Republic of the Marshall Islands
Energy Future

Electricity Roadmap Human Resource

Strategy Working Paper

December 2018

Prepared by: Nicole Baker (Nicole Baker Consulting), Andrew Revfeim (Elemental Power and Renewables)

NEW ZEALAND
FOREIGN AFFAIRS & TRADE
Aid Programme

The development of the Marshall Islands Electricity Roadmap and related analysis was supported by the New Zealand Ministry of Foreign Affairs and Trade.

Summary

The RMI's climate change goals require a wholesale transformation of the electricity sector from diesel generation with which the RMI has a great deal of experience, to automatically controlled, high-tech renewable energy systems which the RMI has almost no experience. The process of transformation requires the rapid design and build of large amounts of wind and solar generation, battery storage, advanced control systems, new high-speed automated diesel generators and other enabling technologies. The success of this ambitious program of work and the achievement of the RMI's climate change targets depends on the skill and commitment of the people who work on these systems.

While the scope of this paper is the electricity sector, multiple sectors in the RMI will benefit enormously from a focused effort to develop a workforce of engineers and technicians. An option is to apply the principles and strategies outlined in this paper to in support of a broader range of organisations including MWSC, KAJUR water and sewage department, RMIEPA, MIMRA, Marshall Islands Shipping Company, Ministries of Public Works, Resources and Development, Ports Authority, MALGOV, KADA, MAWC and the private sector.

There are three approaches to obtaining the human resources required to implement the RMI Electricity Roadmap:

'Make' new entrants to the sector- The long-term solution is to invest in education and training of Marshallese to build the necessary skills and knowledge. This approach focuses on new entrants to the sector, mostly young people, but also attracting experienced and skilled professionals from other sectors.

'Grow' the existing workforce - Identify and nurture talent and provide opportunities for further education, training, and promotions. Provide workforce with ongoing training and development as appropriate. Improve management and supervision capability.

'Buy' expertise and additional capacity - In the short to medium term, it will be necessary to hire expertise from outside the RMI. Some international expertise will continue to be required in the long-term due to the inherent small size of the Marshallese workforce, and that some skills are highly specialised and only needed infrequently.

Key strategies and initiatives that will need to be developed are:

- Mechanisms for **sector leadership and coordination** in HR development
- **Apprenticeship schemes** at MEC and KAJUR (and in other organisations)
- **Internships** at MEC and KAJUR and support for **professional qualifications**
- A cohesive **in-country vocational training** program
- Personal career, education, and training **mentoring** for individuals
- **Management support** through leadership and management training and ongoing support from trusted advisors.

One further idea with exciting potential is to establish a '**twinning**' relationship with another utility that is more experienced with renewable energy, such as the Kaua'i Island Utility Cooperative in Hawai'i. This could involve extended exchanges of staff between utilities to gain experience and knowledge both in technical and management areas.

