SECTOR ASSESSMENT: ENERGY

1. Sector Performance, Problems, and Opportunities

1. **Overview.** Approximately 75% of the population of the Republic of the Marshall Islands (RMI) has access to grid electricity; 92% in the urban areas of Majuro and Ebeye, and 32% in the rural outer islands.[1] Some outer islands have central power plants, some of which run during limited hours of the day. Other remote populations receive electricity services from photovoltaic battery systems provided by international donors and maintained by the central utility.

2. RMI has two power utility companies, both of which are state-owned operating under a joint utilities board appointed by the RMI president's cabinet: the Kwajalein Atoll Joint Utility Resources (KAJUR) and the Marshalls Energy Company (MEC). KAJUR provides electricity (and water and sanitation) services to the island of Ebeye in Kwajalein Atoll. MEC is responsible for electricity service throughout the rest of RMI. MEC's main grid is on the Majuro atoll, along with a diesel mini-grid on the Rongrong islet. Diesel mini-grids on Jaluit and Wotje atolls each serve about 100 homes. MEC also manages stand-alone solar installations on populated outer islands. As of April 2017, many smaller islands have solar-powered small systems, supplying power to local medical centers, reverse osmosis systems, schools and private residences.

3. In fiscal year 2016 (October 2015 through September 2016), MEC generated 53.7 GWh of electricity (72% of RMI's consumption), used 3.8 million US gallons (14.4 million liters) of fuel, with an overall fuel efficiency of 14.0 kWh/US gal (3.698 kWh/liter). Between 2011 and 2016, Majuro's annual consumption decreased from 62.6 GWh to 53.7 GWh, partly attributable to the implementation of a pre-paid residential metering program. In the same period, overall fuel efficiency dropped from about initial 15.2 kWh/US gal to current 14.0 kWh/US gallon, mostly due to the deteriorating condition of MEC's Majuro diesel generation plant.

4. RMI is highly dependent on imported petroleum fuels. It is estimated that about 92% of energy used in 2011 was from petroleum, biomass remaining significant but declining to about 2%, with on-grid and off-grid solar totaling around 6%.[2] The main petroleum imports are gasoline, diesel fuel, dual-purpose kerosene (used as aviation turbine fuel and household kerosene), and liquefied petroleum gas (LPG). In 2011, RMI imported 56 million liters of petroleum fuel. The Marshalls Energy Company (MEC) and Exxon-Mobil are the main importers. Based on information for the years 2007 to 2011, 48% of imports are used for transportation and 52% for electricity generation. Kerosene demand for households is almost zero, with increasing numbers of people using LPG for cooking and solar energy for lighting. However, in the outer islands and atolls, there is evidence that biomass is still the predominant fuel for cooking.

5. Petroleum will likely continue to be the dominant fuel that drives the economy and provides social services to the people, particularly in the urban areas of Majuro and Ebeye. Environmental considerations prompted a change in diesel fuel sulfur content requirements for power generation from 5000 ppm to 500 ppm in October 2013.

6. The Majuro distribution system is powered by a single power generation facility with three long, ageing radial transmission lines. MEC has concerns about the effects of unregulated solar energy connection to this relatively fragile grid. As a result, the company has moved cautiously

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[1] IRENA Policy Brief: Policy Challenges for Renewable Energy Deployment in Pacific Island Countries and Territories. International Renewable Energy Agency, 2012.

[2] Republic of the Marshall Islands National Energy Policy (Draft), April 2014

towards adopting grid-connected solar systems that do not include energy storage. So far it has only allowed five grid-connected solar installations without storage. Two 53 kWp and 57 kWp systems are at the College of the Marshall Islands. The others are a 10 kWp system at the fisheries base, a 30 kWp system at the University of the South Pacific campus and a 209 kWp system at Majuro hospital. MEC intends to move cautiously before allowing a major expansion of grid-connected solar generation. MEC is seeking technical assistance to identify required investments in its existing system to enable it to accommodate connection of a larger share of intermittent renewable generation (primarily solar: Majuro's solar resource is excellent at 5.53 kWh/m2/day. RMI's wind resource has not yet been reliably quantified.)

7. As of September 2014, 359 kilowatt-peak (kWp) of solar had been connected to the Majuro grid. A further 600 kWp of solar generation was installed at Majuro's airport under an IRENA-sponsored grant in 2016; it is currently operating at half-capacity due to an underground cable fault and damage to power inverters in March 2017. It is scheduled to be restored to full capacity in August 2017. With this level of solar penetration, Majuro's power system is unable to accommodate further introduction of intermittent renewable generation without investment in network, generation, and control hardware to ensure network stability.

