programs must use energy efficient systems; and
- reduce dependence on petroleum products through energy conservation and tax disincentives.

The Institutional Structure

National

The planning, management and the coordination of FSM's national energy sector are the responsibilities of a senior officer[5] at the Department of Economic Affairs (DEA). There is no Congressional appropriation and hence no written statement as to the exact details of this coordination responsibility. It is believed that the active participation of FSM on regional energy activities[6] in the 1980s and early 1990s led to the creation of this responsibility at the National government. It was more to do with participation in regional energy activities rather than playing a national role on the energy sector through the Compact energy grants. It is however noted that a Congressional Appropriation in 1995 to hire a Petroleum Adviser resulted in a term of reference clearly spelling out the responsibilities of the adviser.

[5] This senior officer is also responsible for trade development, tourism and investment promotion.
[6] Most notably on photovoltaics and petroleum. FSM was a member of, and chaired, the management committee of the Regional Petroleum Unit of the Forum Secretariat's Energy Division.

There are no established direct links between the energy coordination at the National level and the energy activities of the States[7] although these could have been established through the distribution of the Compact's energy grants. There are therefore no direct interventions by the national energy coordination on such matters such as:

- the pricing of commercial energy sources;
- the promotion of the efficient use of energy;
- establishment of safety standards on the storage and distribution of energy;
- major energy sector investments;
- identification of the indigenous energy potential; and
- energy supply and demand analysis, etc.

While it is assumed that the national coordination role would involve monitoring the performance of the national energy sector and the formulation of appropriate policies and strategies to address national energy issues and constraints, minimal work has been done in these areas. This is largely a result of the lack of priority placed on this responsibility which is reflected in the fact that it is not clearly defined[8] and adopted[9] at the national level. It is lumped together with equally demanding and higher priority areas on only one person[10] and hence the absence of any direct interaction between the National and State governments on energy matters.

The Sectoral Development Division of the DEA has four staffed sectors. They are the fisheries, agriculture, tourism and the sustainable development sectors (see the organizational chart in **Annex 3**). In the sustainable development sector, both national and external funds[11] are used to cover National and State programs relating to sustainable development. There is an established close working relationship between the PICCAP coordinator at the National office and his counterparts in the States.

In 1981, the US Department of Energy (DoE) funded Energy Planner positions in the National and State governments. The role of the national Energy Planner was more to do with coordinating the DOE-funded projects in the States rather than ensuring that all efforts are coordinated and are in line with a national energy policy.

[7] Some States regard this national coordination as an obstacle to the flow of assistance and information and have requested that they be contacted directly on matters directly affecting them.

[8] In some other island countries, the energy office was established by Cabinet to act as the Secretariat to a National Energy Committee (NEC). This followed the oil price shocks of the 1970's and 80's. NEC's responsibility was therefore restricted to petroleum and they were to monitor the adverse economic effects of the rising oil prices and to consider and recommend remedial measures back to Cabinet.

[9] When properly defined, one would see the major potential economic benefit to be derived by the proper and efficient execution of these responsibilities, particularly in the areas of petroleum and electricity pricing, energy conservation, security of energy supply, safety of energy storage and etc. This should be the major justification for the establishment of an Energy Focal Point who shall be the Secretariat of a Bi-annual Energy Summit. (see pages 20-22 for further details).

[10] Current incumbent estimates that he spends 2% of his time on his energy responsibilities.

[11] This is largely from the SPREP-managed UNDP-funded Pacific Islands Climate Change Action Program (PICCAP)

The States

Energy Offices

By 1992, the DOE assistance was discontinued and the position in Chuuk became vacant whereas the position in Yap was abolished. Kosrae and Pohnpei still have their Energy Planners with the primary responsibility of managing photovoltaic and other rural energy projects.

As in national energy coordination, the State energy offices do not have any coordination role and therefore do not have any established links with their respective energy suppliers and major consumers. They therefore have little to do with energy policy and planning and are focussing only on rural energy projects.

The energy offices are small with the number of staff averaging two. Despite their relatively small sizes, the State energy offices (Pohnpei, for example) have and are responsible for large capital funds (up to USD 300,000). Better established energy offices in the region do not normally have access to this level of capital fund.

Some energy offices do not have sole responsibility for photovoltaic projects in their respective States. For instance, in Pohnpei, the Pohnpei Utility Corporation is responsible for the solar photovoltaic (PV) project at Pingelap. PV electrification of the outer islands in Pohnpei is under contract with the States. Operation, maintenance and collection of monthly fees are, however, the responsibilities of established committees on each of the respective islands. All the PV projects that are managed by the energy offices operate under a structure where the recipients form their own island solar lighting committee, they collect a monthly fee and then send this money to the energy office. The energy office in return uses this money to buy the spare parts and to cover other maintenance expenses.

The Power Utilities

All the four State utilities were formed from the assets and operations of their Department of Public Works. The assets were mostly provided by the US Trust administration. Since Independence in 1986, Compact Funds was the major source of funding for asset replacement and expansion.

The move to change the utilities into government-owned corporations started in the early 1990s with the US Department of Interior’s Operation and Maintenance Improvement Program (OMIP) playing a leading role. The corporatization of Chuuk and Yap in 1995 & 1996 respectively marked the completion of the corporatization of the four utilities.

There are no existing National controls over the management, financial and technical performance of the utilities. There is no National utility and no defined national power sector policy. Each of the utilities is under the control of their respective board of directors. While there are areas of commonalties among the States, there are also indications that their policies however differ widely. For instance, all the utilities are not subject to income and gross revenue tax, and fuel tax. However, the utilities in Kosrae, Pohnpei and Yap operate semi-autonomously but depend on government to cover for its deficits. On the other hand, the utility in Chuuk looks upon its government to provide resources for its operations, since it revenue collection rate is low. **Annex 4** provides a comparative analysis of the four utilities and **Annex 5** shows the tariff levels and structures.

Except for the Pohnpei Utility Corporation (PUC), the utilities do not at present carry long term debt. Nevertheless, long term debt is expected to be introduced in order to meet the growing need for extra capacity.

The utilities also carry the responsibilities for water and sewerage. These two additional services are presently not recovering their costs and are therefore a burden on the power sector activities of the utilities, except for PUC.

Except for PUC, all f the power utilities have their own fuel arrangements with either the Mobil Oil Micronesian Islands (MOMI) or the Micronesia Petroleum Corporation (MPC). These fuel arrangements are usually long term in nature (10 -15 years) with no common starting and ending dates.

Power generation is mostly by petroleum products. Hydro resources have been identified and utilized in FSM. The best potential is in Pohnpei where there is an existing 1.8 MW run-of-river hydro plant. Additional studies have been made to increase the running time by diverting the remaining two streams into the existing dam. Kosrae has limited potential and both Chuuk and Yap have no potential.

Petroleum

Petroleum is supplied to the states of Chuuk, Yap and Pohnpei under a National Fuel Agreement with MOMI, which owns fuel import and storage facilities built on leased land. Supply agreements are dependent on oil companies having a current land lease agreement.

Prices are determined using a price monitoring system and an agreed rate of overall annual return allowed to MOMI based on a spreadsheet pricing template. Relative industry sectoral pricing is under the control of the state governors. Generally, lowest prices have been reserved for utilities and government while commercial and retail sales have provided a relatively higher return.

Kosrae is supplied by state owned MPC operating out of the state government owned fuel terminal. MPC has also recently installed a small bulk fuel import terminal in Yap and successfully competes with MOMI. Their success to date in other states has come from targeting the high retail margin market while charging higher prices than other States to the utility and government in their monopolized home State market.

The responsibility for the pricing of petroleum products, the monitoring and verification of oil companies' pricing submissions is defined at both the national and states levels but has been plagued by a lack of adequate focus and human resources.

It is also not clear as to whom is responsible for ensuring the safety of the storage and the handling of petroleum products although there is evidence that, at least in Pohnpei, the state EPA has plans to propose adoption of appropriate standards. It is assumed that policing of the standard would then come under state EPA control.

There is inadequate government record on the volume of petroleum products imported, however, the national government is currently working on compiling the national import figures for petroleum products.

LPG

There is no one single arrangement for the supply of LPG to FSM. Each state has a single supplier and a local distributor / marketer. The supply of LPG is usually from Guam with no bulk supply and storage facilities available in most of the states.

Biomass

Biomass is not regarded as a major area of concern in the FSM energy sector although it is still the major source of energy for the rural population. It is estimated that 80% of FSM's land area is covered with forests, secondary vegetation, and mixed coconut or scrubland. This abundance of biomass resources promoted by FSM's favorable climate is the major reason behind biomass being taken for granted as an energy source.

Solar

The solar radiation in FSM is generally attractive except in Pohnpei, where rainfall and cloud cover are high. But even in Pohnpei, the radiation has proven to be sufficient for the electrification of some of its outlying islands.

Others

There may possibly be a potential for other alternative energy sources like wind, wave, biomass and hydro in FSM but these need detailed monitoring and analysis before they are being considered for extraction.

Energy Supply and Demand

The unavailability of data has been a major constraint to an analysis of the energy supply and demand patterns in FSM. Since insufficient data were available to construct the energy balances, estimates for 1990 and 1995 that were made by the World Bank-led Pacific Regional Energy Assessment (PREA) of 1990 were used. An estimate for 1998 was made based on the PREA estimates. **Annex 6** shows the estimated energy balances for FSM for the years 1990, 1995 and 1998 respectively.

The energy supply for FSM during the period of 1990–98 has been dominated by imported petroleum products, accounting for 88% in 1990, 89% in 1990 and 90% in 1998. **Figures 3 – 5** show the petroleum imports as compared to the total imports and exports. The heavy reliance on petroleum products is a reflection of an economy which is overly dependent on imported energy sources and where its indigenous energy resources are either under utilized or very limited. During the period 1990-98, no extra hydro capacity was commissioned while the biomass supply only grew at an annual average rate of 2%. This can be compared with the 5% growth in petroleum products as a group. Individually, the average annual growth in the supply of Jet A1 was the fastest at 8%, gasoline at 5%, ADO at 4% and then avgas at 2%.

ADO was the major energy source in FSM. It accounted for more than a half (51%) of the total energy supply during 1990 and 1995 and 49% in 1998. Gasoline was the second most used energy source, followed by Jet A1 (averaging 15%) and then biomass (averaging 10%).

ADO has been used mainly for power generation and for transportation. On average, 63% of the total ADO imports have been used for power generation. This is equivalent to 35% of the total petroleum imports. Gasoline and Jet A1 are transportation fuels and were used mostly for that

purpose. Biomass was used mostly in the households, where an average of 72% was consumed for various domestic purposes.

Petroleum products, ADO in particular, have accounted for an average of 97% of the power generation mix, the other 3% being for hydro.

Putting power generation aside, of the energy sources that were available for consumption by the major consuming sectors, gasoline was the major energy source, followed by ADO, Jet A1, biomass, then electricity. On average, electricity only accounted for 12% of the energy consumed in FSM.

With ADO, gasoline and Jet A1 being the major fuels consumed, it is not surprising to find that the transportation sector was the major consuming sector. On average, the transportation sector accounted for 73% the total consumption, followed by households at 25% and then the remainder at the agro-industries sector. Even if the electricity consumption[12] was factored in, there would be no significant change to the above consumption pattern.

There is a need for a more detailed analysis of the energy supply and consumption behaviour in FSM in order to get a better understanding of the mechanics that are influencing the supply and demand behaviors. Such detailed analysis would depend on the availability of comprehensive data. Nevertheless, it can generally be said that the energy supply and demand mix of FSM is representative of very much commercialized and mechanized economies with energy intensive industries like mining, freezing or metal works.

It is still very common in the Pacific Island countries to find biomass as the dominant energy source, accounting for at least 40% of the total supply. This is the normal picture one would expect to see in small economies which are still very much subsistence and agricultural-based. The energy supply pattern seen in FSM is similar to those for Nauru and the Cook Islands. The former has a fairly high GDP per capita and the latter having undergone rapid technological and social changes.

On FSM's energy consumption, long distances between the states can partly explain why transportation is the dominant consuming sector. One would also presume that there is a good potential for energy conservation in the transportation sector.

FSM's GDP per capita for 1995 was AUD2513 while Tonga's was 2128. However, their commercial energy consumption per capita over the same period was 491 kgoe for FSM and 232

kgoe for Tonga. While this major difference can possibly be explained by technical and behavioural differences, one can generally say that commercial energy is more intensively used in FSM and possibly holds a bigger demand for energy conservation. **Figure 6** shows the major energy sources and consumption sectors.

SUMMARY OF PRINCIPAL CONSTRAINTS TO THE FSM ENERGY SECTOR

The major constraints to the FSM energy sector can be summarized into the four broad areas of the sector: institutional, power, petroleum and renewable energy.

Institutional

- *A relatively small but fragmented energy sector*

Discussion – Most of the individual state's energy sector is regarded as small, by Pacific Island standard. In the power sector, only PUC's operation is classified as medium. States petroleum demand is also regarded as small. However, certain advantages of scale could be realized if certain institutional and policy changes are carried out. This is particularly true in the case of the supply, storage and handling of petroleum products and the generation and distribution of power. For instance, a tender for a bigger volume of ADO for power generation would attract better terms and conditions than a smaller volume would. Additionally, if all the storage and handling of petroleum products are carried out according to one national standard or the power utilities were merged into one national utility then the equipment used, the skills and the training needs of the states would be compatible. Bargaining power certainly increases with the volume of the order for supplies.

