# GOVERNMENT OF KIRIBATI

GoK (14) DPF (Presentation 05)

# DEVELOPMENT PARTNERS FORUM

*Tarawa, Kiribati*
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**AGENDA ITEM 5: Towards an energy secure Kiribati**

## Purpose

To provide an overview on the Energy Sector highlighting the key policy areas, strategies and key expected outcomes and results.

## Background

As a small Pacific Island Country with no sources of conventional energy, Kiribati is extremely dependent on imported petroleum fuels for all electricity generation, transport and cooking. Biomass is estimated to constitute around 25% of the gross national energy supply and is used for cooking and copra drying. Solar PV is used in the outer islands, but accounts for less than 1% of national energy consumption. On the outer islands the per capita energy use is very low, and energy is often solely used for lighting and cooking with solar and biomass as the main sources. Petroleum use is mainly kerosene used for lighting or cooking and to operate a few motorcycles and outboard powered boats. The Government of Kiribati struggles with the high cost of importing fossil fuels, in particular to the outer islands. In order to keep the import of fossil fuels at a minimum, the Government has long had a policy of utilising renewable energy and local resources for electrification and associated development. The Kiribati National Energy Policy (KNEP) has a vision of '*available, accessible, reliable, affordable, clean and sustainable energy options for the enhancement of economic growth and improvement of livelihoods in Kiribati'*.

In 2012, the Government of Kiribati and the International Renewable Energy Agency (IRENA) conducted a Renewable Readiness Assessment (RRA) with a goal to maximize the economic use of Kiribati renewable energy resources. The results of the study are listed below;

I. Maintaining grid stability while allowing a high level of solar PV input.
II. Develop CNO as a biofuel for power generation and transportation.
III. Rural electrification.
IV. Policy, legislation and regulation development to support renewable energy

Addressing the issues identified in the RRA will effectively cover the following key problem areas:

- *Energy security*: Extreme reliance on petroleum which is subject to rising and volatile prices, transportation difficulties and environmental risk, including greenhouse gases.

- *Inequitable distribution of resources to the outer islands:* low per capita energy use on the outer islands is contributing to limited development and economic opportunities.

- *Lack of electricity for basic services (education, health, community development, etc.) and local government*: schools, health centres, community institutions and municipal buildings are without electricity.

Another significant outcome of the RRA is the fossil fuel reduction target for electricity generation by 2025 which was stated in the Majuro Declaration. This is an important measure to reduce the consumption of imported fossil fuel and the Government is committed to work towards achieving the target with the support from its development partners. The target is focused on the following sectors;

1. South Tarawa 45% (23% RE and 22% EE
2. Kiritimati Island 60% (40% RE and 20% EE)
3. Rural public infrastructure 60% (40% RE and 20% EE
   >*Southern Kiribati Hospital and Ice plants*
4. Rural public and private institutions 100% (100% RE)
   >*Boarding Schools, Island Council, private amenities and households.*

## CURRENT SITUATION AND POSSIBLE ARES OF INTERVENTION

### 1) OUTER ISLAND AND RURAL ELECTIFICATION

There is wide disparity between the economic conditions in the capital, Tarawa, and the outer islands, where a lack of economic opportunities and a persistently lower standard of service delivery, particularly in health, education and water and sanitation is causing urban migration. 49% of the population is now concentrated in urban centers, leading to overcrowding. Due to the better standard of living and economic opportunities that electricity brings, migration to the capital may be reduced by increasing access to electricity to the outer islands. To date roughly 34% of outer island homes have solar lighting services and this will increase significantly when the solar lighting project financed by the European Union finally concluded in 2015. In addition, Taiwan Government donated 2160 solar lighting kits which were distributed to 426 community halls in most of the Islands. The table below shows the coverage of the solar system in the Outer Islands.

| Total number of households in Kiribati (2010 Census) | Outer islands households only (2010 Census) | No of Households with existing Solar System in the OI (2010 census) | Total No. of Households to be covered under EDF10 project | Remaining No of Households to be covered to achieve 100% coverage |
|---|---|---|---|---|
| 16043 | 8011 | 2923 | 2290 | 3458 |

Table 1: No of Households with solar system

The Government of the Republic of Kiribati considers the development of its outer islands as an essential part of its development policy. This policy aims to improve the quality of life and economic conditions of the outer islands and providing greater access to modern electricity services is a key component in the effort to improve outer island socio-economic conditions.