8. The current cost of electricity for utility customers in RMI is $0.416/kilowatt-hours (kWh) for government, $0.406/kWh for commercial, and $0.346/kWh for residential customers. Roughly 60% of residential customers receive a subsidized "lifeline" rate, which is $0.326/kWh for the first 500 kWh/month of consumption. Outer-island homes with off-grid solar systems pay a $5/month lease to MEC for maintenance of these solar systems.

9. A 2010 assessment of MEC's Majuro network determined total losses to be 27%, deriving from technical and non-technical losses, and unbilled usages such as street lighting and the power station's internal consumption (known as "parasitic load"). MEC's Majuro power station's parasitic load was above 7%, which is relatively high (a typical station's parasitic load should not exceed 5%).

10. The expanded deployment of pre-paid meters has enabled MEC to improve its revenue collections. As of September 2016, MEC had 551 standard residential post-paid meters and 2604 residential pre-paid meters. (Commercial meters numbered 427, of which 10 were of the pre-paid variety. Government meters numbered 129 post-paid meters). These meters, however, are not "smart" meters. They do not communicate with a central data collection center, and cannot be remotely monitored. It is also observed that no written record is kept on the assignment of individual meters to distribution transformers. In these conditions, MEC's ability to identify in which areas of its distribution network its technical and commercial losses are highest is undermined.

11. Average household electricity consumption in FY 2016 was 544 KWh per month; sold at about US$0.38 per kWh. It has been reported that the introduction of pre-paid meters has positively influenced energy conservation, which in turned reduced overall consumption from 62.6 GWh in 2011 to about 53.7 GWh in FY 2016. However, streetlights remain un-metered and therefore show up as technical losses. Government policy provides free electricity allowance of 1000 KWh/month is provided to owners of land on which MEC's network assets are located. While this is fully covered by direct transfer from government, due to MEC's poor financial management practices, this arrangement creates a substantial liability for MEC. Further, this arrangement is being crudely abused: through a mitosis-like proliferation of land titles, as of April 2017, 901 households receive this benefit (a change from 600 in 2015).

12. KAJUR has an installed capacity of 4.8 MW and a peak demand of 2 MW. It has about

1,300 metered customers and generates 16.9 GWh of electricity per year (FY 2016 data) using 4.58 million liters of fuel. The cost of electrical energy is heavily subsidized through duty tax imports exemptions and tax rebates given to MEC.

13. The outer rural islands and atolls are electrified through off grid solar PV home systems through various projects being implemented since 2006. However, the sustainability of these solar home systems is in doubt with regards to the continuation of maintenance of batteries over the lifespan as well as replacement at the end of the battery life of 5 years. While the full life-cycle cost of the deployed solar home systems is estimated at $28 per month, MEC is authorized to collect only $5 per month from customer households. No explicit government subsidy exists to fully compensate MEC for this shortfall.

14. RMI's main fuel storage facility is situated at Majuro Atoll on the ocean side of the southern side of the island. Diesel fuel is supplied from tankers which berth within the lagoon. Diesel is supplied to the Marshall Islands Energy Company power generation facility which is situated on the northern side of the main road between dock and the fuel storage facility. In addition to storing fuel for power generation, MEC also delivers fuel to KAJUR, and sells fuel to commercial marine fleets (primarily licensed fishing vessels). An assessment funded by the World Bank in 2011 found that the facilities have significant uncontrolled risks associated with the operation. Its location makes it extremely vulnerable to atmospheric corrosion and maintenance of such a tank farm will always require significant expenditure. Catastrophic tank failure, tank floor leaks and pipeline leaks are significant risks with no current plan or methods of control in place. This has been identified by MEC and RMI's Ministry of Resources and Development as an urgent investment need. Rehabilitation is estimated to cost at least $5 million; replacement of the facility may be more cost-effective, moreover as its capacity appears far in excess of MEC's current requirements.

2. Government's Sector Strategy

15. In 2009, the Energy Planning Division under the Ministry of Resources and Development was established to formulate policy. A National Energy Policy and Energy Action Plan[3] was prepared and adopted by the government, spurred on by the 2008 fuel price spike that nearly bankrupted the country. The plan was revised in 2014, and again in April 2016. The policy has four priority outcomes: (i) improved enabling frameworks for reducing dependence on imported fossil fuel; (ii) all Marshallese have equitable access to modern energy services; (iii) smarter uses of energy in households, businesses, government, transport sector and power utilities; and (iv) reliable, sustainable and affordable energy supply. The revised policy from April 2016 holds the following targets: (i) 100% urban and 95% rural household electrification by 2015; (ii) access to modern forms of cooking increased to 90% by 2020; (iii) improve residential and commercial energy efficiency 50% and government buildings efficiency 75% by 2020; (iv) achieve transport sector 20% efficiency improvement; (v) 20% reduction of supply-side losses by 2017; and (vi) 20% renewable energy contribution by 2020.