Both options would permit staff training in both administrative, financial and technical areas to be cost-effectively carried out on common ground and for the exchange of expertise, materials and equipment to promote efficiency.

[12] Data on the sectoral consumption of electricity are not available and therefore no estimates have been made on this.

- *An energy sector environment which is not too conducive to competition and private sector participation*

Discussion – There is limited competition and minimal private sector participation in the energy sector of FSM. The state governments are focussed on the delivery of energy services rather than establishing an environment, which would promote competition and the active participation of the private sector. This environment would of course include the establishment of technical and operational standards by which government would oversee and monitor the performance of the energy sector players.

In the power sector, all the power generation, transmission and distribution are carried out by the state-owned power utilities. As in some power utilities in the region (Tonga and Vanuatu), the function of generating power is now in the hands of the private sector. Considering FSM's power utilities as a national entity or as four separate entities, it may be possible to generate competition for the delivery of some of its services.

In the petroleum sector, FSM was supplied by MOMI on a monopolistic basis until Kosrae State established Micronesia Petroleum Company (MPC). Many major petroleum consumers noted that both services and price improved after the entry of MPC. While operating a fuel import tank farm is not recommended for State governments, owning one gives governments the flexibility to generate some competition among suppliers. This has been demonstrated in the government or independently owned storage facilities in Tonga at Vava'u, Solomon Islands at Noro, American Samoa, Nauru and Marshall Islands.

In the renewable energy sector, the energy office at Pohnpei is directly involved in the installation, maintenance and the ordering of spare parts from outside FSM. While the existing renewable energy market is quite small in FSM, the potential for growth is there and therefore opportunities for private sector involvement look bright.

- *Absence of an effective overseeing and coordinating mechanism between the national government and the States and between the States and their respective energy sector players (energy suppliers, pricing authorities, consumers, etc)*

Discussion – While the importance of the energy sector is appreciated in FSM, the establishment of a well trained, funded, staffed and equipped "authority" with a well-defined and legally backed role to oversee the whole sector has not been realized. This may partly be due to some existing national / state government non-energy legislation / policies which are currently addressing certain issues of the sector. For instance, the Public Safety Act may be dealing with the manner in which petroleum products are stored and handled. Similarly, government's policy on

corporatization and privatization may be covering certain matters relating to the utilities' corporate goals and strategies.

On the other hand, the questions of what the functions of this authority should be, what the costs of running it would be like and the benefits expected of it, should be clearly defined and adopted by the FSM government.

In the late 70's to early 80's a lot of PICs formed National Energy Committees (NEC) to coordinate and advise their respective governments on energy matters. These were reactions to the oil price shocks of the time and therefore most had a petroleum-focussed mandate. Most of these NEC are no longer functional, either because their mandate was too narrowly defined and/or the NEC secretariat (mostly the Energy Planning Units) did not have the expertise and experience to effectively service the NEC. It was also very common to find that some NEC were mandated through a Cabinet decision to address the petroleum pricing issues while the legislative power for such a matter rested with a different authority.

- *Lack of capacity at both the national and state levels to coordinate, plan and manage energy sector activities and to keep the general public informed of major issues and development in the energy sector*

Discussion – There is presently a lack of capacity at certain levels of the FSM national and state energy sector to effectively plan and manage their energy sector activities. This insufficient capacity is in the number of people employed to coordinate the energy sector and a lack of qualified people in energy planning and policy, electrical engineering and in Power Sector Planning and Management.

While it is known that Pohnpei is possibly the only state with an Energy Office, manned by only two people, there is yet to be a graduate in Energy Planning and policy in FSM. Further, there are only a few with postgraduate degrees in electrical engineering.

It is a fact that energy affects everyone's life through their prices, availability, quality, their consumption, handling and disposal. There is therefore a need for the general public to be well informed of energy sector issues, developments and other energy matters that would be of interest to them. By providing this service, the general public would gain a better appreciation and recognition of the importance of energy.

Power

- *A highly subsidized power sector operation*

Discussion – FSM people have grown accustomed to receiving water and power at little or no cost during the Trust Territory period. This was the time when the public utilities were directly under government, with progressive financial assistance through the Compact Funds and the US-funded OMIP. Cost recovery and user pays was not a concern during that time, however, the excessive financial burdens imposed by these utilities on their respective state utilities led to the move to corporatize them. The corporatization has been completed and improvements in service delivery, reliability and cost recovery have been achieved. Though there is still room for improvement, a clear commitment towards full cost recovery based on an adopted program of efficiency improvements and tariff increases would enable the full benefits of corporatization to be realized. By adopting full cost recovery pricing, the issue of wasteful use of power would be addressed and it should lead to a sufficient capital base for improving service delivery.

- *Absence of any standardized technical and operational procedures and networking among the utilities*

Discussion – The energy sector of FSM is small but fragmented. A direct result of this fragmentation is the absence of adopted national standards (technical and financial). Such national standards are seen as the first step to establishing technical cooperation and assistance among the energy sector players within and between the states, especially in the exchange of technical expertise, tools, equipment and information.

In the power sector, a performance standard may be established with regards to the following:

- a generation efficiency range for all power generation systems;
- minimum energy performance standards for electrical appliances;
- distribution losses;
- disposal of all petroleum waste materials including used and waste oil;
- emissions;
- tariff level;
- annual return on investments; and
- criteria for system expansion.

Though there are differences in the size and management of the power utilities, there is a need for a mechanism where they can come together to share experiences and discuss matters of mutual benefits.

In the petroleum sector, these may include:

- a storage and handling standard;
- product quality and specifications; and
- disposal of all petroleum waste materials including used and waste oil

In the renewable energy sector, these may include:

- the institutional, financial and management structure for all renewable energy projects and program;
- a criteria for being a recipient of renewable energy projects; and
- disposal of used batteries.

- *Need for the development of a long term sustainable development plan*

Discussion – Most of the utilities have their own respective corporate plans and strategies. While this can be regarded as an excellent start, there is a need that the existing plans be expanded in terms of their timeframe, coverage and purpose. This may ultimately involve the adoption of a long-term sustainable development plan, which will include staff training, public relations program, environmental protection, technology development and a sound economic strategy.

Petroleum

- *Limited competition for the supply of petroleum products*

Discussion – Traditionally, a single oil company, Mobil Oil Micronesia, has supplied FSM. This was to FSM being a small and remote market and there was limited interest in it by other oil companies. In reality, however, the main factor was the import barrier related to the ownership of the fuel storage terminals. Consider the cases of Palau and Kosrae: Palau, a much smaller market than FSM, which has utility-owned fuel storage, oil companies compete to provide supply through periodic tender; whereas, Kosrae operates a state-owned oil company and supply comes from a number of sources.

Market size has been an inhibiting factor in the entry of new competitors, who would need to invest in new storage facilities in order to compete for part of an already small market. One solution is to promote the construction of independently (or government-owned) fuel storage

facilities. These could then be used to promote increased competitive activity in the fuel industry. Such terminals would need to be professionally managed, however, with no compromises on environment, health and safety issues. One way to achieve this is to have the terminal periodically tendered out to competing oil companies as is currently the practice in American Samoa, Vava'u, Tonga and Noro, Solomon Islands.

- *No oil company commitment to take responsibility for collection, removal and disposal of used and waste oil and any other petroleum waste*

Discussion – Lube oil and grease are necessary products for industry but are gross pollutants of a closed ecosystem. They generate residual liquid waste, which if not collected and removed, can pollute potable water and/or fish resources. This can have disastrous medium-to long-term consequences for remote islands.

It is proposed that the original suppliers be held responsible for dealing with the problem or at the very least be required to fund the total cost of collection, removal and disposal of used and waste oil, perhaps through a pro-rata system based on original supply share.

Similarly, the responsibility and cost of dealing with waste or off-spec fuel should be the responsibility of suppliers.

- *Inadequate fire fighting capability is available in terminals and the general community to cope with a worst case disaster scenario*

Discussion – Petroleum products carry with them an inherent fire risk. Oil companies possess expertise in dealing with this risk and apply this expertise in protecting company- owned or operated storage depots and terminals.

Remote communities often do not have the resources or expertise to adequately deal with fuel fires. There are examples in the region of narrowly-averted civil disasters that it would not have been possible to control given existing community fire fighting equipment and training. We believe it appropriate that oil companies be required to make their expertise available to the general community by way of funding community fire-fighting equipment and sponsoring appropriate training.

Renewable

- *Existing solar electrification programs are not sustainable*

Discussion – Most of the existing solar electrification programs in the FSM are presently not sustainable for a host of reasons. These include the ineffectiveness of the islands solar lighting committees, the non-payment of the monthly fees and hence insufficient funds are put aside for maintenance, replacement of parts and the expansion of the program.

The Mwoakilloa Solar Lighting project in Pohnpei was installed in October 1995. A total of 43 households, including the municipal office, received a solar system each. Each system consisted of 4 lights, 2 panels @ 75 Wp, 2 batteries @104 Ah and recipients were to pay a monthly fee of USD5.

The record of the Pohnpei Energy Office shows that the payment of the monthly fees was very good over the first twelve months of the project. It is estimated that the payment rate is now less than 60% and the trend will continue downward.

- *High capital costs of renewable energy*

Discussion – Renewable energy is characterized with its high initial capital cost but with a relatively modest operational cost. While the high capital cost is something that can be negotiated with the suppliers, bulk purchasing and larger sized projects are other means of lowering the initial capital cost.

- *Absence of any long term experience with renewable energy and lack of management and technical training*

Discussion – In FSM as well as throughout the region, numerous renewable energy projects have either been proposed and/or implemented as demonstration or pilot projects. A lot of these were either donor or technology driven. They have been implemented in various areas of FSM and funded through various aid programs. They have been in the areas of wood stoves, centralized PV systems, wind and biogas. As in other parts of the region, renewable energy projects were either abandoned because of technical failures and/or were not closely monitored over a sufficient period of time in order to get a fair idea of how they would work in the socio-economic and physical environment of FSM. Further, most of the experiences with these projects have not been properly documented for use as a reference for future similar projects.

Successful renewable energy projects are always associated with intensive local management and technical training. The training is needed at both the users' end as well as in the offices responsible for managing the projects. It should cover the installation, monitoring and the maintenance of renewable energy systems. At the same time, it should also cover the evaluation of installed projects, the recovery of costs, and the maintenance of a close and cooperative working relationship with the recipient communities.

- *Much of FSM's renewable energy potential has not been monitored*

Discussion – FSM's geographical location is such that it is extended over a longitudinal area of more than 20^{o}. This is a vast cover of ocean, which may offer opportunities for exploiting ocean-based energy sources such as wave, tidal and OTEC.

On the other hand, its equatorial characteristics offer an excellent potential for the application of solar technologies such as dryers, solar-powered appliances and water heaters. Though a few solar projects have been implemented in FSM, their designs were not based on actual monitored data.

The biomass energy resource in FSM varies among the states depending very much on their respective levels of development. Biomass is not regarded as a threatened resource however no studies have been carried out to accurately determine the existing stock level and to make predictions on what it would be like given differing scenarios of supply and consumption.

- *Disposal of used batteries*

Discussion – Most batteries used for solar PV projects and those that are used in home appliances (radios, torches, etc) contain harmful elements such as lead, cadmium, etc and if not properly disposed, they can be a major pollutant to the ocean and the water systems. It is noted that a private firm and the EPA are collecting used batteries in Pohnpei and perhaps this service should be extended to the other States.

OBJECTIVE OF THE NATIONAL ENERGY SECTOR

To formulate the national energy policy, it is important that they be consistent with the current national energy sector objective(s). In the absence of any current energy sector objective(s), it is recommended that the objective below be adopted:

To promote the sustainable social and economic development of FSM through the provision and utilization of cost-effective, safe, reliable and sustainable energy services[13].

Important sentiments that are incorporated in the above objective:

Sustainability

The sentiments of sustainable socio-economic development and the provision of sustainable energy services are embedded in the following:

- The provision of energy is to be executed as a **tool** for FSM's sustainable development. This would involve giving special consideration to things such as:
  - the creation of jobs;
  - the production of value-added goods;
  - the offering of equal opportunities to both women and men
  - promotion of income earning activities;
  - utilization of local and indigenous natural and human resources; and the
  - observance of traditional cultural practices.

- The provision of energy is to be carried out as a **service**. This would involve putting in place an environment where not only is there coordination at the national and state levels but energy consumers can choose who the supplier and what the service would be. This should naturally force the service providers to deliver their services cost-effectively and efficiently. Consumer satisfaction would be of paramount importance in this respect. Equally important would be the fact that consumers should be willing to pay for the quality service they are receiving and the prices attached to those services shall be transparent and mutually agreed to by the providers and the users of the service.

[13] Energy services refer to work relating to the sale, supply, storage and distribution of energy.

- The energy service suppliers/providers shall be **financially independent**. The provision of energy services is to be carried out in a manner where costs are fully recovered. Where costs are not fully recovered and subsidies are considered appropriate, such subsidies are to be identified in the government budget as a subsidy to the end users of that service.

- Financial independence will have a direct bearing on the **quality** of the services provided. When people are happy with the services then the costs charged of them are fully justified. Service providers should be guided to put away sufficient funds for maintenance and capital replacements.