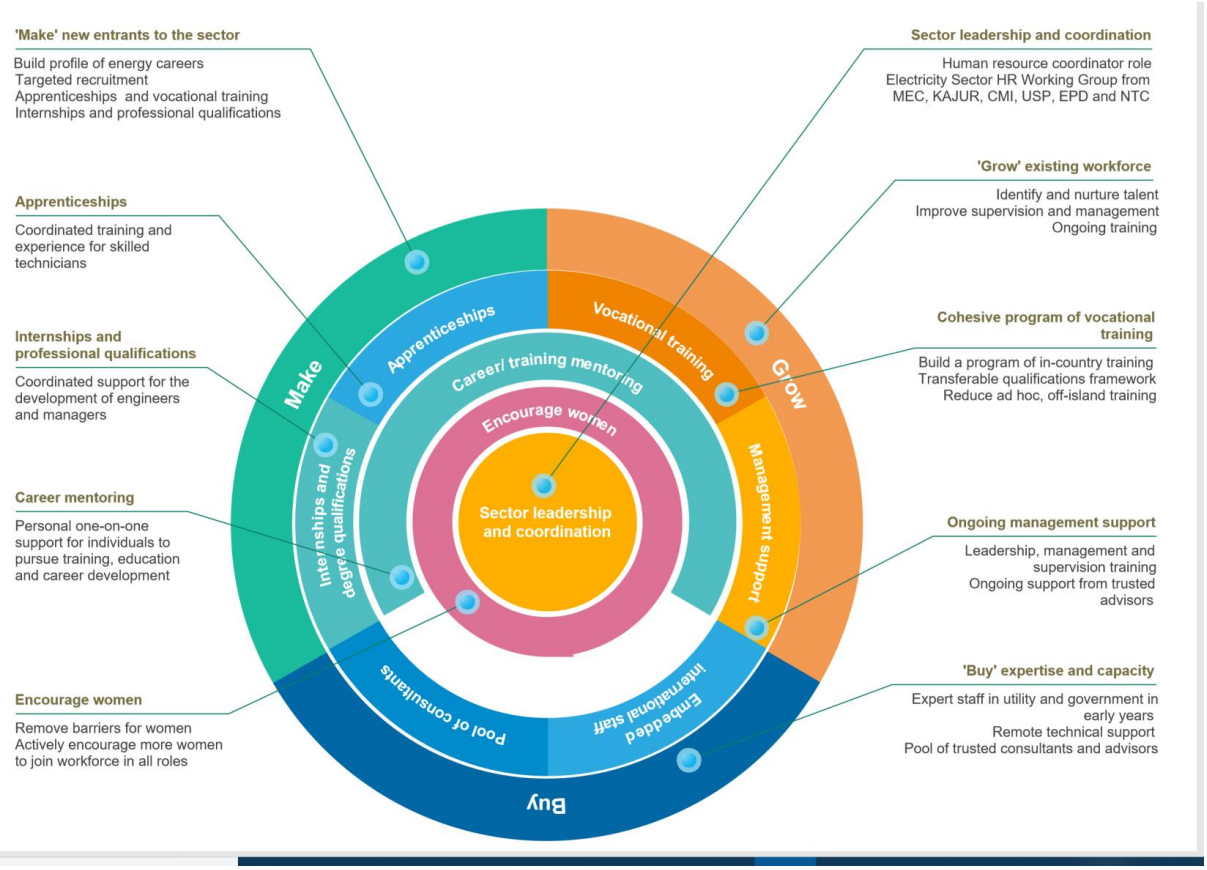

Figure 1: Summary of proposed human resource strategies for the RMI electricity sector

Next steps:
The first step is to hire an experienced HR development professional as the **RMI Electricity HR Coordinator** for an initial three-year term. This person will have responsibility to carry out the following:

1. Convene the **RMI Electricity HR Working Group** including MEC, KAJUR, CMI, USP, Energy Planning office, the National Training Council (NTC), RMI Scholarships Board, and Division of International Development Assistance (DIDA).
2. Set up **first intake of apprentices** in MEC and KAJUR
3. Identify **first candidates for internships and engineering study**, and assist them with scholarships and applications
4. Design and implement in-country vocational training program, learning from other Pacific experiences.

Republic of the Marshall Islands Energy Future

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Purpose of this paper

The RMI's climate change goals require a wholesale transformation of the electricity sector from diesel generation, with which the RMI has decades of experience, to automatically controlled, high-tech renewable energy systems, with which the RMI has no experience. The process of transformation requires the rapid design and build of large amounts of wind and solar generation, battery storage, advanced control systems, new high-speed automated diesel generators and other enabling technologies.

The success of the RMI's ambitious plan to reduce emissions and shift to a world-class renewable energy system will depend entirely on the commitment and skills of the people who make this happen. A skilled workforce is required to design, build, operate and maintain cutting-edge renewable energy systems and to implement other aspects of the RMI electricity roadmap including policy, governance, financing and donor coordination.

This paper is a background document to the RMI Electricity Roadmap and presents a discussion of issues and proposed strategies to develop this workforce. The paper has been developed through:

- discussions with key Marshall Islands stakeholders (a list of people consulted is at Appendix A);
- assessment of future workforce needs, particularly the skills and number of personnel needed in addition to the existing workforce (a summary of this workforce needs assessment is at Appendix B).

This paper is necessarily high level and does not constitute an assessment of existing skills and capability, or an identification of specific training needs. It is instead, a broad gap assessment based on our understanding of future workforce needs, the current workforce and existing training and education.

A comprehensive capacity building study was previously carried out on Ebeye for KAJUR [1], although not in the context of a high-renewables system. The ADB is about to embark on an organisational review of MEC which will identify capacity development needs particularly in the areas of management and administration. It is expected that a more detailed study of the current capability and training needs would be done as part of the design of apprenticeship and vocational training programs.