16. The RMI has few policies addressing energy efficiency and renewable energy technologies beyond the goals established in its National Energy Policy and Energy Action Plan. Current policies and standards are described below.

17. In 2005, the RMI cabinet approved a new policy requiring all government departments to purchase only diesel-fueled vehicles, which are considerably more efficient than gasoline for the

[3] Ministry of Resources and Development. 2016. *National Energy Policy and Energy Action Plan*, Majuro.

same engine size. This policy could potentially have a strong impact on RMI's fossil fuel consumption because transportation makes up about two-thirds of the country's fuel use. However, the policy does not seem to be enforced.

17. A standard formula for power tariffs developed in 2006 is used across the to provide identical rates by sector in all power districts. The rate formula was approved by the president's cabinet. The rate structure is insufficient to recover all operating costs and, due to the uniformity across islands, provides a subsidy to higher-cost districts. Rates are set by the government at a level that is considered affordable, *not at a level that provides sufficient revenue* to cover utility expenses.

18. There is no independent utility regulator in RMI. The president and cabinet act as the sole regulatory authority, with all tariff decisions requiring cabinet approval. RMI's has a Combined Utilities Board (governing MEC, KAJUR, and the Majuro Water & Sewer Company) that oversees utilities' operations. However, its ability to direct and empower management of RMI's utilities to pursue their commercial mandate and long-term sustainability and shield management from political interference in operational decisions is not evident.

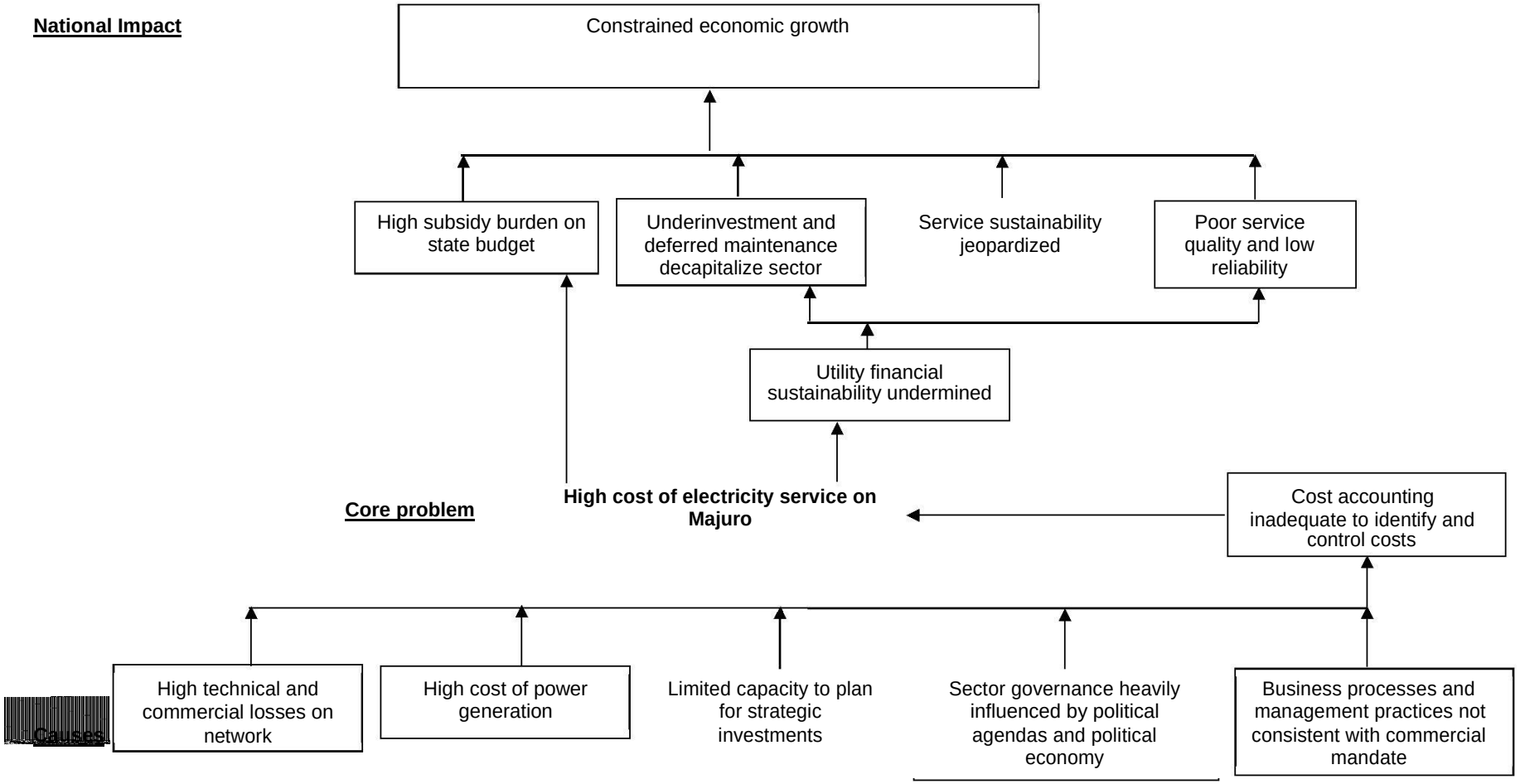
19. There are no policies or provisions that explicitly permit utility customers to connect their own renewable energy systems to the power grid; nor is there a net-metering policy, or grants, production incentives, or capacity-based incentives offered by the government of the RMI, MEC, or KAJUR to promote private investment in renewable energy or energy efficiency technologies by utility customers. As of April 2017, it is against the law to connect to and distribute power through MEC or KAJUR networks; RMI Code Title 31-160 prescribes a fine of $100 and 6 months' jail time for offenders. No contractual framework currently exists to allow third-party power generation and sale to MEC or KAJUR. However, given the current physical condition of MEC's and KAJUR's systems, and opaque financial management and accounting arrangements (at least in the case of MEC), the lack of such policies is not an immediate priority.

