

ECONOMIC ANALYSIS

A. Overview

1. The Republic of the Marshall Islands (RMI) is a small and remote economy. The services sector is the largest contributor to the economy, accounting for an average 69.7% of gross domestic product (GDP) in FY2010–FY2014. Government expenditure, with significant funding from grants under RMI’s Compact of Free Association with the United States, is a primary driver of service sector activity. Agriculture and fisheries place a distant second, averaging 18.9% of GDP during the same period—although this share has risen steadily since 2012 because of higher fisheries license revenues. Industrial output accounted for an average of 11.3% of GDP in FY2010–FY2014, mainly because of copra and tuna processing, as well as handicraft manufacture. The economy’s dependence on government spending means that growth prospects are generally determined by infrastructure project cycles. After expanding by 3.0% in FY2013 with completion of a road realignment project financed by the United States Federal Aviation Authority, the RMI economy grew by only 0.5% in FY2014 because of a lack of new infrastructure projects and unforeseen delays in other scheduled capital expenditures. The resulting weakness in construction activity, as well as reduced Compact grants for education and health, lowered demand for associated services such as transport, storage, and communications. Growth is expected to rebound to 3.5% in FY2015 as work on delayed infrastructure projects is accelerated and new projects start, and then slow to 1.5% in FY2016 as projects near completion and construction activity winds down.

2. Ebeye is the most heavily populated island in the RMI’s Kwajalein Atoll and is the RMI’s second-most populated urban center after Majuro. Ebeye has about 10,000 residents, most of them descended from Marshall Islanders relocated from other islets within Kwajalein Atoll following the establishment of the United States Army Kwajalein Atoll base after World War II. The economic fortunes of Ebeye residents depend upon the base’s operations, which provide most of the formal employment on the island, and overseas remittances. Ebeye has had periodic job shortages, fueling out-migration and prompting remittance inflows. Such job shortages and migration have significantly reduced Ebeye’s contribution to the RMI economy.

B. Ebeye Water Supply and Sanitation Project: Rationale

3. Ebeye has a high incidence of waterborne disease: about one reported case per eight residents each year. Since 2001, Ebeye Hospital has recorded an average of 1,182 cases per year of waterborne disease, primarily gastroenteritis. The high incidence of waterborne disease is due to (i) limited access to safe water; (ii) ineffective hygiene, particularly among children; and (iii) a dilapidated sanitation system. To address the high incidence of waterborne disease on Ebeye, the government and the Kwajalein Atoll Joint Utility Resource Inc. (KAJUR) have prepared electricity, water supply, and sanitation master plans with associated prioritized investment plans. The master plans will guide the development of electricity, water supply, and sewerage assets from 2015 to 2025. With the implementation of the master plans and under medium population growth scenarios, the demand for potable water from the Ebeye water supply system is forecast to grow from 1.55 million liters per day in 2015 to 1.60 million liters a day in 2025—and the water supply system is currently able to meet only about 38% of demand. The peak daily demand for electricity is expected to increase from 2.1 megawatts in 2015 to 2.7 megawatts in 2025; average daily sewage loads are projected to increase from about 1.1 million liters per day in 2015 to 1.9 million liters per day in 2025.

4. The project will deliver high-priority components of the Ebeye electricity, water supply,

and sewerage master plans; a hygiene awareness and education program; and measures to improve KAJUR's financial and technical sustainability. The project outputs will be (i) output 1: secure and safe freshwater supplies; (ii) output 2: effective and efficient sewerage services; (iii) output 3: enhanced hygiene awareness and improved hygiene behaviors; (iv) output 4: secure electricity supply for water and sewerage operations; and (v) output 5: financial and technical sustainability of KAJUR. The project is estimated to cost \$19.02 million (Table 1).