Despite the social and economic benefit that modern electricity brings to the Islanders, the Government will also save more money by spending less on fuel as fuel needs on the Islands reduced considerably by using renewable energy. The European Union contributions were focused on Education for Senior Secondary schools, households, communities and private businesses. Yet there is a pressing need for electricity at Junior Secondary Schools, health service centres and community and municipal centres. The following list highlights targeted area identified during the consultation with the Outer Islands energy working committee.

1) Health;
   i) Solar PV for Southern Kiribati Hospital
   ii) Solar PV for Outer Island Clinics
2) Education;
   i) Solar PV system for Mereang Taabwai Secondary School
   ii) Solar PV system for Outer Island JSS

3) Productive Population and Poverty alleviation;
   i) Solar lighting kit for households
   ii) Solar PV for Island Council
   iii) Solar PV for Fish centers
   iv) Solar PV for desalination plant.
   v) Solar system for radio communication – Police post
   vi) Solar PV system for non-government vocational institutions: CCL Manoku and Alfred Sadd Institution.

## Description of the proposed activities and their effectiveness

Activity 1 – Solar pv mini grid system for Southern Kiribati Hospital (2.4 million)

This activity will design, procure and install off-grid PV systems for the Southern main hospital (265kWp) to a level to support a fully equipped needed to operate a hospital. This activity wills extent to hospital staff's residence. Technical assistance may be required to design the systems as necessary and provide training for Hospital staff on solar PV systems, including basic operation and maintenance. The proposed project will address the major challenges faced by the Government of Kiribati in particular the Ministry of Health and Medical Services on the excessive spending on fuel cost and the availability of fuel on the island on a monthly basis including the unexpected interruption of the hospital services due to fuel issues.

Activity 2 – Outer Island Clinic solar system rehabilitation ($ 230,000.00)

This activity will design, procure, and install 58 systems in total on 20 outer Islands. The system will provide power for lighting and for HF communication radio. The entire power system for all the clinics fail and therefore, all clinics are inconveniently operated during the night during emergency cases and unable to communicate with the hospital if they have problems. The aim is to provide basic necessaries needed to operate health centres.

Activity 3 – Mereang Taabwai Secondary Schools solar pv mini-grid system ($500,000.00)

This activity will design, procure and install off-grid PV systems (20 kWp) for the school to a level to support a fully equipped computer lab, dormitory lighting, refrigerator/freezers, office equipment and audio-visual equipment. This activity wills extent to teacher's residence. Technical assistance may be required to design the systems as necessary and provide training for school teachers and headmasters in the basic principles of solar PV systems, including basic operation and maintenance. The aim will be to retain teachers, improve quality of education & access to information and eventually improve employment prospects for school leavers.

Activity 4 –Junior Secondary School (JSS)system.($285,000.00)

This activity will design, procure and install off-grid PV systems for lighting and Charging Laptop computers of 2 classrooms and staff room in all JSS in the Outer Islands (410 Wp each). This will allow staff and student to work and study in the evening especially during exam preparations.

Activity 5 –Solar Home System for Households.(1.5milliom)

This activity will procure and install 3900 solar home system to cover up all remaining households in the Outer Islands. The system will provide basic lighting, phone and radio charging which will improve social-economic condition in the Outer Islands. (1.5 million)

Activity 6 – Outer Island Council solar PV mini grid system ($710,000.00)

This activity will design, procure and install off-grid PV systems (5 kWp each) for island council administrative centres in the Gilbert and Line Groups. The administrative centres have a great need for power supply to run office equipment, telecommunication centres for telephone and internet, computers, printers and photocopiers.