- As much as possible, **community participation** shall be encouraged so as to enable them to play leading roles in the maintenance and management of their energy projects. This would involve building the capacity locally at where the services are being delivered and used.

- The provision and consumption of energy services must be based on **eco-development** principles where due consideration is given to the welfare of the environment.

Complementarity

The provision of energy services would not be a stand alone initiative but it shall be carried out in a manner which would become a part of a larger development initiative. For instance, the delivery of energy services could be part of an initiative to improve income from fishing for rural folks. Similarly, it could be incorporated as a component of a health project to improve the rural family's dietary environment.

Consistency

Any fiscal and financial incentives to a particular energy service shall give due consideration to the provision of the same and/or different incentives to other related and affected energy services such that all the related energy services are on a level playing field.

Flexibility

The policies and guidelines would be flexible and would be continuously reviewed to ensure that it reflects government's current socio-economic and political aspirations.

FSM's NATIONAL ENERGY SECTOR POLICY

Based on the constraints identified and the recommended energy sector objective, it is also recommended that FSM's energy policy be based on five broad policy elements. This can be referred to as FSM's Five Star[14] Energy Policy Elements for publicity purposes. They represent the identified broad areas where development is required to address the constraints identified and thereafter enable a more effective effort towards the recommended energy sector objective.

Policy Element 1: An effective, coordinated, resilient and dynamic joint states and national energy sector

Strategies

i. establish an energy coordination mechanism with well-defined responsibilities and legislative power to coordinate energy sector activities at both the national and state levels;
ii. encourage the participation of the energy sector in the states and national economic development decision making committees;
iii. promote and support dialogue, consultations and networking among and within the states' and the national government's energy sector players; and
iv. provide a well trained, staffed, funded, disciplined and equipped energy sector work force.

Discussion

It is critical that energy sector activities are well coordinated at both the national and state levels in order to avoid duplication and wastage and to ensure energy initiatives are well focused and effective. To facilitate this coordination, the role of this coordination mechanism should be clearly defined and given the appropriate mandate and legislative power to intervene in the operations of other energy sector players, where it will be mandated to do so.

[14] Five Star can be taken literally to mean 'first class, perfection and a goal to be pursued'. It can also be taken to mean 'Energy Efficiency' and 'wise use of energy resources' as one would see in the star rating labels of energy consuming appliances.

It is critical that all the states are operating under an adopted national energy policy. States energy policies should be consistent with the national one thus ensuring compatibility and consistency. Strategies and plans may differ depending on resources and the bureaucracy in each of the states but if they are all operating under a common philosophy, then the chances of progressing towards the national objectives are much better. The national energy policy should provide for the energy sector's flexibility to accommodate changes in priorities of the national government and also any changes in priorities and strategies in some of the key strategic sectors of the economy. It should also permit the energy sector to be responsive to the needs of the states and national administrations, existing energy sector players and any new players who are interested in participating in the sector.

The national government should consider establishing a national energy focal point (EFP)[15] and the state governments should do likewise. These EFPs should be supported to interact with each other and there should be an official networking link between them to share information and experiences, to discuss matters of common interest and to keep the general public well-informed of energy sector issues and developments.

The EFPs should have adequate capabilities in the following broad areas:

- Economic analysis of the macro-economic life cycle impacts of energy investment projects and programs, changes in energy prices, fuel substitutions and energy conservation;
- Data collection, analysis, formulation and reviews of energy policies and the evaluation of energy sector performances;
- Management of energy projects and programs including the formulation of projects for funding, liaison with investors/donors, mobilization of resources for project implementation, supervision of projects implementation, monitoring of projects performance against planned outputs and reporting of projects experience to all interested parties;
- Technical capability in the installation and maintenance of conventional and indigenous energy systems, including energy conservation systems; and
- Technical capability to establish and enforce safety and technical standards for electrical wiring, fuel storage and handling.

The national government should consider convening a bi-annual energy summit (BES), (or more often as appropriate) with representatives of the state governments and the relevant public and private sector organizations. Generally the functions of the BES would be to formulate and review the national energy policies and strategies. Specifically, the policies and strategies should be to

[15] Can either be a new establishment or the strengthening of existing institutions.

do with the manner in which the energy resources required for FSM's socio-economic development are supplied, stored and consumed and how they (in the processes of supply, storage and consumption) relate to the macro socio-economic aspirations of the nation.

Specifically the BES should formulate and review policies and strategies in the following areas:

- the supply of petroleum products (contracts or otherwise, products quality, pricing, etc);
- the storage of petroleum products (petroleum storage and handling standards and etc);
- consumption of petroleum products (emission levels, efficiency standards, disposal of off-spec fuel, used and waste oil, etc);
- power generation (generation efficiency, generation mix etc);
- power consumption (appliance labeling, minimum energy performance standards, energy audits, tariff setting etc);
- renewable energy (resource monitoring, pilot project, government and community participation etc);
- energy conservation (public education and awareness programs); environmental protection (establish efficiency and emission standards, waste disposal practices, etc); and
- institutional and energy sector coordination (reporting procedures, board representations, data retrieval and accessibility, inter-linkages among the energy sources, inter-linkages between the national and states energy offices etc).

The BES should bring together the following:

The National EFP;
Secretary of Economic Affairs;
Secretary for Finance;
Environment Protection Agency;
Managers of the States Power Utilities; and
States EFPs.
Two representatives each from the four states (one from the state administration and the other from the private sector)

The successful implementation of the national energy policy would depend on a capable, well-disciplined and equipped work force. The FSM government would be supporting the key energy sector players with the training of their staff in strategic areas and in equipping them with specialized tools and equipment.

Policy Element 2: Safe, reliable, cost-effective and sustainable energy supply

Strategies

i. adopt a petroleum safety and handling standard;
ii. adopt a performance standard for power utilities;
iii. adopt a minimum energy performance standard for power consuming appliances
iv. introduce energy conservation in building designs and road designs;
v. review the pricing structures for electricity and petroleum;
vi. power utility capacity expansion and grid extension are based on least-cost options including DSM;
vii. life-cycle costing is used in determining the feasibility of energy projects; and
viii. put in place the appropriate institutional and management structures for managing off-the-grid energy supply systems;

Discussion

The socio-economic development of FSM would depend to a large extent on the availability of a reliable and cost-effective energy supply. When the energy supply is not reliable, economic activities would unnecessarily be interrupted. On the other hand, when energy costs are too high, the competitiveness of FSM's products would be affected and its attractiveness to energy intensive foreign investment would be adversely affected too.

The following specific areas increase FSM's petroleum prices and the feasibility of removing or minimizing their impact should be looked at:

- geographical remoteness;
- inadequate import terminal storage capacity has necessitated sub-optimal consignment sizes;
- inadequate wharfage and/or anchorage limits vessel sizes;
- relatively high in-country operating and distribution costs;
- perceived high in-country risks resulting in high ROI guaranteed to oil companies;
- inappropriate fuel grades (ADO for large scale power generation rather than heavy fuel oil);
- local prices may not reflect real world prices; and
- local prices out of step with published world prices.

Experience in the region has shown that donor and/or technology-driven energy projects do not last and fail within their early years of operation. A mechanism must be put in place where energy

proposals of state significance are screened before they are approved for implementation. This screening process must consider alternative options, which are available, and the life cycle costs of each of the alternative options.

The following Regulations regarding standards and specifications are to be reviewed/adopted with regards to improving the reliability, safety and the cost-effectiveness of the supply and consumption of energy:

- Regulations dealing with the design and the construction of power houses, their cooling systems, fuel storage and disposal system, batteries disposal, etc, etc;
- Regulations dealing with electricity generation, including grid-connected and hybrid systems, as per fuel source and engine sizes, reticulation systems as per voltage and load types;
- Regulations dealing with the wiring and the inspection of all energy installations;
- Regulations dealing with the specifications of electrical appliances that are to be imported into the FSM;
- Building regulations and/or codes and road designs;
- Regulations dealing with petroleum products storage installations, handling and products quality; and
- any other Act or Legislation that may affect the energy sector.

In the region, it has been proven that where the institutional and management structures are in place to manage off-the-grid power supply systems, they tend to be more sustainable as they are properly monitored, maintained and that sufficient capital is put aside for the replacement of parts. The states and national governments should identify/establish an institution and tasked with this responsibility.

Policy Element 3: An efficient, attentive, responsive and competitive energy sector

Strategies

i. strengthen the public relations efforts of the players in the energy sector
ii. complete the current initiatives to commercialize of the power utilities;
iii. consider consolidating the operations of the states power utilities
iv. encourage states/national-ownership of storage facilities and consider establishing a national petroleum company;
v. encourage the establishment of Energy Service Companies (ESCOs); and

vi. recipient rural communities are encouraged to own, manage and operate their rural energy projects.

Discussion

Generally, governments are not very efficient in service delivery and are best suited to the setting of standards and policies and monitoring them. All the power utilities of FSM have been corporatized and initiatives are currently underway to commercialize their operations. While there are major benefits to be achieved from privatizing the power utilities, the utilities should first complete the commercialization process before considering the feasibility and the practicality of privatization. The process of commercialization would be an extension of the corporatization that has been completed. It would involve transforming the internal operations of the utilities to actually deliver greater efficiencies, lower prices in real terms and better quality of supply. This transformation is characterized by the following features:

- customer-focus systems where the utilities' efforts are focussed on satisfying customers in a more competitive market;
- addition of profit and shareholder value adding mechanisms throughout the utilities by internal reorganization to create business units, each with their own profit targets;
- revamping financial and commercial management systems, usually, involving internal transfer pricing and service level agreements;
- changing and renegotiating standard contract agreements to reflect a more commercial and productive culture; and
- re-aligning the workforce into core functions (usually strategic and asset management) and non-core functions (usually servicing functions; e.g. capital construction and maintenance) and subjecting non-core service functions to competition and possible outsourcing.

A major feature of the petroleum industry in the region is the lack of competition. This results from oil company ownership of distribution and storage facilities, which restricts entry into the petroleum sector. The ownership of the storage facilities in Kosrae by the MPC has demonstrated that this strategy can create competition and lower prices. This strategy should be promoted not only at the states but at the national level too. The feasibility of a nationally owned petroleum company should be as similar arrangements have been put in place in the region, as in the Kiribati Oil Company of Kiribati.

As part of the process of devolving government's direct involvement in the energy sector, the establishment of community-owned or foreign/locally-owned ESCOs should be encouraged through the removal of barriers and constraints and the provision of appropriate government incentives. ESCOs, being private, should play a major role in the supply and management of energy projects in areas not covered by the state grids. Performance of government-related contracts should be through open competitive tenders thereby promoting competition and efficient quality service delivery.

Where, in the opinion of the government, certain incentives are to be extended to a particular energy source, considerations should also be given towards extending such incentives to the other energy sources in order to remove any bias towards a particular energy source and/or supplier.

Policy Element 4: A diversified energy resource base

Strategies

i. monitor the indigenous energy resources potentials (solar, biomass, wave, hydro, etc) and their feasibility for harnessing
ii. identify feasible alternative fuel sources for electricity generation and for the transport sector

Discussion

FSM should actively pursue a diversification of its energy mix, giving priority to indigenous energy sources where they are economically, environmentally and technically feasible. This would involve monitoring FSM's energy resources potential and monitoring of the international development in energy sector technologies and practices and evaluating their economic, environmental and technical feasibility in FSM. FSM should also, where funding permits, install demonstration projects to evaluate the economic and technical feasibility of grid-connected, hybrid and stand alone power generation systems. Priority should only be given to indigenous sources if they are technically, environmentally and economically feasible. FSM should only get involved in demonstration projects if external funding is available.

FSM should contribute financially to the monitoring of resources for which technologies are commercialized and proven in the Pacific region. For the others', only in-kind assistance should be provided. The same would apply for demonstration projects. As much as possible, monitoring of FSM's indigenous energy resources should be carried out by the relevant existing institutions.

Petroleum products are the major commercial energy source for FSM and have the most significant impact on the FSM's foreign exchange and the environment. Petroleum products are used mostly for power generation and in the transportation sector. It is envisaged that if the consumption of petroleum products in these two areas could be diversified together with the appropriate energy conservation measures, significant benefits would be made in the balance of trade as well as to the physical environment.

Policy Element 5: The environmentally-sound and efficient use of energy

Strategies

i. carry out national campaigns on energy efficiency and environmental issues relating to energy;
ii. institute minimum efficiency standards; and
iii. the generation, storage and distribution of energy services should comply with the existing EPA regulations

Discussion

There is a direct link between energy and the environment and much of the environmental problems of the FSM can be attributed to the generation, distribution and consumption of energy. The general public at large should be educated and made aware of the relationships between energy and the environment and how to minimize the detrimental impact on the environment of energy usage.

FSM should adopt minimum performance standards for its electrical consuming appliances and road transport.

Energy conservation awareness programs should be carried out to educate both the public, private institutions and the general public at large on how to use energy efficiently and safely.

Companies supplying lubricants should be made to be responsible for collecting, storing and the environmentally acceptable disposal and/or the shipping of used & waste oil out of FSM. The Department of Environment should be supported in its current effort of collecting and the environmental disposal and/or shipping dry cell batteries out of Pohnpei Energy sector activities shall be carried out in a manner, which comply with existing environmental regulations in FSM.