Table 1: Summary Cost Estimates
(\$ million)

	Amount^a
A. Base Cost^b	
1. Output 1: Secure and safe freshwater supplies	8.61
2. Output 2: Effective and efficient sewerage services	4.55
3. Output 3: Enhanced hygiene awareness and improved hygiene behaviors	0.67
4. Output 4: Secure electricity supply for water and sewerage operations	1.39
5. Output 5: Financial and technically sustainability of KAJUR	1.11
Subtotal (A)	16.33
B. Contingencies^c	2.49
C. External Grant Administration Fee	0.20
Total (A+B+C)	19.02

^a Includes taxes and duties of \$1.86 million. All project costs will be exempted from taxation and duties in RMI.

^b In early-2015 prices.

^c Physical contingencies computed at 15% of base costs less grant administration fees and provision for land acquisition and resettlement costs. Price contingencies computed at an average of 1.3% on foreign exchange costs and 1.9% on local currency costs over the duration of the project.

Source: Asian Development Bank.

C. Economic Analysis

5. The economic analysis compares a with-project scenario and a without-project scenario over a project lifecycle of 30 years following completion of project construction and installation in 2018 (i.e., extending to 2047) to identify the incremental costs and benefits associated with the project. No residual value to the project is assumed at the end of this period. For both scenarios, routine operation and maintenance (O&M) expenditures (which occur annually in varying amounts) and major maintenance expenditures (which occur periodically) have been estimated. Routine O&M expenditures include running costs (e.g., electricity and chemicals) and minor maintenance items (e.g., filter changes and cleaning operations). Major maintenance includes periodic replacements of equipment (e.g., pumps and meters) or major equipment overhauls (e.g., diesel generators) on a set schedule. These estimates are closely aligned with the asset management plans developed under the technical assistance for electricity, water supply, and sanitation.

6. The without-project scenario is not the same as a do-nothing scenario. Without the project, KAJUR still faces substantial running costs and maintenance expenditures. The latter may be incurred only reactively, but as KAJUR's existing assets have aged, equipment failures have become frequent and repairs are continually needed. To set the comparison of the without-project scenario on a basis consistent with the with-project scenario, a running cost and maintenance schedule has been postulated for KAJUR's existing asset base under the without-project scenario. The comparison of the two scenarios shows the running costs and maintenance expenditures that are incrementally incurred because of the project.

7. **Project costs.** Project economic costs are expressed in the domestic price numeraire. The main assumptions employed in the calculations to convert project financial costs to

economic costs are

- (i) shadow exchange rate factor (SERF) applied to tradable inputs and outputs: 1.03 (based on FY2013 trade and trade tax values for RMI);
- (ii) SERF applied to non-tradable inputs and outputs: 1.0;
- (iii) shadow wage rate factor: 0.67 (reflects a high unemployment rate in Ebeye);
- (iv) foreign component of the project, including international labor, is tradable and subject to the SERF applied to tradable items of project cost; local materials and local labor are non-tradable; and
- (v) project construction spans four years, from 2015 to 2018

8. The project's economic costs total \$16.6 million. Those associated with the water supply component include direct investments, incremental O&M, and asset replacement for the expanded water supply and improvements to the wastewater system. Economic costs for the electricity supply component comprise backlog maintenance worth about \$1.1 million to make urgent replacements to physical power infrastructure and install a power plant automated data network. Under the with-project scenario, the backlog maintenance is assumed to occur during the project's investment period (2015–2018); the without-project scenario assumes a delay of 3 years in relation to the with-project scenario, as maintenance might be carried out only in reaction to system failure.

9. **Benefits.** The economic benefits of the project can be only partially quantified; the project has significant non-quantifiable benefits. The two economic benefits that can be partially quantified are (i) a clean water supply, valued at willingness to pay; and (ii) health benefits, measured as avoidance of the costs of illness related to waterborne diseases, especially diarrhea and gastroenteritis. The significant economic benefits that could not be quantified include savings on health care for unreported cases of waterborne diseases,¹ which are not captured by data (and could outnumber reported cases); and avoided lost wages for employed persons who contract waterborne diseases, (either reported or unreported cases) as the proportion of employed persons relative to the number of reported cases is not known. Other benefits include (i) improved water supply and sanitation in schools, and increased school attendance; (ii) higher standard of living in currently unconnected locations; and (iii) greater security of livelihoods and marine recreational opportunities.