Where are we now? (Current situation)

Context of the Marshall Islands

RMI shares many challenges with other island states as a result of their smallness, isolation and 'island-ness'. Small island states are characterized by a small population and therefore limited human capital. Remoteness and small size mean there are few education facilities in-country and a severe lack of specialised skills. The lack of scale in the job market means there are limited opportunities for employment. The close relationships and social structures of small island communities often bring challenges in managing employees.

Marshallese have the right to live and work in the US provided under the Compact of Free Association (COFA). It is thought around one-third of the total Marshallese population have moved to the US seeking better education and employment opportunities, and that this trend continues.

Identified issues

Specific issues identified for human resources in the electricity sector include:

- Small pool of qualified, skilled people available in the labour market—as a result of being a small country with a relatively low level of education.
- Critical person risk – as a result of the small and shallow pool, there is critical person risk of individuals who hold exceptional institutional knowledge. If these people were to move on, critical functions would not be fulfilled.
- Proliferation of projects – in the last decade there has been a proliferation of development partners and projects, resulting in very high demands on the time and attention of key personnel. These demands take the form of administrative requirements, hosting missions, negotiations with development partners and travel to off-island meetings and training courses. This impacts heavily on the capacity of the small professional-level workforce and creates a sense of fatigue.
- *Ad hoc* training courses and meetings for RMI representatives are offered by development partners. This is not coordinated between development partners, often key people are away for too much time. Short training courses offered either internationally or in-country offer no follow up or embedding of learnings. Training is often poorly targeted, lacking context and too short to have lasting impact. (note: the longer training offered by JICA is seen as an exception to this and is considered by RMI stakeholders to be useful and relevant).
- Scholarships not targeted to workforce needs—there is no systematic linkage of scholarships and training programs with the strategic workforce needs of the country in engineering, technology and management.
- Out migration/ brain drain – many of those who gain qualifications overseas will be attracted to the higher salaries, the lifestyle and the professional culture in the US or in other countries. A significant gap in recruitment of professionals is that there is no direct connection between individual agencies and the students studying overseas to allow recruitment of Marshallese nationals into professional positions. Of obvious concern is the loss of young educated Marshallese people who either choose not to return to the Marshall Islands upon completion of their studies, or else who leave after working there for a short time.
- Poor recruitment and performance management processes—rarely are the human resource needs of an organisation systematically identified and recruitment of new staff is often done without a clear job description. Additionally, employee performance management systems within the utilities and public sector are inadequate in terms of setting expectations, performing fair and professional performance evaluations and positive or negative consequences for performance.
- No succession planning and poor efforts at retention in the utility—there are key person critical risks if the couple of people with good knowledge and experience of the systems were to leave the utility or the RMI.
- Low participation of women in the sector—particularly the case in technical and engineering roles. Anecdotally, we have heard of several women who have expressed interest in operator, lineman and electrical engineering roles, although they may have been met with a discouraging response from the utility. One of the identified barriers to having women in these roles is a lack of female toilets at the power plant and work sites.

Where do we want/need to be? (the Goals)

Desired outcomes

The RMI has an effective and skilled electricity sector workforce to manage, build, operate and maintain cutting edge renewable energy and energy efficiency systems in the Marshall Islands, and to implement the RMI Electricity Roadmap. This means that:

- In the short-term, there is a highly skilled workforce to manage the RMI's transition to renewable energy, including both international and Marshallese personnel;
- In the medium- to long-term, a highly skilled, primarily Marshallese, energy sector workforce includes trained engineers and technicians, and effective managers and policy practitioners.

Increasing technical complexity of RMI electricity systems

The RMI has ambitious and technically challenging plans to take the major grids of Majuro and Ebeye and some outer island mini-grids to high levels of variable renewables. These grids will move from manually-dispatched aged diesel generators to automated systems which allow stable operation with little or no diesel generation running during periods of high renewable energy resource, along with enabling technologies such as battery storage. Critical infrastructure—fuel tanks, diesel generators and the distribution network—must be brought up to a standard where the system can absorb high levels of renewable energy. The RMI's ambitions mean this dramatic shift will need to happen within only a seven year period to 2025.

New generation technologies, coupled with advanced control systems and other enabling technologies will require significant international expertise, new skills sets from new staff and new training for existing staff in order to maintain safe and reliable electricity supply. Operations will require upgrading of the existing skills in fuel management, diesel operations and maintenance, electricity distribution, along with new capabilities in new technologies. Management and supervision skills will be required to ensure these systems are financially sustainable, well-staffed and have consistent and adequate operation and maintenance.