Activity 7 – Outer Island Fish Centres ($610,000.00)

This activity will design, procure and install off-grid PV systems for the Fish Centres (3.75kWp each) in all the Islands to a level to support a fully equipped centres lighting, refrigeration and other equipment. The proposed project will address the major challenges faced by the Government of Kiribati in particular the Ministry of Fisheries on the excessive spending on fuel cost and the availability of fuel on the island on a monthly basis which in some occasion caused the centres to close down.

Activity 8 – Desalination Plant for vulnerable rural community. ($115,000.00)

13 community systems for solar water desalination plant will be procured and installed on 9 selected Islands. This activity will improve quality of life in households by providing portable water supply to the most vulnerable Islands in Kiribati. This activity provides an opportunity to address the issue of portable water shortage leveraging the availability of solar energy on the Islands.

Activity 9 – Outer Island Police Station solar system rehabilitation ($60,000.00)

23 solar systems (120 Wp each) will be procured and installed in all of the outer Islands. The solar system currently used for communication, lighting, etc at the Police stations are old which deter the services provided by the police as most of the system failed. A new system will enhance the Police daily works and will surely carry out effective policing functions which results in a more effective responsive to emergency cases without delays.

Activity 10 – Solar PV system for non-government vocational institutions: CCL Manoku and Alfred Sadd Institution ($500,000.00)

This activity will design, procure and install off-grid PV systems (10 kWp) for each community institution to support the institution daily activities. This activity wills extent to teacher's residence. Technical assistance may be required to design the systems as necessary and provide training for school teachers and headmasters in the basic principles of solar PV systems, including basic operation and maintenance. This is a community based energy project that have strong link to livelihoods improvement.

## 2) URBAN ENERGY AND ELECTRIFICATION

### 2.1.0 Electricity

Supply of electric power is provided primarily by the Public Utilities Board (PUB) on Tarawa, though there are small grids on Kiritimati. The on-grid access to electricity is about 44% by the PUB plus another 3% by the multiple small grids on Kiritimati. As seen in Table 1, Tarawa electricity demand in 2011 was about 6.6 GWh for government, 7 GWh for domestic and 3 GWh for commercial. Since there is no significant tourism or other industry, commercial uses are mostly for stores and offices. Table 2 also shows the sale of generated electricity on Tarawa which was approximately 17.3 GWh, requiring a use of around 5.8 megalitres (ML) of automotive diesel oil (ADO). **Running the generators cost PUB about $8million annually.**

| | Billed | | | Not Metered | | | |
|---|---|---|---|---|---|---|---|
| Year | Domestic | Commercial | Govt. | Water & Sewer[3] | PUB[4] | Total MWh | Total Fuel Used at PUB [kl] |
| 2005 | 7 893.00 | 5 093.00 | 3 376.00 | 568.09 | 23.48 | 16 953.57 | 5 913.73 |
| 2006 | 6 864.00 | 4 500.00 | 4 458.00 | 568.09 | 3.13 | 16 393.21 | 6 235.66 |
| 2007 | 7 562.00 | 2 854.00 | 8 331.00 | 568.09 | 10.50 | 19 325.58 | 6 293.07 |
| 2008 | 7 197.00 | 3 073.00 | 7 335.00 | 568.09 | 8.52 | 18 181.61 | 5 881.87 |
| 2009 | 7 395.58 | 2 826.61 | 7 170.05 | 568.09 | 44.94 | 18 005.27 | 5 812.71 |
| 2010 | 7 111.00 | 3 086.00 | 7 029.00 | 568.09 | 2'0.32 | 17 814.41 | 5 744.97 |
| 2011 | 7 060.00 | 3 051.00 | 6 629.00 | 568.09 | 14.03 | 173 22.11 | 5 791.26 |

Table 2: Electricity Statistics 2005-2011(MWh)
Source: PUB

A feasibility study on the potential for grid-connected solar PV on the South Tarawa grid system has been undertaken under the assistance of the WB. The study finds that 900 kWp (STC) and 800 kWp (AC) of solar PVs can be connected to the grid without the need for enhancements to the grid systems and operations provided the installations are appropriately sized, specified and located and there are controls to cut back on solar input on weekends and holidays to ensure grid stability can be maintained. Kiribati, with the support of the WB, has agreed on four sites where an initial 516 kWp (STC) of solar PVs are to be installed with funding from AusAID through the Pacific Regional Infrastructure Facility and the Global Environment Facility.