THE POTENTIAL PAY-OFF FROM THE RECOMMENDED ENERGY SECTOR POLICY

It is impossible at this stage to accurately quantify the costs and benefits of the recommended policy. The policy is only to lay down FSM government's vision for the planning and management of its energy sector. The actual evaluation of costs and benefits would be carried out when work programs and projects are formulated to address a particular provision of the policy. For instance, the recommended policy for an **effective and coordinated energy sector** is to **coordinate energy sector activities at both the national and state levels.** To do this, options are available. These include establishing energy coordinator positions, putting the energy coordinating functions under an existing position or recruiting an expatriate to carry out this energy coordination functions. The costs and benefits of these options is a matter for the relevant authorities in FSM to calculate and subsequently prioritize for implementation.

CONCLUSION

The current national objective for FSM's energy sector is not quite clear and therefore those that were identified in the second national development plan of 1992-96 ought to be updated. It is recommended that the objective for FSM's energy sector be generally: **"To promote the sustainable social and economic development of FSM through the provision and utilization of cost-effective, safe, reliable and sustainable energy services".** The effort towards the realization of the above objective are envisaged to be impaired by constraints which have been identified to exist in the sector. These constraints include:

- a relatively small but fragmented energy sector;
- an environment which does not promote private sector participation and competition;
- insufficient capacity to plan and manage the sector;
- a highly-subsidized power sector operation;
- absence of any national standards in the power and petroleum sectors;
- absence of any long-term data on the country's renewable energy potentials; and
- the non-sustainability of the existing rural electrification projects.

The energy sector policy has been formulated around the areas where further development is required in order to address these constraints and thereby enabling a more effective effort towards the recommended energy sector objective. They have been formulated based on **Five Star** Policy Elements of:

- an effective, coordinated, resilient and dynamic joint state and national energy sector;
- a safe, reliable, cost-effective and sustainable energy supply;
- an efficient, attentive, responsive and competitive energy sector;
- a diversified energy resource base; and
- the environmentally sound and efficient use of energy.

The policy is not intended to be fixed over the long term. Its effectiveness should be monitored regularly to ensure that they still reflect government's aspirations and priorities.

ANNEX 1

Committee Report
Infrastructure/Transportation, Communication, & Energy

I. INTRODUCTION

The importance of the development of a solid infrastructure in the various areas of concern were not underestimated in the review of the policy matrix as recommended. Extensive discussions were had on numerous items, with the full participation of all involved. In that the Committee obtained a consensus on the matrix as presented, only matters which invoked significant discussion will be noted herein. Please refer to the matrix as finalized in comparison with the suggested matrix for a more complete understanding of the thought process of the Committee.

II. DISCUSSIONS

The Change in the Title – An Inclusive Balanced Approach:

At the onset, the Committee immediately noted that the title for the policy matrix did not encompass the entirety of the nature of the infrastructure to be addressed. It was felt that by noting only the transportation sector one might obtain a misunderstanding as to the balance which must be approached, balancing and including the infrastructure needs of the communication and energy sectors also. The title was changed to reflect a more balanced, comprehensive and inclusive approach.

The Government's Role and Inclusion of the Private Sector – Developmental Partners:

The Committee remained sensitive as to the need for cooperation between all levels of government, and where deemed appropriate, changed language to remove what could be viewed as a focus on the roles of the state and national, to more general wording, utilizing only the term "government". It was the desire of the Committee that in reading it as such one might be able to ascertain that they acknowledged the key role that the municipal governments may play in each state, and the need for cooperation and coordination between all such divisions of government, including the municipal, in order for the successful implementation of many programs and infrastructure changes.

In addition to broadening the base of cooperation and coordination to all levels of government, the Committee took definitive steps to insure the inclusion of the private sector in the infrastructure revisions as well as all other aspects. Evidence of their concern as to insuring the inclusion of the same, can be found in their adding the Private Sector as being partly responsible under each policy element and strategy. This was done to confirm the understanding of the interdependence between public and private in the successful development of the infrastructure.

Economic versus Constitutional Mandates – A Harmonious Blend:

All participants endorsed the constitutions of the individual states and the national government and the respective structures and order put in place in accordance to them. In addition, all participants recognized the importance of viewing the action 7si i7~ction's of the government in light of their economic impact on the growth and sustainability of the nation. Recognition of the importance of both mandates led to revision of language in the matrix, where necessary, where such mandates appeared to be in conflict with each other. It remained the belief and understanding that both sets of mandates could function in harmony. It was also the understanding and stance of the members of the Committee that in no instance should

Constitutional mandates be over-ridden for economic goals. Acknowledging the comprehensive coverage of our states' and national constitutions, and the flexibility inherent in them, the participants endorsed the pursuit, where ever and whenever deemed necessary, of the utilization, not violation, of proper appropriate legislative procedures to support economic reform.

Economic Viability and Justification balanced against Citizenry Needs – A Shared Burden:

In noting the importance of economic evaluations in the analysis of infrastructure development, in all sectors, the Committee took into consideration the needs of the citizens of the FSM. There may be times in which a particular project is not economically viable, or, as the language originally suggested, economically justified; i.e., it does not in and of itself bear the cost of sustainability, but it may be of necessity for the improvement of the citizenry who live in that particular area of the nation. In such circumstances it was the expressed desire that the needs of the citizens be heavily waited in the analysis, with a unity mentality; i.e. a view toward a sharing of the cost by more viable operations and projects; i.e. a sharing of the burden by the whole for the benefit of the few. The Committee recognized that when any of our citizens do not have the benefit of advancement, we all suffer. Language was removed, with phrases modified in an attempt to communicate such an understanding.

Environmental and Fiscal Responsibility, Two Sides of the Same Coin:

It was understood that one cannot have a fiscally responsible and prosperous people if one does not have clean air to breath, water to drink and uncontaminated food to eat. We are partners with our environment in the development of our country. It was understood that most every developmental infrastructure decision has the potential to have an effect on the **environment.** When we establish a park, a hanger, or even simply lay a concrete sidewalk, we are re-designing our environment. It was therefore viewed as impossible to preserve the environment if we are to develop the infrastructure necessary for our continued sustainability. Emphasis, therefore, was placed not on an attempt to preserve the environment, but to minimize destruction of the environment and to help the environment to regenerate itself as much as possible. Such minimization was to be accomplished by considering the effect of the proposed improvement in the design phase, thereby where enabling us to be more of a cooperative partner with the environment in which we live.

Although a large amount of the environmental issues and concerns seem to be directly addressed in Policy Elements Seven (7) and Eight (8), it was intended that they be examined across more than just the energy sector infrastructure issues. It is hoped that the language, which was modified and inserted, reflects such an understanding.

Energy Policy – A Unified Cooperative Approach:

Much discussion was had on the development and implementation of a national energy policy. Even in the plenary discussion was this matter viewed as of great importance. Input was sought from several professionals and evaluated in light of the direction of the country. It was the perceived direction of the country, towards privatization, which seemed to go directly against the proposals with respect to how to establish and implement a national energy policy for the nation. Members were concerned about the creation of a new governmental agency or division when we are in the process of streaming down the size of government. The recommendation of the formation of a national petroleum company, and the language with respect to it, was worked and reworked for numerous hours. The final decision was as you see it on the attached matrix.

The usage of the term "FSM" petroleum company was the result of a decision that such language would communicate the Committee's hopes and desires that, it, the company include the states

input directly, equally, and cooperatively; that it not, necessarily be a company run by the national government, but perhaps a privately owned company of which the government would have an ownership interest. The need for the coordination of the energy policies and its benefit to the whole company was thereby acknowledged, but the concern as to the increase in the size and power of the national government was hopefully addressed.

Similar concern was taken as to the language, which called for the "Establishment of an energy coordination mechanism with well defined responsibilities and legislative power to coordinate energy sector activities at both the national and state levels." This concern was, as noted previously, further discussed at the general plenary session with the result that the language "and legislative power" was removed. It is again hoped by the committee that this sufficiently addresses their concerns, and communicates the intent of the members.

III OTHER MATTERS & CONCLUSION:

There were numerous other matters which were addressed, including but not limited to, the ownership versus control of the storage tank facilities, the coordination of the implementation of Public Sector Investment Programs, the immediate need for marine vessels (including passenger vessels), the establishment of a maintenance trust fund out of the percentage of construction fund allotments, as well as the investigation and implementation of new technologies with respect to waste management systems. Although not elaborated herein, such were important issues, which were addressed and discussed.

The Chairman, Mr Robert Weilbacher and Co-chair, Mr Rokucho Billy, wish to express their thanks to all the members for their participation and diligent work. It is believed that the matrix as presented accurately reflects the consensus of the citizens of the differing states, and has sufficiently charted a path towards growth and sustainability.

Submitted by: Murphy Peterson, Staff Counsel
Transportation, Communication & Infrastructure Committee
Eleventh Congress of the Federated States of Micronesia
Rapporteur, FSM 2nd Economic Summit

Infrastructure/Transportation, Communication, & Energy Policy Matrix

Policy Elements	Strategies	Programs & Activities	Responsibility
1. Improve institutional arrangements and coordination to better define government roles in infrastructure development and delivery of services	1.1 Seek policy consensus on government structures and organizations that allow for maximum efficiency in the delivery of public services 1.2 Strengthen government role in administering and regulating international shipping and airline services 1.3 Solidify the governmental positions with respect to the regulating of infrastructure and services 1.4 Seek the engagement of the private sector in the coordination of activities with government entities	1.1.1 Conduct regular policy related consultative meetings between all levels of government agencies 1.2.1 Coordinate States and National functions and responsibilities utilizing economic mandates 1.3.1 Develop and execute appropriate MOU on program management based on resource allocation 1.4.1 Establish a sub-regional organization to administer and regulate air service in the Micronesian region	TC&I, State Transportation, State Public Works TC&I, Economic Affairs, Legislature, Private Sector, Dept of Planning
2. Manage government infrastructure and services within fiscal realities and encourage private sector take over where feasible and appropriate	2.1 Strengthen management capabilities of government institutions at all levels of government 2.2 Continue privatization and corporatization of infrastructure and services as appropriate, including communication and other utility companies 2.3 Develop cost recovery mechanisms to finance adequate infrastructure maintenance, including vessels	2.1.1 Provide quality career education programs for top management positions 2.1.2 Develop ongoing management training programs 2.1.3 Arrange for within industry management training in collaboration with private sector 2.2.1 Corporatize port management and operation 2.2.2 Establish action plan for continuous review of privatization programs 2.2.3 Establish incentive programs to encourage and facilitate privatization 2.3.1 Conduct aggressive public education programs to promote user fee concept 2.3.2 Establish users fee legislation 2.3.3 Establish reliable and effective collection and enforcement procedures	TC&I State transportation State public works Utilities agencies State DOA/DPW/DOT, Private Sector, Dept of Planning
3. Provide appropriate and economically and needed infrastructure facilities and services	3.1 Coordinate and facilitate the improvement of transportation and communications infrastructure and services to strengthen social and economic development activities 3.2 Coordinate and facilitate the improvement of public buildings and facilities to enhance health and education programs 3.3 Coordinate and facilitate the development of public utilities and services	3.1.1 Complete concrete asphalt paving of all primary road systems, including circumferential road systems 3.1.2 Incorporate pedestrian walkways in the design and construction of roads 3.1.3 Complete cross-island road and inner roads to facilitate agricultural and other development 3.1.4 Update the National Airport System Plan to reflect the current airport development needs 3.1.5 Extend all air carrier airports to improve safety and	State DPW TC&I State DPW HESA, State DOH CFSM, State DOE Public Utility Corporation, Private Sector, Dept of Planning

Policy Elements	Strategies	Programs & Activities	Responsibility
		eliminate payload restrictions 3.1.6 Improve all other domestic airports to required standards of safety 3.1.7 Improve and repair dock facilities, including dry dock, to meet both fisheries and commercial shipping needs 3.1.8 Immediately seek to provide modern safe and efficient inter-state and inter-island passenger and cargo vessels 3.1.9 Continue to expand and improve communication services to remote areas of the nation 3.1.10 Encourage and assist FSM Telecom to improve and evaluate tariff costs and level of services in minimization of consumer costs 3.1.11 Continue to coordinate and facilitate the improvement of aids to navigation 3.2.1 Construct modern and efficient hospital facilities 3.2.2 Develop the capability and provide for a national referral hospital 3.2.3 Continue to improve and expand primary, secondary and post-secondary school facilities 3.2.4 Continue to assist and strengthen private educational institutions to the nation 3.2.5 Expand and enlarge recreational and professional sport facilities 3.3.1 Improve waste water facilities providing 100% coverage 3.3.2 Evaluate and institute state of the art, technologically advanced, solid and liquid waste management systems 3.3.3 Improve water supply and distribution systems 3.3.4 Implement Public Utility Corporation improvement plans 3.3.5 Utilize existing facilities whenever possible	
4. Establish and Priotize investments in infrastructure development in order to ensure viability and sustainability	4.1 Establish professional review process for all infrastructure development projects 4.2 Coordinate and facilitate the implementation of Public Sector Investment Programs 4.3 Establish maintenance trust fund from percentage of construction fund allotments	4.1.1 Establish rigorous funding criteria for infrastructure development programs 4.1.2 Conduct cost benefit analysis on all infrastructure projects 4.1.3 Conduct technical and economic feasibility studies on all major infrastructure investment projects 4.1.4 Apply performance budgeting principles on all infrastructure projects	CFSM State Legislature State DPW, C&I, DOA, DOFA, Dept of Planning, Executive, Private Sector