Demand-side management and energy efficiency involves policies and programs that require significant expertise. This area will need ongoing attention both in government and utilities with both recruitment of skilled staff and the upskilling of existing staff will be required.

Future workforce needs

Increased staffing numbers

A review of the tasks and roles required for the design, build, operation and maintenance of the new systems show a need to rapidly increase the number of skilled staff across the sector (including MEC, KAJUR and government agencies) by around 40 by 2025. This is an increase of around 16% from the current 265 staff to a total of 308 by around 2022. Additional personnel are chiefly required in three main areas:

1. project management and implementation personnel to deliver the planned RE projects
2. an increase in staff in the Energy Planning Division/Office to have the resources necessary to manage the sector effectively

3. specialist operations and maintenance engineering skills for wind, solar, battery and control systems technologies.

The specialised skills required in these three categories mean that many of the positions will need to be filled by international hires for up to ten years. This will come at a higher cost than employing local staff, with costs for each international person assumed to be four times that of local staff. We have assumed a strong drive to transition specialist positions to Marshallese staff as they gain the required qualifications and experience. These numbers do not include external project design engineers or construction contractors, who typically work for short periods in the delivery of specific projects.

Smaller increases in numbers of staff are needed in utility administration and the other operations teams with a view to improving the reliability and service levels of some of the outer island systems. As the scope of this work does not review the existing staffing levels of different parts of the utility, we assume that current staffing remains, and that there is capacity for existing staff to carry out some of the operation and maintenance tasks required by the new systems, with little or minor upskilling.

New and improved skills required

Energy planning and policy:

The rapid scale of build, the importance of this to RMI's climate policy, and the need for very substantial improvements on demand side management and energy efficiency, requires new/ improved skill sets in both the government Energy Planning Division/Office and the utilities on:

- Sector strategy and planning
- Policy, regulation and standards
- Energy efficiency policy and program design
- Data collection, monitoring and reporting.

Majuro and Ebeye grids:

The larger Majuro and Ebeye grids will incorporate the greatest number of new technologies and technical complexity in the future and look to be maintaining the highest services levels. New/improved skill sets are required in:

- Management of operations and maintenance (urgently needed)
- Occupational health and safety
- Large scale solar operations & maintenance
- Wind turbine operations & maintenance
- Large scale battery energy storage system operations and maintenance
- Renewable energy (RE) project development, management, and implementation
- Sophisticated SCADA, controls, and communications
- Grid design and redesign incorporating high levels of RE
- Commercial arrangements for Independent Power Producers (IPPs)
- Project financing and economics
- Demand side energy efficiency
- Electric transportation (vehicles and boats).

Outer island mini-grids:

Outer island mini-grid systems generally provide lower customer service levels, and due to their remoteness and size, demand a level of technical simplicity in their operations and maintenance. New/improved skill sets will be required in:

- Battery energy storage
- Controls and communications
- Grid management
- Device fault diagnostics.

However, for these locations, and due to the need for simplicity and robustness in the outer island systems, the technical skill level required on-island will be at technician (rather than engineer) level.

Standalone solar household systems:

MEC already has a large team of solar system technicians for small-scale remote solar systems. The training of these technicians will need to continue and be upgraded as systems are replaced. Improved management at MEC is required to ensure effective tariff collection, maintenance, and replacement programs.