In addition, Kiribati is working with the PEC Fund to install additional solar PV capacity to take the total installed capacity to the technically feasible limit of 900 kWp of grid connected solar PV systems. The United Arab Emirates (UAE) project implemented by Masdar will add another 400kW of solar PV

capacity which will make up a total of 1.3MW of solar PV capacity to be installed to the existing grid. The UAE project will utilize a control and monitoring system which will prevent grid stability and allows the grid to absorb more than what was assumed in the WB study. It is estimated that PUB will save at least **0.8 million** on fuel once all systems comes online.

On the other hand, Kiribti has examined several options to utilize coconut oil (CNO) as a substitute for diesel fuel. KCMCL attempted to use CNO in their production boilers and vehicles at different blending ration. Through that experiment it was learnt that CNO must be treated and filtered to upgrade its fuel quality while moisture must also be removed. There is little doubt that diesel-powered generators can run safely on blended CNO if the challenges posed by CNO use are well understood and effectively managed.

With the increasing demand of electricity one of the most cost-effective and efficient strategies among others is to reduce the demand is through energy labeling and minimum energy performance standards (MEPS). MEPS prevent the least efficient products from entering the country and labelling allows buyers to seek out the most efficient products on the market. These programmes do not have to increase the price of products – efficient appliances do not necessarily cost more to buy, but they will certainly cost less to run. Kiribati is now of Pacific Appliance Labeling and Standard program and it is envisioned that the benefit for PUB and the general public are;

1. A saving of about 413,000 litres per year in diesel fuel by 2020 (with a value of between USD 890,000 and 1,310,000 per year, depending on oil prices;
2. A reduction in emissions of about 3,900 tonnes CO2-e per year by 2020; and
3. Net savings to households of between AU $49 and 52 per year by 2020, rising to over AU $135 per year by 2028

The Government is keen to explore further opportunities in utilizing renewables and energy efficiency measures with a view to reduce PUB fuel consumption while keeping up with the increasing demand and the following highlights possible intervention areas;

i) Upgrading PUB grid including automation, duel fuel genset and storage technology to increase capacity of RE penetration into the grid.
ii) Renewable Energy for power generation in Kiritimati Island.(EU/NZ express interest)
iii) Grid centralization in Kiritimati (Ronton to Tabwakea and Banana to Main Camp corridors)
iv) Additional fuel tank (2 Million liters)

## Description of the proposed activities and their effectiveness

Activity 1 – Upgrading PUB grid including automation, duel fuel genset and storage technology

This activity has three components;

1. Install a reliable communication system coupled with suitable software package that would be able to display instantaneous data which will allow for control and monitoring of the generation between the two power houses – Betio and Bikenibeu. Existing transformers must be replaced as well to increase grid reliability and genset dispatch. (1.93million)
2. Procuring and installing of duel fuel genset to cater for the increasing demand and to allow for biofuel to be used as an alternative fuel. Biofuel production and test facility will be part of this activity (1.5 million).
3. Procure and install storage technology that will stabilize the grid as the level of renewable installation increases. (1.1 million)

Activity 2 – Renewable Energy for power generation and grid upgrading in Kiritimati Island (NZD 10 million)

This activity will procure and install solar pv system, upgrade existing grid and develop management and operation plan for electiricty in Kiritimati. The project goal is "A financially self-sustained sector development in Kiritimati Island.