5. Promote development of infrastructure that minimizes the destruction to the natural environment and resources	5.1 Apply conservation and sustainable development decision making principles in all infrastructure development projects	5.1.1 Strengthen national and state environmental protection laws and regulations 5.1.2 Conduct environmental impact assessment on all infrastructure development projects 5.1.3 Develop and implement monitoring and mitigation measures for projects	CFSM State Legislature EPA, State DPW, Dept of Planning, Private Sector
6. An effective, coordinated, resilient and dynamic joint states and national energy sector efficient and responsive to the energy sector requirements	6.1 Establish an energy coordination mechanism with well-defined responsibilities and to coordinate energy sector activities at both the national and state levels; 6.2 Encourage the participation of the energy sector in the states and national economic development decision making committees; 6.3 Promote and support dialogue, consultations and networking among and within the states' and the national government's energy sector players; and 6.4 Provide a well trained, staffed, funded, disciplined and equipped energy sector work force.	6.1.1 Review existing legislation and enact 6.1.2 new one to give legal mandate and power to an energy coordination authority; 6.1.2 Secure government appropriation for the staffing and activities of the energy coordination authority; 6.2.1 Convene bi-annual energy summit of states and national energy coordination authorities; and 6.3.1 Carry out a public awareness/education program	DEA/State Energy Offices/Utilities Legislature
	6.5 Strengthen the public relations efforts of the players in the energy sector 6.6 Complete the current initiatives to commercialize of the power utilities; 6.7 Encourage states/national-ownership of storage facilities and consider establishing a FSM petroleum company; 6.8 Encourage the establishment of Energy Service Companies (ESCOs); and 6.9 Recipient rural communities are encouraged to own, manage and operate their rural energy projects.	6.6.1 Carry out feasibility studies on the consolidation of the utilities in FSM; 6.7.1 Carry out feasibility studies on a national petroleum entity and/or states ownership of petroleum storage facilities; 6.8.1 Establish a FSM Utility Association; and 6.9.1 Review current energy-related legislation to remove monopolistic provisions and allow other players to enter the market.	Utilities; State Eos/DEA/TC&I/AGs/DoJ, Dept. of Planning/ Private sector/Legislature
7. A diversified energy resource base	7.1 Monitor the indigenous energy resources potentials (solar, biomass, wave, hydro, etc) and their feasibility for harnessing 7.2 Identify feasible alternative fuel sources for electricity generation and for the transport sector	7.1.1 Carry out a site-specific monitoring program of FSM's solar, wind, biomass wave, OTEC and any other extractable indigenous energy resource; and 7.2.1 Implement a pilot solar/diesel hybrid system.	State EOs/Utilities/T3/DEA/TC&I
8. The environmentally-sound, efficient, safe and reliable sustainable energy supply	8.1 Carry out national campaigns on energy efficiency and environmental issues relating to energy; 8.2 Institute minimum efficiency standards; and 8.3 The generation, storage and distribution of	8.1.1 Establish an environmental friendly way of disposing, and a central collection location, for items containing toxic waste, including used batteries and transformers 8.1.2 Establish an environmental friendly way of disposing	EPA/Private Sector/State EOs/DEA/TC&I

	energy services should comply with the existing EPA regulations 8.4 Adopt a petroleum safety and handling standard; 8.5 Adopt a performance standard for power utilities; 8.6 Adopt a minimum energy performance standard for power consuming appliances; 8.7 Introduce energy conservation in building designs and road designs; 8.8 Review the pricing structures for electricity and petroleum; 8.9 Power utility expansion and grid extension are based on least-cost options including Demand Side Management 8.10 Life-cycle costing is used in determining the feasibility of energy projects; and, 8.12 Put in place the appropriate institutional and management structures for managing off-the-grid energy supply systems	used/waste oil and establish a central collection place for used/waste oil; and 8.3.1 Formalize the involvement of the EPA [through provision of comments, representation in appropriate committees, etc] in energy sector development proposals and plans. 8.4.1 Establish and adopt a technical, quality and performance standards for petroleum industries; 8.5.1 Establish and adopt a technical, quality and performance standards for power industries; 8.6.1 Establish and adopt a minimum reserve capacity for all energy suppliers, particularly petroleum, power and LPG suppliers; and 8.8.1 Review power and petroleum pricing principles and remove subsidies	

ANNEX 2

The Energy Policy Matrix

POLICY	STRATEGY	PROGRAM & ACTIVITIES	RESPONSIBILITY	STATUS/COMMENT
Policy Element 1: An effective, coordinated, resilient and dynamic joint states and national energy sector	• establish an energy coordination mechanism with well-defined responsibilities and legislative power to coordinate energy sector activities at both the national and state levels; • encourage the participation of the energy sector in the states and national economic development decision making committees; • promote and support dialogue, consultations and networking among and within the states' and the national government's energy sector players; and • provide a well trained, staffed, funded, disciplined and equipped energy sector work force.	• Review existing legislation and enact new one to give legal mandate and power to an energy coordination authority; • Secure government appropriation for the staffing and activities of the energy coordination authority; • Convene bi-annual energy summit of states and national energy coordination authorities; and • Carry out a public awareness/education program		
Policy Element 2: Safe, Reliable, cost-effective and Sustainable energy supply	• Adopt a petroleum safety and handling standard; • Adopt a performance standard for power utilities; • Adopt a minimum energy performance standard for power consuming appliances • Introduce energy conservation in building designs and road designs; • Review the pricing structures for electricity and petroleum; • Power utility capacity expansion and grid extension are based on least-cost options including DSM; • life-cycle costing is used in determining the feasibility of energy projects; and • put in place the appropriate institutional and management structures for managing off-the-grid energy supply systems;	• Establish and adopt a technical, quality and performance standards for both the power and petroleum industries; • Establish and adopt a minimum reserve capacity for all energy suppliers, particularly petroleum, power and LPG suppliers; and • Review power and petroleum pricing principles and remove subsidies.		

Policy Element 3: An efficient, attentive, responsive and competitive energy sector	• Strengthen the public relations efforts of the players in the energy sector • complete the current initiatives to commercialize of the power utilities; • consider consolidating the operations of the states power utilities • encourage states/national-ownership of storage facilities and consider establishing a national petroleum company; • encourage the establishment of Energy Service Companies (ESCOs); and • recipient rural communities are encouraged to own, manage and operate their rural energy projects.	• Carry out feasibility studies on a national petroleum entity and/or states ownership of petroleum storage facilities; • Carry out feasibility studies on the consolidation of the power utilities in FSM; • Establish a FSM Power Utility Association; and • Review current energy-related legislations to remove monopolistic provisions and allow other players to enter the market.		
Policy Element 4: A diversified energy resource base	• monitor the indigenous energy resources potentials (solar, biomass, wave, hydro, etc) and their feasibility for harnessing • identify feasible alternative fuel sources for electricity generation and for the transport sector	• Carry out a site-specific monitoring program of FSM's solar, wind, biomass wave, OTEC and any other extractable indigenous energy resource; and • Implement a pilot solar/diesel hybrid system.		
Policy Element 5: The environmentally-sound and efficient use of energy	• carry out national campaigns on energy efficiency and environmental issues relating to energy; • institute minimum efficiency standards; and • the generation, storage and distribution of energy services should comply with the existing EPA regulations	• Establish an environmental friendly way of disposing used batteries and establish a central collection place for used batteries; • Establish an environmental friendly way of disposing used/waste oil and establish a central collection place for used/waste oil; and • Formalize the involvement of the EPA [through provision of comments, representation in appropriate committees, etc] in energy sector development proposals and plans.		

OVERVIEW – FINAL RESULT

<table>
<tr><td colspan="7">THE NATIONAL ENERGY SECTOR OBJECTIVES</td></tr>
<tr><td colspan="7">To promote the sustainable social and economic development of FSM through the provision and utilization of cost effective safer and sustainable energy services</td></tr>
<tr><td colspan="7">THE ENERGY SUB-SECTOR OBJECTIVES</td></tr>
<tr><td colspan="2">To promote the sustainable supply, utilization of indigenous and renewable energy sources</td><td colspan="2">A safe, reliable and cost effective supply and consumption of power</td><td colspan="2">A safe, reliable and cost effective supply and consumption of petroleum</td><td>An effective planning and coordination of the FSM National Energy Sector</td></tr>
<tr><td colspan="7">THE NATIONAL ENERGY POLICY STATEMENTS</td></tr>
<tr><td>A diversified energy base including RE</td><td>Joint State and National coordination, and development of a dynamic and resilient energy sector</td><td>A safe and efficient, competitive supply of energy services</td><td>A well-informed user base of energy services (transparency)</td><td>A energy sector supportive and complimentary to other sector activities / economic objectives of FSM</td><td colspan="2">A resilient and dynamic energy sector</td></tr>
<tr><td colspan="7">THE IDENTIFIED AND GROUPED ENERGY STRATEGIES</td></tr>
<tr><td colspan="2">To promote the sustainable development of renewable energy (RE) in a cost effective and coordinated manner.</td><td colspan="2">Consolidate and rationalize the operation of the power utilities, diversify power generation sources and use power efficiently</td><td colspan="2">To encourage competition, transparency and build local capacity to coordinate, adopt a National petroleum standard and monitoring petroleum supply contracts.</td><td>To establish a well-staffed, equipped and funded energy coordination mechanism with the appropriate legal power, defined responsibilities and access to related National and State Agencies</td></tr>
</table>

INSTITUTIONAL

OBJECTIVE: AN EFFECTIVE PLANNING AND COORDINATION OF THE FSM NATIONAL ENERGY SECTOR				
IDENTIFICATION AND GROUPING OF THE STRATEGIES				
To establish a well-staffed, equipped, and funded energy coordination mechanism with the appropriate legal power, defined responsibilities and access to related national and state agencies				
	Organization and Coordination	Create legislation delineating organization responsibilities at national and states govts.	Organize energy sector offices with staff and funding needs	Organize energy sector offices with staff and funding needs
Establish national energy co-ordination and strengthen states level coordination	Organize -public information -training -data collection	Address energy legislation at the Economic Summit	Provide funding for technical, academic programs at the state level	Provide funding for technical, academic programs at the state level
IDENTIFICATION AND GROUPING OF THE ISSUES, CONSTRAINTS AND OPPORTUNITIES				
Absence of a coordination mechanism with a clearly defined role in the energy sector	Lack of public information on energy	Absence of a legal power in energy coordination	Insufficient fund to establish energy coordination mechanism	Lack of technical expertise in national energy planning and policy
Lack of coordination of energy concerns via national & states	Consistent public education on conservation & energy issues - educating political leaders	Lack of legal system	Lack of funding	Lack of local experts to be responsible for energy requirements
No energy office at national government as well as the state level - Fully funded - Fully staffed	No public information office for energy.	Lackness of legislation & policies to address energy thoroughly (no energy plan)		
No monitoring entity to address customer complaints in Price increases	No networking among utilities in FSM			
Lack of attention / priority at national and state level	Lack of technical prep / curriculum primary / secondary / college education			
Lack of defined divisional role at the national govt	Lack of public awareness programs			
Lack of master planner (long term) - Manpower - Equipment - etc	No info on fuel costs and energy production costs			
Not enough clout given to energy office				

PETROLEUM

OBJECTIVE: A SAFE, RELIABLE, COST-EFFECTIVE SUPPLY AND CONSUMPTION OF PETROLEUM				
IDENTIFICATION AND GROUPING OF THE STRATEGIES				
To encourage competition, transparency and build local capacity to coordinate, adopt a national petroleum standard and monitor petroleum supply contracts				
	Mobil to regularly provide petroleum data to National Government		National Energy coordinating energy	
	To seek assistance from ForSec for training in the petroleum sector	Establish National Fuel Corporation -bid price internationally -reserve retain in the country	Designate Energy sector office to coordinate and monitor prices, standards and volumes	
To avoid long-term contract exclusivity	ForSec to regularly provide petroleum data to National Govt	Promote States / National ownership of tanks	Encourage sharing of information between the States and the National Government	To adopt national standards - Storage - Handling - distribution - quality
IDENTIFICATION AND GROUPING OF THE ISSUES, CONSTRAINTS AND OPPORTUNITIES				
Insufficient initiative to generate an environment for competition	Insufficient local capacity to negotiate, monitor and enforce petroleum supply constraints	Promote local participation in the petroleum industry (opp)	Lack of coordination and cooperative among states and national agencies in the petroleum sector	Absence of a standard on petrol storage, distribution, quality and handling standards
No competitive pricing	enforcement of fuel supply - quality control - - price monitoring - - etc	Locally owned petroleum company (opp)	Collection and sharing of data info amongst the states and national government	Safety standards for use and storage
No competition	Grades of fuel	Each state owning own tank farm (opp)	Lack of means of disseminating fuel information	Lack of standard at the distribution level - safety - fuel quality
Petroleum products pricing -monitoring - price control	Unreliable supply	Unify power plant procurement of fuel (opp)	Lack of public information on fuel prices	Lack of standardized training on proper fuel handling
No government control on fuel price	Lack of standardized training on proper fuel handling			