10. The project's quantifiable water supply economic benefit is incremental water supply, valued at willingness to pay. A field investigation estimated Ebeye residents' average willing to pay for water (other than collected rainwater) at \$0.013 per liter under current conditions, falling to \$0.003 per liter when the project boosts supply.² Given an estimated incremental water supply of 70 liters per capita per day, the gross economic benefit with the project is about \$3.7 million per year. Half of the benefits of the upgraded water supply system are expected to be achieved in 2017 when the first components are commissioned, increasing to 80% in 2018 and 100% by 2019.

11. The project's quantifiable health benefit is the avoided cost of illness related to waterborne diseases. Combined reported incidences of diarrhea, abdominal pain, acute gastritis and gastroesophageal reflux disease, and acute gastroenteritis have averaged 1,326

¹ Patients who choose to receive treatment at home rather than go to the hospital.

² A water sales experiment was conducted in Ebeye's poorest communities to estimate the relationship between the price of potable water and demand. A contingent value willingness-to-pay survey was not undertaken as the number of households on Ebeye did not constitute a significant sample size.

cases per year since 2008. Acute gastroenteritis accounts for 69.5% (922 cases).³ Other waterborne diseases of note are conjunctivitis (commonly referred to as pink eye), averaging 250 cases per year since 2008, and amebiasis, averaging 160 cases per year since 2007. The Marshall Islands Economic Policy, Planning and Statistics Office estimated that, based on 2007 Ministry of Health budget data, the medical and treatment costs of an outpatient visit to treat gastroenteritis in Ebeye averaged \$119.⁴ Assuming that real health care costs haven't changed significantly from 2007 to 2014, the average cost of outpatient treatment of gastroenteritis in 2014 dollars is about \$161. With the project, it is assumed 20% of such cases will be avoided through increased access to safe water and improved hygiene,⁵ resulting in avoided costs of about \$42,000 per year.

12. **Economic evaluation.** Comparing the discounted costs and benefits under the with- and without-project scenarios over the project lifecycle yields an economic internal rate of return (EIRR) of 12.8% and economic net present value of \$0.92 million. The incremental water supply accounts for the bulk of the economic benefit, but the health benefit is likely undervalued because not all cases of waterborne diseases are reported, and lost wages and productivity are not estimated. Table 2 presents the annual estimated economic costs and benefits for the project.

13. **Sensitivity analysis.** Sensitivity analyses were undertaken on the economic results to examine the impacts of key assumptions and project risks as follows: (i) capital cost increased by 20%, (ii) O&M cost increased by 20%, (iii) incremental water supply benefits decreased by 20%, and (iv) health benefits decreased by 20%. Under these scenarios, when assessed individually, the viability of the project falls—with EIRRs of 8.9%–12.8%. When all scenarios are considered together, the EIRR for the project drops to 5.9%.⁶

³ Ebeye Hospital records waterborne disease statistics for Ebeye.

⁴ Government of the Marshall Islands. 2011. *Majuro and Kwajalein Atoll Household Water Survey* Majuro

⁵ Improved hygiene, particularly hand washing with soap can, reduce the risk of waterborne disease by 23% to 40%. M.C. Freeman et al. 2014. Systematic review: hygiene and health: systematic review of handwashing practices worldwide and update of health effects. *Tropical Medicine International Health*. 19(8). pp. 906–916.

⁶ Programs and projects in weakly performing countries should not be expected to always yield the same financial and economic rates of return as would be expected in stronger performing developing countries. ADB. 2007. *Achieving Development Effectiveness in Weakly Performing Countries (The Asian Development Bank's Approach to Engaging with Weakly Performing Countries)*. Manila.