3. ADB Sector Experience and Assistance Program

20. ADB's most recent programmatic engagement in the energy sector in RMI was a Japan Fund for Poverty Reduction (JFPR) grant in the amount of $1.76 million in 2010 for the "Improved Energy Supply to Poor Households" project. The Grant Agreement was signed on 1 September 2010, and project implementation concluded in January 2014. The objective of the grant was to extend access to clean electricity to disconnected and unconnected low-income households. The grant funded the extension of prepaid metered connections in low-income areas of Majuro and a trial of bio-fuel generation in the Marshalls Energy Company's (MEC's) system. The scope of the project covered three components: (i) Component A: Improved access and management of electricity for the poor; (ii) Component B: Extended and improved supply of power to low-income households; and (iii) Component C: Use of local fuels in power generation to provide alternative incomes for the poor. The project was successfully completed, with the exception of Component C: MEC has been unable to reassemble the generator engine that was designated to run on a coconut-oil/diesel fuel blend; as of July 2017, MEC does not intend to return this engine to service.

21. ADB conducted a consultation mission in March 2017 to identify and discuss energy-sector priorities and opportunities for programmatic engagement. The government and MEC have confirmed their interest in network loss-reduction investments, business-process reengineering and capacity building, mobilizing investments (including prospective Green Climate Fund co-financing) for increased renewable energy generation, and rehabilitation of the MEC tank farm.

Problem Tree for Energy



RMI = Republic of the Marshall Islands

Sector Results Framework -

Country Sector Outcomes		Country Sector Outputs		ADB Sector Operations	
Outcomes with ADB Contribution	**Indicators with Targets and Baselines**	**Outputs with ADB Contribution**	**Indicators with Incremental Targets**	**Planned and Ongoing ADB Interventions**	**Main Outputs Expected from ADB Interventions**
Improved energy security and cost controls.	Investment in rehabilitation or replacement of sector assets. (2017 baseline: widespread dilapidation and decapitalization) Sector costs correctly determined and controlled; revenues sufficient to provide for sustainability. (2017 baseline: cost accounting distortions, revenues do not cover costs)	Network losses reduced; MEC fuel tank farm rehabilitated or replaced; Business-processes streamlined, MEC management pursues commercial mandate. .	Network losses decrease by 4% by 2019. Tank farm restored to acceptable operational and environmental condition by 2020. Management diagnostic completed by 2018; business-process reengineering and management practices recommendations approved and implemented by 2019.	**Planned key activity areas:** Investments in network modernization (75%); business-process reengineering and management practices (25%) **Pipeline projects with estimated amounts** Majuro Power Network Strengthening ($2 million – Phase One; $18 million – Phase Two); Tank-farm rehab ($5 million) **Ongoing projects with approved amounts** N/A	**Planned key activity areas** Loss reduction and business-process and management practices improvements **Pipeline projects** Network losses on Majuro reduced by 4% with advanced metering; Network upgrades and renewable energy contribution increased to 20% in power generation; MEC tank farm restored to adequate condition **Ongoing projects** N/A

ADB = Asian Development Bank, MEC = Marshalls Energy Company, MW = megawatt, N/A = not applicable, PPTA = project preparatory technical assistance, RRP = report and recommendation of the president, TA = technical assistance;
Source: Asian Development Bank