POWER

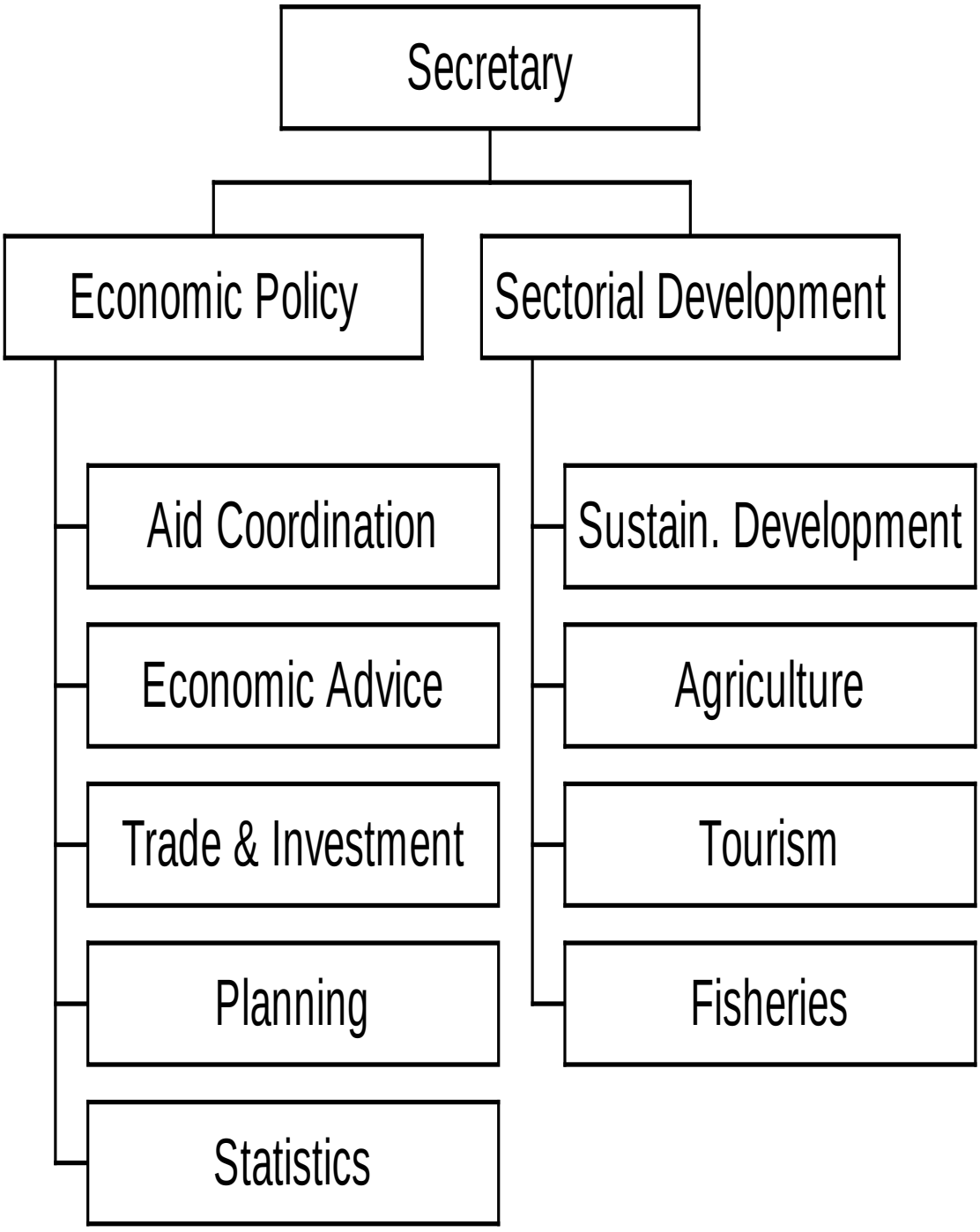
OBJECTIVE: A SAFE RELIABLE AND COST-EFFECTIVE SUPPLY AND CONSUMPTION OF POWER					
CONSOLIDATE AND RATIONALIZE THE OPERATIONS OF THE POWER UTILITIES, DIVERSIFY POWER GENERATION AND USE POWER EFFICIENTLY					
IDENTIFICATION AND GROUPING OF THE STRATEGIES					
Coordination of manpower training w/ resultant instructions					
To do a survey / inventory of manpowwer / equipment in place					
Organize a FSM utility association					
Eventual privatization of utilities					
Ratification of tariff rates					
Standardizing of generators with more output for less fuel					Develop other alternate means of power generation
Make suppliers be responsible for disposal of waste oils					Supplement existing power generation
Centralize incorporate all power authorities to create uniformity on generators across the country			Public education -proper use of power - proper appliance & use - alternative energy supply & use	Develop a tariff schedule for different sectors based on needs	To upgrade the national capability to coordinate the complex energy sector
IDENTIFICATION AND GROUPING OF ISSUES, CONSTRAINTS AND OPPORTUNITIES					
Consolidation of the power utilities and the utilization of indigenous energy resources	A heavily subsidized power sector	Land access	Lack of systemic public relations program	An insufficient revenue base	Absence of a long term sustainable development plan
Consolidation of the operations of the power utilities (opp)	Heavy reliance on grants	Land access	Lack of systematic publication education Program	Political funding for power sector	Absence of a long term sustainable power development plan
Using copra as a fuel for power generation (opp)			Quality of - supply - service	Limited consumer base	Institutional strengthening
Cooperation between utilities				Insufficient capital to electrify the outer atolls	Reduce reliance on fossil fuels
Non-uniformity of generators / equipment used				Power to outer islands (rural)	Wasteful use of power
Generators spare parts				Non-enforcement of collection policies	Improved efficiency
Maintenance and replacement of power infrastructure				Subsidy of fuel money	Lack of organized career development training
Absence of a national power performance standards					Training across all sectors
Security of power supply - outages					
Disposal of waste oil					
Quality of petroleum products					
Limited competition in petroleum supply					
Competitive fuel pricing					

RENEWABLE ENERGY

OBJECTIVE: TO PROMOTE THE SUSTAINABLE SUPPLY AND UTILIZATION OF INDIGENOUS AND RE SOURCES				
IDENTIFICATION AND GROUPING OF STRATEGIES				
TO PROMOTE THE SUSTAINABLE DEVELOPMENT OF RE IN A COST-EFFECTIVE AND COORDINATED MANNER				
Unify / facilitate source of info on new and RE from local level and upward				
National coordinating office				
Seek internal / external funding for the development of renewable energy				
Strengthening of agencies responsible for the development of R/E		Provide waste disposal management incentives and public awareness		Initiate pilot projects to kick start R/E program in the outlying communities and eventually, hand over
Carry out user/ need surveys - payment scheme		Recycle of used batteries OR the proper disposal		Develop annual R/E fairs to display products
To carry out monitoring program (potential, sources and alternatives)				
IDENTIFICATION AND GROUPING OF ISSUES, CONSTRAINTS AND OPPORTUNITIES				
Lack of management and technical training on RE and knowledge about the local resource potential	Lack of capital for new RE projects and insufficient revenue to keep existing ones going	Disposal of used batteries	High capital costs for RE systems	Promote the use of RE
Lack of attention / coordination -no financial support -no technical know how	High initial capital investment	Disposal of Batteries (pollution)	Scale of economy bulk purchase	PCE opportunity (waste to energy) (opp)
Lack of technical data	Collection of monthly rates	PV introducing health hazard (lead)	Economy of scale	Use coconut oil as an alternative fuel especially on outer islands (opp)
Lack of technical knowledge	Lack of universal financial assistance to fund alternative usage			
Limited human resources to operate sophisticated technologies (OTEC)				
Repair, maintenance training				
Appropriations not meeting people's needs				
Technology availability vs suitability				

ANNEX 3

The Organizational Structure of the Department of Economic Affairs



ANNEX 4

Comparative Analysis Of The Four Utilities

	Chuuk	Kosrae	Pohnpei	Yap
Country Data				
Population	53000	7400	34000	12100
% Population access to electricity	36	95	81	50
Persons served by the Public Power Supply	19080	7030	27540	6050
Institutional Data				
Utility	CS/PUC	KUA	PUC	YS/PSC
Government or Private	Govt	Govt	Govt	Govt
Utility Commencement Year	1995	1992	1991	1996
No. of Board Members	5	5	7	7
Total Staff	65	33	130	77
Also responsible for water & sanitation	Yes	No	Yes	Yes
Taxes and Subsidies				
Subject to Income or Gross Revenue Tax	No	No	No	No
Liable to Non-Power Support Cost	Yes	No	Yes	Yes
Subject to Import Duties	No	No	No	No
Subject to Fuel Tax	No	No	No	No
Receives Operating Subsidy (Power)	Yes	Yes	Yes	No
Power Customers Cross-Subsidized	No	Yes	No	No
Total Number of Customers by Category	1618	1280	4564	2116
Residential	1325	1023	3646	1617
Commercial & Government	293	254	918	499
Industrial	n/a	3	n/a	n/a
Customers to Staff Ratio	25	39	35	27
Technical Data				
Installed Capacity by Technology (MW)	5.8	3	25.4	9.2
Diesel	5.8	3	24.2	9.2
Gas Turbines				
Hydro			1.2	
Installed capacity per customer (kW)	3.6	2.3	5.6	4.3
Gross Generation by Technology (MWh)	29338	9306	44889	15851
Diesel (incl Gas Turbines)	29338	9306	39889	15851
Hydro			5000	
Purchased Energy				
Peak Demand (MW)	4.3	2.01	6.9	2.5
Generation Plant Availability (%)	n/a	90	n/a	98
Total sales by customer category (MWh)	19808	8655	38665	12970
Residential	4512	3895	17399	2879
Commercial & Government	15296	4760	21266	10091
Industrial				
Total system losses (% gross generation)	32.48	7.00	13.87	18.18
Financial Data (USD)				
Fuel Expense				
Fuel consumed (million litres annually)	7.48	3.17	12.16	3.93
Fuel Conversion Efficiency (kWh gen/litre)	3.92	2.93	3.28	4.03
Price per litre of fuel ($)	0.19	0.19	0.19	0.19
Expend on fuel and lubrication ($m)	1.44	0.61	2.34	0.76
% of fuel in total operating expenses	71.50%	32.70%	28.30%	50.60%
Fuel cost per kWh sold ($)	0.07	0.07	0.06	0.06

| | Chuuk | Kosrae | Pohnpei | Yap |

Current Financial Performance				
Revenue from electricity sales ($m)	0.27	1.47	6.67	1.32
Operating Expenses ($m)	2.01	1.87	8.27	1.50
Operating Income ($m)	-1.75	-0.40	-1.60	-0.18
Net Income ($m)	-1.75	0.50	0.97	0.80
Operating costs per customer ($)	1245	1462	1811	707
Net Fixed Assets ($m)	5.76	4.30	33.62	6.96
Rate of return on net fixed assets (%)	-30.33	-9.28	-4.74	-2.53
Has long term debt	No	No	Yes	No
Tariffs and Revenues				
Average revenue per kWh sold ($)	0.01	0.17	0.17	0.10
Average cost per kWh sold ($)	0.10	0.22	0.21	0.12
Average Residential Tariff ($)	0.06	0.08	0.16	0.13
Average Commercial Tariff ($)	0.10	0.17	0.16	0.16
Average Industrial Tariff ($)		0.17	0.17	
Residential Revenues ($m)	0.27	0.31	2.78	0.37
Commercial & Government Revenues ($m)	1.53	0.81	3.40	1.61
Industrial Revenues ($m)				

Source: Adapted from the Forum Island Country Power Sector Tariff/Cost Study
Forum Secretariat, 1998

ANNEX 5

FSM Tariff Level and Structure

Chuuk Public Utilities Corporation		US$
	Metered:	
Residential	<1,000 kWh/month	.0600
	>1,000 kWh/month	.0900
Government	<1,000 kWh/month	.0600
	>1,000 kWh/month	.0900
Commercial	All consumption	.1000
	Unmetered:	
Residential ($/bedroom/month)		15.0000
Commercial ($/month)	Retail Store	150.0000
	Other, 1-phase	250.0000
	Other, 3-phase	450.0000
Pohnpei Utilities Corporation		
Residential	Energy Charge, $/kWh	0.1600
	Monthly Service Charge	4.0000
Commercial	Energy Charge, $/kWh	0.1600
	Monthly Service Charge	4.0000
Large Power Service	Energy Charge, $/kWh	0.1600
	MD Charge, $/kVA/month	9.0000
	Monthly Service Charge	10.0000
Industrial Power Service	Energy Charge, $/kWh	
	<100,000 kWh/month	0.1400
	>100,000 kWh/month	0.1200
	MD Charge, $/kVA/month	8.1000
	Monthly Service Charge	25.0000
Kosrae Utility Authority		
Residential and Commercial	<100 kWh/month	0.0640
	<1,000 kWh/month	0.9000
	<10,000 kWh/month	0.1600
	<100,000 kWh/month	0.1500
	>100,000 kWh/month	0.1100
Government	<100 kWh/month	0.1700
	<1,000 kWh/month	0.1700
	<10,000 kWh/month	0.1900
	<100,000 kWh/month	0.1800
	>100,000 kWh/month	0.1300
Large Commercial / Industrial	<100 kWh/month	0.1600
	<1,000 kWh/month	0.1600
	<10,000 kWh/month	0.1750
	<100,000 kWh/month	0.1650
	>100,000 kWh/month	0.1100
Yap State Public Service Corporation		
All Customers	<1,000 kWh/month	0.1300
	<5,000 kWh/month	0.1500
	>5,000 kWh/month	0.2000
	Monthly Service Charge	5.0000

Source: Adopted from the Forum Island Country Power Sector Tariff/Cost Study, Forum Secretariat, 1998.