### 2.1.1 Petroleum

Due to the fact that Kiribati has no fossil fuels, the demand for petroleum products, mainly diesel, gasoline and kerosene, is met solely by fuel imports though CNO is produced locally and there is potential for it to replace a portion of petroleum imports. With the increase in local demand of petroleum products and increase in energy prices at the international markets, Kiribati's annual spending on fuels is at the range of USD 8-9 million. This in turn has pushed electricity prices up to a level among the highest in the region, ranging from USD 0.42/kWh to USD 0.73/kWh and the need for additional storage to cater for the increasing demand.

KOIL currently implements a fuel storage expansion project which will provide sufficient fuel storage capacity to increase its current fuel imports level for ADO (diesel), ULP (petrol) and DPK (kerosene and JETA1). The current turnaround of the local coastal tanker of 28 days could potentially cause fuel shortages in the country in case of delays due to bad weather as continued to be experienced every so often. KOIL should have sufficient fuel storage capacity to maintain sufficient fuel level to last for more than 30 days at least until the next fuel shipment arrives.

The new fuel farm will increase KOIL storage capacity from 2,380$m^3$ to 4,820$m^3$ which will increase local tanker turnaround from 28 days to 60 days. Three new storage tanks (1x2000$m^3$ - ADO, 1x1000$m^3$ - ULP and 1x1000$m^3$ - Jet A1) will be located on the new reclaimed site. The new site would also need to be compacted to be able to accommodate four fuel tanks, 2x2000$m^3$ and 2x1000$m^3$. KOIL will start with three new storage tanks and the fourth one is for future development.

KOIL fuel is currently supplied by MOBIL under a 2 year contracts which will end in July 2014. Supply security and pricing are critical components of the fuel supply contract and this again will be considered in the next supply contract.

**Description of the proposed activities and their effectiveness**

Activity 1 – Additional tank – 2000$m^3$ (2 million)

This activity will construct and erect a new tank. The new tank will provide more storage for fuel which will attract a more competitive fuel pricing from suppliers and savings expected from fuel supply costs.

## 3) POLICY PLANNING AND COORDINATION

The National Energy Policy was established in association with the Kiribati Development Plan 2008-2011 and has as its primary goals human resource development in the energy sector, development of livelihoods, energy security and energy access. The guiding principles are sustainability, gender equity, environmental compatibility, stakeholder participation, good governance and cultural/traditional compatibility. However targeted policy is required to address specific areas to better serve the emerging

needs of Kiribati as a whole. The following list highlights policy areas that will address the current situation in energy;

1. Review existing supply contract and identify options for alternative fuel supplier where possible.
2. Electricity tariff review to support the private sector and low income households,
3. National Energy Roadmap development.
4. Policy and legislation for Renewable Energy, Electricity and Petroleum fuels.
5. Energy efficiency and conservation measures.

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## Description of the proposed activities and their effectiveness

Activity 1 – Review existing supply contract and identify options for alternative fuel supplier where possible.($25,000)

This activity will explore contract criteria and options that will enable KOIL to obtain a secure supply of fuel at the best price.

Activity 2 – Electricity tariff review to support the private sector and low income households.($45,000)

This activity will analyze PUB generation, transmission and distributed costs and determine a tariff for each respective customer. This activity will be extended to review tariff on the Island of Kiritimati The aim is to provide a tariff that will support private sectors and low income households.

Activity 3 – National Energy Roadmap development. ($30,000)

This activity will develop and provide a detailed plan in achieving renewable energy and energy efficiency target recently endorsed by Government. The transport sector energy reduction target will be part of the roadmap development. Once developed, the roadmap will be a working document for the Government on Energy.

Activity 4 – Policy and legislation for Renewable Energy and Energy Efficiency, Electricity and Petroleum fuels.($150,000)

This activity will develop specific policies such as Feed in Tariff/Net metering policies that will enable increase utilization of renewable energy at all levels. Energy legislations need to be established to back up policies and ensure safe, effective and efficient use of energy.