Table 2: Economic Costs and Benefits

(\$ million)

Year	With-Project Costs			Without- Economic Costs			Incremental Costs			Benefits			Net Benefits
	Investment	Routine O&M	Major Maintenance	Investment	Routine O&M	Major Maintenance	Investment	Routine O&M	Major Maintenance	Increased Water	Health Benefits	Total Benefits	
2015	2.47	0.75			0.65		2.47	0.10					(2.57)
2016	5.48	1.44			0.96		5.48	0.48					(5.96)
2017	4.30	1.40	0.41		0.67	0.41	4.30	0.74		1.53		1.53	(3.50)
2018	2.03	1.42			0.67		2.03	0.75		2.45	0.04	2.50	(0.28)
2019	1.44	1.44	0.05		0.68	0.05	1.44	0.76		3.07	0.04	3.11	0.91
2020	0.54	1.45	1.25		0.69	1.25	0.54	0.77		3.07	0.04	3.11	1.80
2021	0.36	1.47	0.05		0.69	0.05	0.36	0.78		3.07	0.04	3.11	1.97
2022		1.47			0.69			0.78		3.07	0.04	3.11	2.33
2023		1.77	0.05		0.99	0.05		0.78		3.07	0.04	3.11	2.33
2024		1.47			0.69			0.78		3.07	0.04	3.11	2.33
2025		1.47	1.18		0.69	1.11		0.78	0.07	3.07	0.04	3.11	2.26
2026		1.77			0.99			0.78		3.07	0.04	3.11	2.33
2027		1.47	0.05		0.69	0.05		0.78		3.07	0.04	3.11	2.33
2028		1.47			0.69			0.78		3.07	0.04	3.11	2.33
2029		1.47	0.05		0.69	0.05		0.78		3.07	0.04	3.11	2.33
2030		1.47	1.35		0.69	1.35		0.78		3.07	0.04	3.11	2.33
2031		1.47	0.05		0.69	0.05		0.78		3.07	0.04	3.11	2.33
2032		1.47			0.69			0.78		3.07	0.04	3.11	2.33
2033		1.77	0.05		0.99	0.05		0.78		3.07	0.04	3.11	2.33
2034		1.47			0.69			0.78		3.07	0.04	3.11	2.33
2035		1.47	1.95		0.69	1.68		0.78	0.27	3.07	0.04	3.11	2.07
2036		1.77	0.02		0.99	0.02		0.78		3.07	0.04	3.11	2.33
2037		1.47	0.05		0.69	0.05		0.78		3.07	0.04	3.11	2.33
2038		1.47			0.69			0.78		3.07	0.04	3.11	2.33
2039		1.47	0.05		0.69	0.05		0.78		3.07	0.04	3.11	2.33
2040		1.47	8.62		0.69	6.62		0.78	2.00	3.07	0.04	3.11	0.33
2041		1.47	0.05		0.69	0.05		0.78		3.07	0.04	3.11	2.33
2042		1.47	0.36		0.69	0.36		0.78		3.07	0.04	3.11	2.33
2043		1.77	0.05		0.99	0.05		0.78		3.07	0.04	3.11	2.33
2044		1.47			0.69			0.78		3.07	0.04	3.11	2.33
2045		1.47	0.46		0.69	0.39		0.78	0.07	3.07	0.04	3.11	2.26
2046		1.77			0.99			0.78		3.07	0.04	3.11	2.33
2047		1.47	0.05		0.69	0.05		0.78		3.07	0.04	3.11	2.33
2048		1.47			0.69			0.78		3.07	0.04	3.11	2.33
EIRR													12.8%
NPVs	13.64	12.86	2.53		6.77	2.36	13.64	6.09	0.17	20.55	0.27	20.82	0.92

() = negative, EIRR = economic internal rate of return, NPV = net present value, O&M = operations and maintenance.

Source: Asian Development Bank.