ANNEX 6

ENERGY BALANCE ESTIMATES FOR THE FEDERATED STATES OF MICRONESIA FOR 1990 in original units											
	Biomass	Hydro	Electricity	Gasoline	Jet A1	Kerosene	ADO	IFO	Avgas	LPG	Petroleum
	(tonnes)		(GWh)	(kUSgal)							
Primary Supply											
Production	17774	2.49									
Imports				4091	2274	299	8429		60		15153
Bunkering/exports											
GROSS AVAILABLE	17774	2.49		4091	2274	299	8429		60		15153
Conversion											
Power Generation		2.49	67.37				-5298				-5298
Transformation Losses											
Station Use			-3.08								
T & D Losses			-9.00								
NET SUPPLIED	17774	4.98	55.29	4091	2274	299	3131		60		9855
Final Consumption											
Household	11774		na			299					299
Transport				4091	2274		3131		60		9556
air					2274				60		2334
road				3881			919				4800
sea				210			2212				2422
Govt/Commercial			na								
Industrial/Construction			na								
Agroindustries	6000										
Other			na								
TOTAL	17774			4091	2274	299	3131		60		9855

Source: Extracted from the Pacific Regional Energy Assessment, Volume 3. FSM: Issues and Options in the Energy Sector, 1992 (World Bank/ADB/UNDP/Forum Secretariat)

ENERGY BALANCE ESTIMATES FOR THE FEDERATED STATES OF MICRONESIA FOR 1990 '000 TOE												
	Biomass	Hydro	Electricity	Gasoline	Jet A1	Kerosene	ADO	IFO	Avgas	LPG	Petroleum	TOTAL
Primary Supply												
Production	6.08	0.62										6.70
Imports				12.50	7.56	0.97	28.45		0.18		49.66	49.66
Bunkering/exports												
GROSS AVAILABLE	6.08	0.62		12.50	7.56	0.97	28.45		0.18		49.66	56.36
Conversion												
Power Generation		-0.62	18.50				-17.88				-17.88	
Transformation Losses			-12.81									-12.81
Station Use			-0.26									-0.26
T & D Losses			-0.76									-0.76
NET SUPPLIED	6.08	0	4.67	12.50	7.56	0.97	10.57		0.18		31.78	42.53
Final Consumption			4.67									4.67
Household	4.10		na			0.97					0.97	5.07
Transport				12.50	7.56		10.57		0.18		30.81	30.81
air					7.56				0.18		7.74	7.74
road				11.86			7.47				19.33	19.33
sea				0.64			3.10				3.74	3.74
Govt/Commercial			na									
Industrial/Construction			na									
Agroindustries	1.98											1.98
Other			na									
TOTAL	6.08		4.67	12.50	7.56	0.97	10.57		0.18		31.78	42.53

Source: Extracted from the Pacific Regional Energy Assessment, Volume 3. FSM: Issues and Options in the Energy Sector, 1992
(World Bank/ADB/UNDP/Forum Secretariat)

ENERGY BALANCE ESTIMATES FOR THE FEDERATED STATES OF MICRONESIA FOR 1995 in original units											
	Biomass	Hydro	Electricity	Gasoline	Jet A1	Kerosene	ADO	IFO	Avgas	LPG	Petroleum
	(tonnes)		(GWh)	(kUSgal)							
Primary Supply											
Production	19647	2.49									
Imports				5109	3211	306	10265		69		18960
Bunkering/exports											
GROSS AVAILABLE	19647	2.49		5109	3211	306	10265		69		18960
Conversion											
Power Generation		-2.49	84.14				-6553				-6553
Transformation Losses											
Station Use			-3.85								
T & D Losses			-11.24								
NET SUPPLIED	19647	0	69.05	5109	3211	306	3712		69		12407
Final Consumption			68.44								
Household	13647		na			306					306
Transport				5109	3211		3712		69		12101
air									69		69
road				4598			1114				5712
sea				511			2598				3109
Govt/Commercial			na								
Industrial/Construction			na								
Agroindustries	6000										
Other			na								
TOTAL	19647		68.44	5109	3211	306	3712		69		12407

Source: Extracted from the Pacific Regional Energy Assessment, Volume 3. FSM: Issues and Options in the Energy Sector, 1992
(World Bank/ADB/UNDP/Forum Secretariat)

ENERGY BALANCE ESTIMATES FOR THE FEDERATED STATES OF MICRONESIA FOR 1995 '000 TOE												
	Biomass	Hydro	Electricity	Gasoline	Jet A1	Kerosene	ADO	IFO	Avgas	LPG	Petroleum	TOTAL
Primary Supply												
Production	6.73	0.62										7.35
Imports				15.61	10.67	0.99	34.64		0.20		62.11	62.11
Bunkering/exports												
GROSS AVAILABLE	6.73	0.62		15.61	10.67	0.99	34.64		0.20		62.11	69.46
Conversion												
Power Generation		-0.62	22.74				-22.12				-22.12	
Transformation Losses			-15.68									-15.68
Station Use			-0.33									-0.33
T & D Losses			-0.95									-0.95
NET SUPPLIED	6.73	0	5.78	15.61	10.67	0.99	12.52		0.20		39.99	51.85
Final Consumption			5.78									5.78
Household	4.75		na			0.99					0.99	5.74
Transport				15.61	10.67		12.52		0.20		39.00	39.00
air					10.67				0.20		10.87	10.87
road				14.05			8.76				22.81	22.81
sea				1.56			3.76				5.32	5.32
Govt/Commercial			na									
Industrial/Construction			na									
Agroindustries	1.98											1.98
Other			na									
TOTAL	6.73		5.78	15.61	10.67	0.99	12.52		0.20		39.99	51.85

Source: Extracted from the Pacific Regional Energy Assessment, Volume 3. FSM: Issues and Options in the Energy Sector, 1992
(World Bank/ADB/UNDP/Forum Secretariat)

ENERGY BALANCE ESTIMATES FOR THE FEDERATED STATES OF MICRONESIA FOR 1998 in original units											
	Biomass	Hydro	Electricity	Gasoline	Jet A1	Kerosene	ADO	IFO	Avgas	LPG	Petroleum
	(tonnes)		(GWh)	(kUSgal)							
Primary Supply											
Production	20916	2.49									
Imports				5910	4072	310	11666		75		22033
Bunkering/exports											
GROSS AVAILABLE	20916	2.49		5910	4072	310	11666		75		22033
Conversion											
Power Generation		-2.49	97				-7529				-7529
Transformation Losses											
Station Use			-4.46								
T & D Losses			-13.00								
NET SUPPLIED	20916	0	79.54	5910	4072	310	4137		75		14504
Final Consumption			79.54								79.54
Household	14992		na			310					310
Transport				5910	4072		4137		75		14194
air									75		75
road				5127			1262				6389
sea				783			2875				3658
Govt/Commercial			na								
Industrial/Construction			na								
Agroindustries	5924										
Other			na								
TOTAL	20916		79.54	5910	4072	310	4137		75		14504

Source: Author's estimates based on the PREA estimates of 1992.

ENERGY BALANCE ESTIMATES FOR THE FEDERATED STATES OF MICRONESIA FOR 1998 '000 TOE												
	Biomass	Hydro	Electricity	Gasoline	Jet A1	Kerosene	ADO	IFO	Avgas	LPG	Petroleum	TOTAL
Primary Supply												
Production	7.21	0.62										6.70
Imports				18.06	13.53	1	39.26		0.21		72.06	72.06
Bunkering/exports												
GROSS AVAILABLE	7.21	0.62		18.06	13.53	1	39.26		0.21		72.06	78.76
Conversion												
Power Generation		-0.62	26.01				-25.42				-25.42	
Transformation Losses			-17.88									-17.88
Station Use			-0.39									-0.39
T & D Losses			-1.10									-1.10
NET SUPPLIED	7.21	0	6.64	18.06	13.53	1	13.84		0.21		46.64	59.36
Final Consumption			6.64									6.64
Household	5.22		na			1					1	6.22
Transport				18.06	13.53		13.84		0.21		45.64	45.64
air					13.53				0.21		13.74	13.74
road				15.66			9.69				25.35	25.35
sea				2.40			4.15				6.55	6.55
Govt/Commercial			na									
Industrial/Construction			na									
Agroindustries	1.98											1.98
Other			na									
TOTAL	7.20		6.64	18.06	13.53	1	13.84		0.21		46.64	59.36

Source: Author's estimates based on the PREA estimates of 1992.

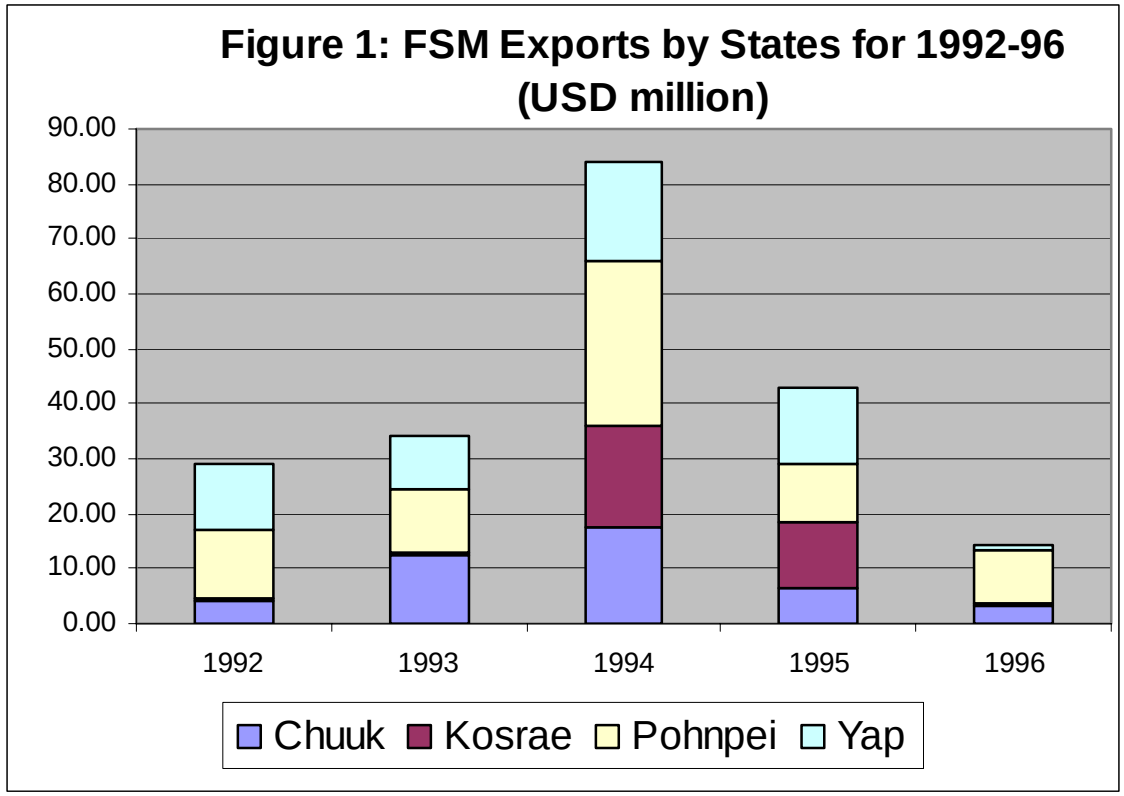


Figure 1: FSM Exports by States for 1992-96
(USD million)
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
1992
1993
1994
1995
1996
Chuuk
Kosrae
Pohnpei
Yap

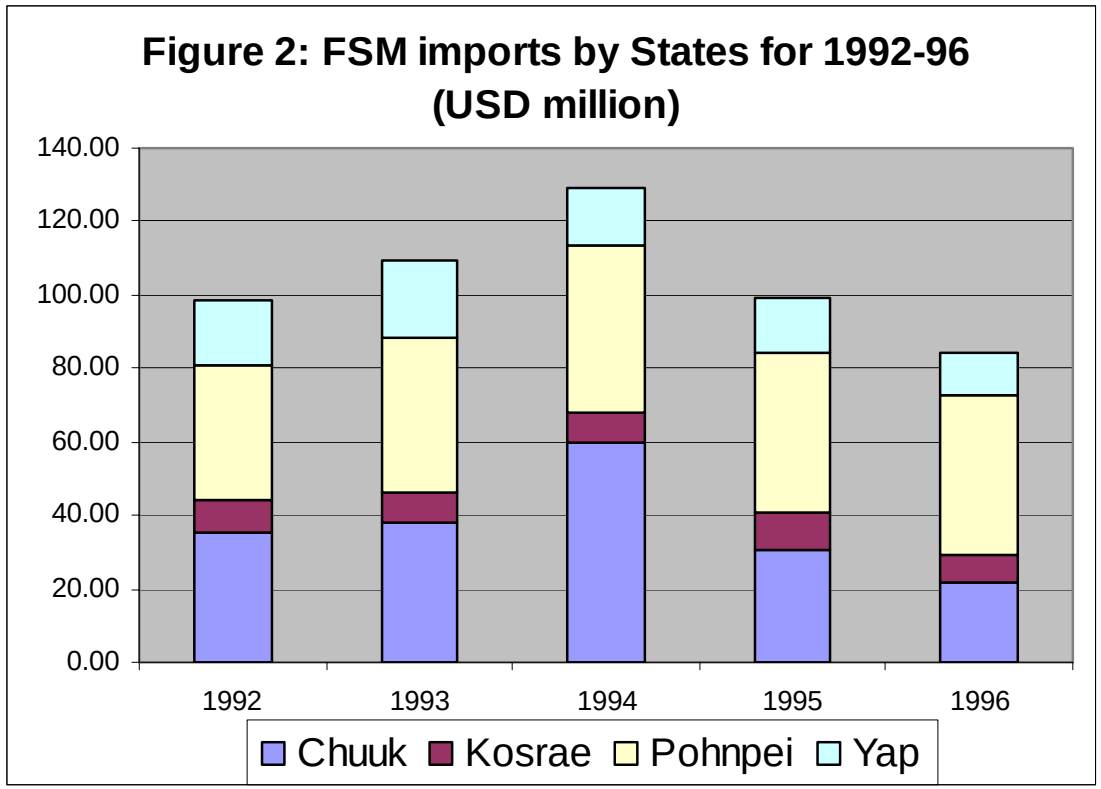


Figure 2: FSM imports by States for 1992-96
(USD million)
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
1992
1993
1994
1995
1996
Chuuk
Kosrae
Pohnpei
Yap

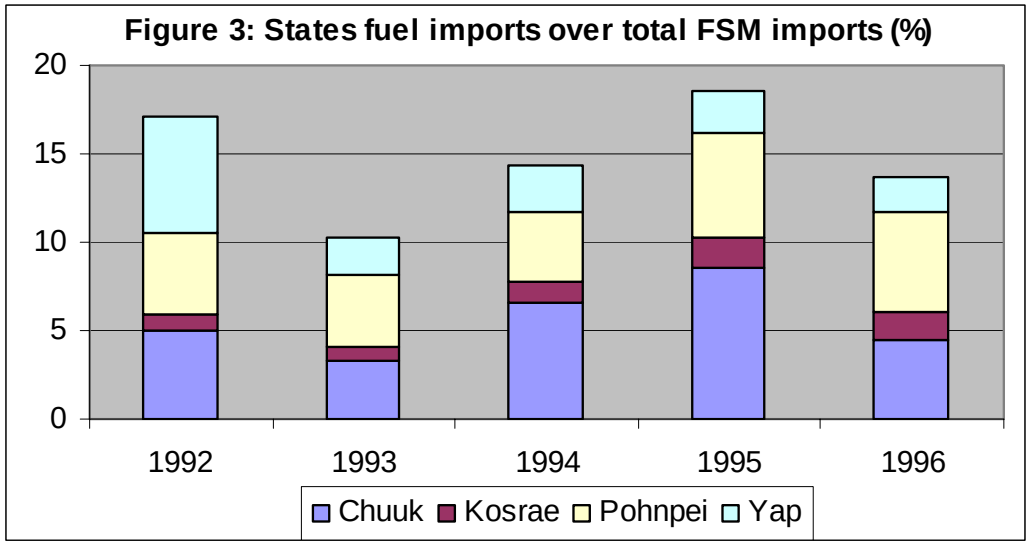


Figure 3: States fuel imports over total FSM imports (%)
20
15
10
5
0
1992
1993
1994
1995
1996
Chuuk
Kosrae
Pohnpei
Yap

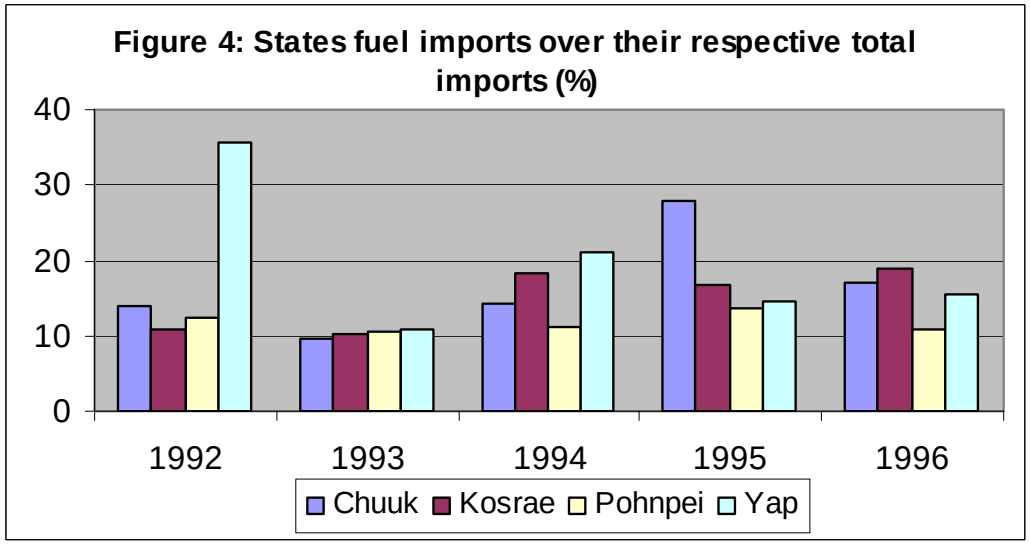


Figure 4: States fuel imports over their respective total imports (%)
40
30
20
10
0
1992
1993
1994
1995
1996
Chuuk
Kosrae
Pohnpei
Yap

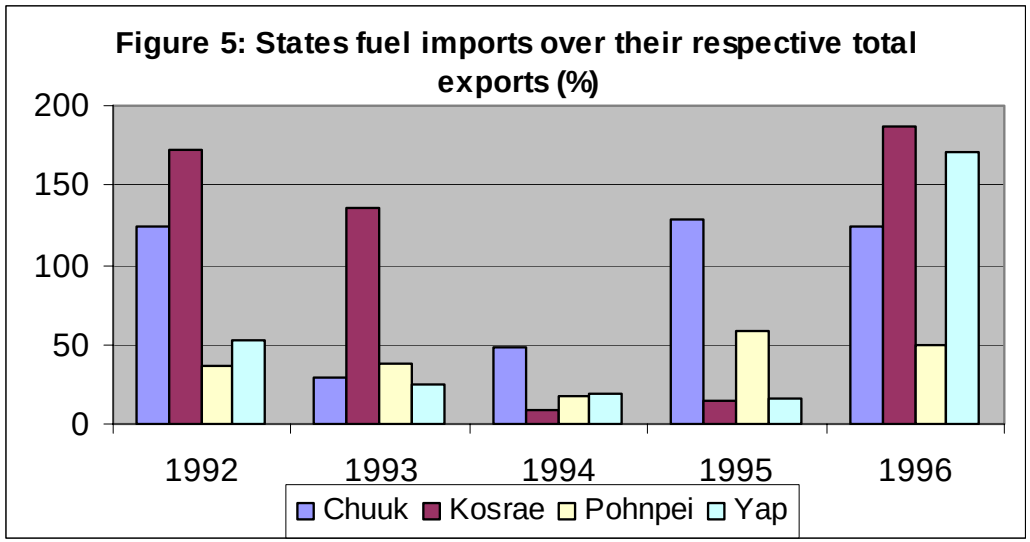
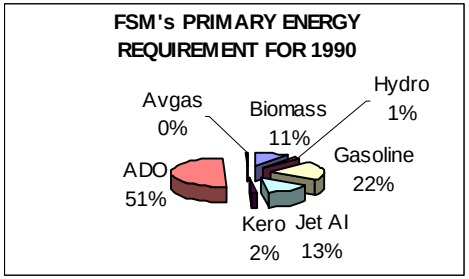
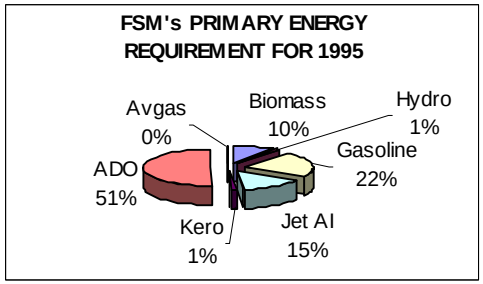


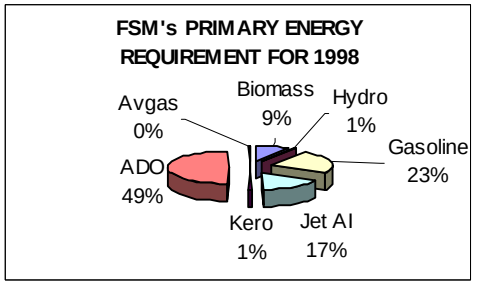
Figure 5: States fuel imports over their respective total exports (%)
200
150
100
50
0
1992
1993
1994
1995
1996
Chuuk
Kosrae
Pohnpei
Yap

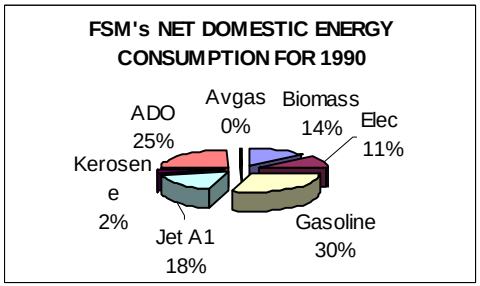
Figure 6

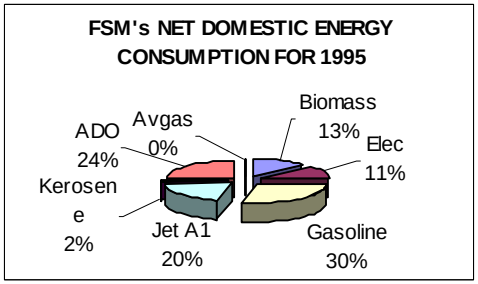
FSM's MAJOR ENERGY SOURCES AND CONSUMPTION SECTORS

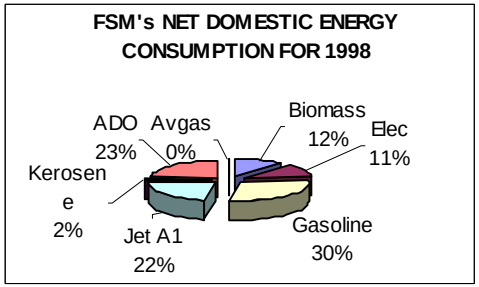


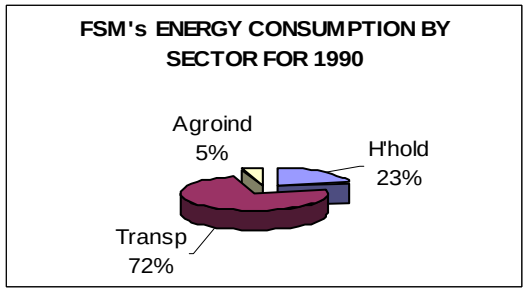


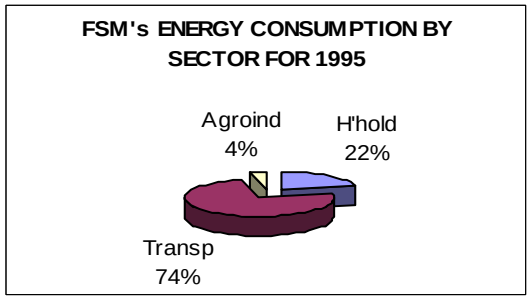


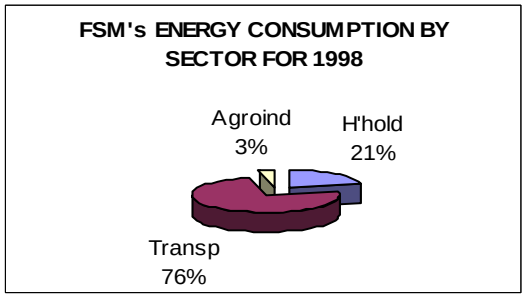


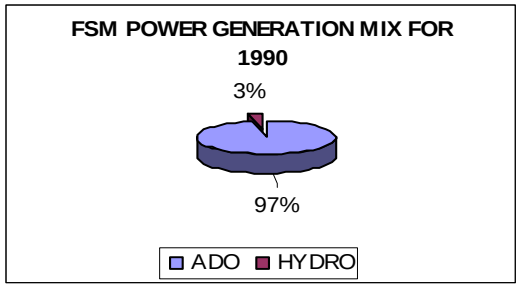





FSM's ENERGY CONSUMPTION BY SECTOR FOR 1990
Agroind 5%
H'hold 23%
Transp 72%


FSM's ENERGY CONSUMPTION BY SECTOR FOR 1995
Agroind 4%
H'hold 22%
Transp 74%


FSM's ENERGY CONSUMPTION BY SECTOR FOR 1998
Agroind 3%
H'hold 21%
Transp 76%


FSM POWER GENERATION MIX FOR 1990
3%
97%
ADO
HYDRO