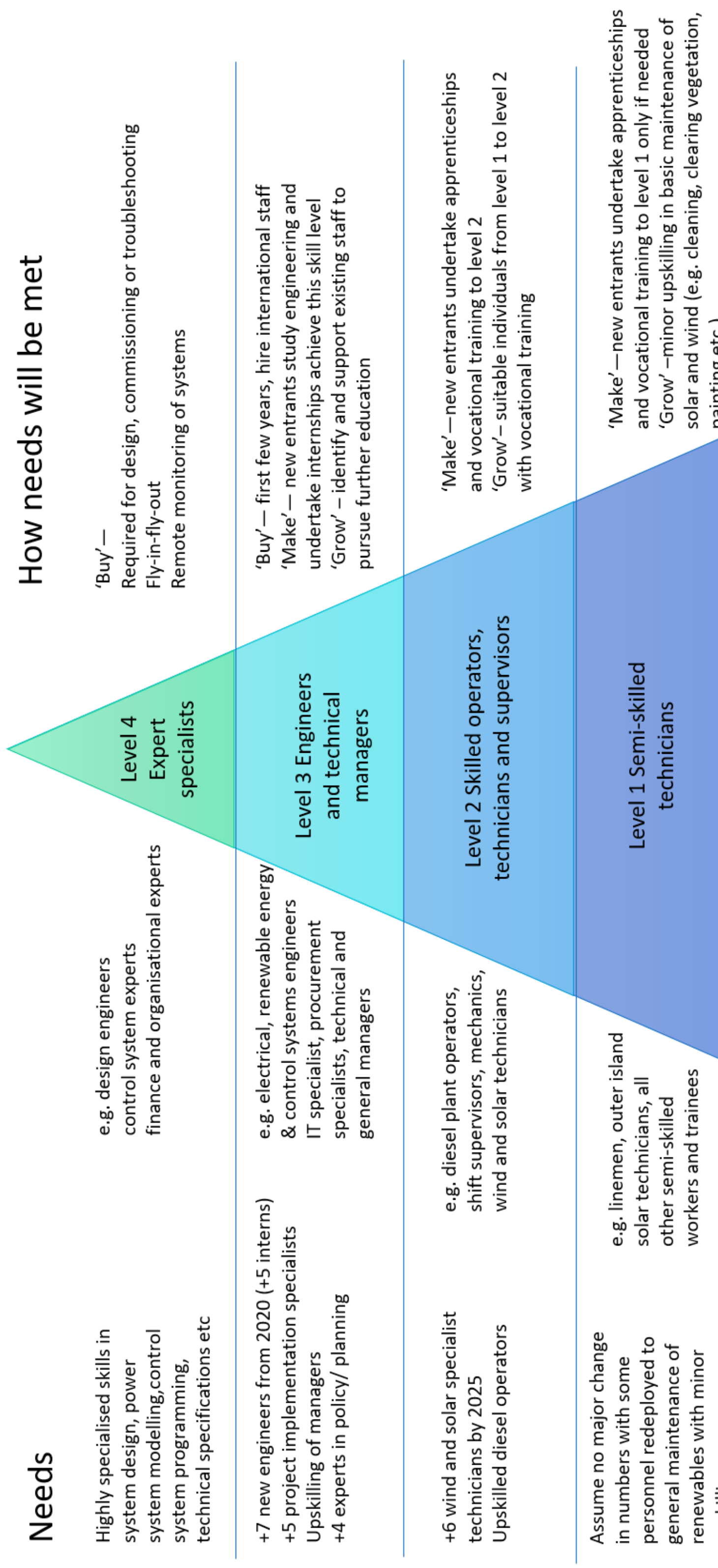

Figure 2: technical workforce needs and how they will be met

How do we get there? (the Strategies)

Principles

While it is clear that a workforce with the right skills and capability is essential, principles can provide us with a framework to think about the best way to do things.

Build the skills and capability of Marshallese people

Navigating a renewable energy future provides an opportunity for developing Marshallese people with science, technology, engineering and management capability. This will require a long-term view and dedication to this outcome, as there are many barriers (described subsequently).

Encourage collaboration and strong sector leadership

The way in which the people at the top show leadership and work together, across government, utilities, education and the private sector, will determine the success or otherwise of the RMI Electricity Roadmap, and of the Human Resource program.

Implement a cohesive program, rather than ad hoc

Personnel working in the sector should be able to see a clear career and development path. The pathway should include job progression based on competencies and experience, and ideally, a qualifications framework. A program in which trainings are context-specific and build on each other is greatly preferred over the current *ad hoc* one-off training practice.

Encourage and enable more women in the sector

Currently there are a few women leaders in the sector and some administration staff are women, but in general participation by women is low. Strategies to promote more women in the sector are to be integrated into the program – some suggestions follow.

Enable choice and mobility for personnel

A human resource development program for the energy sector should take advantage of the mobility people have by encouraging people who have gained an education overseas to return and apply their skills to the energy sector. It should also empower Marshallese by building skills that would be valued elsewhere, and that would support them getting jobs abroad.

Use renewable energy as a platform/driver for education in 'Science, Technology, Engineering and Mathematics' (STEM) and human resource development in other sectors

As young people see the potential for careers as technicians, engineers and managers in this sector, and undertake education, there is the potential for spillover effects into other STEM-related sectors, such as marine and civil engineering, or even medicine.

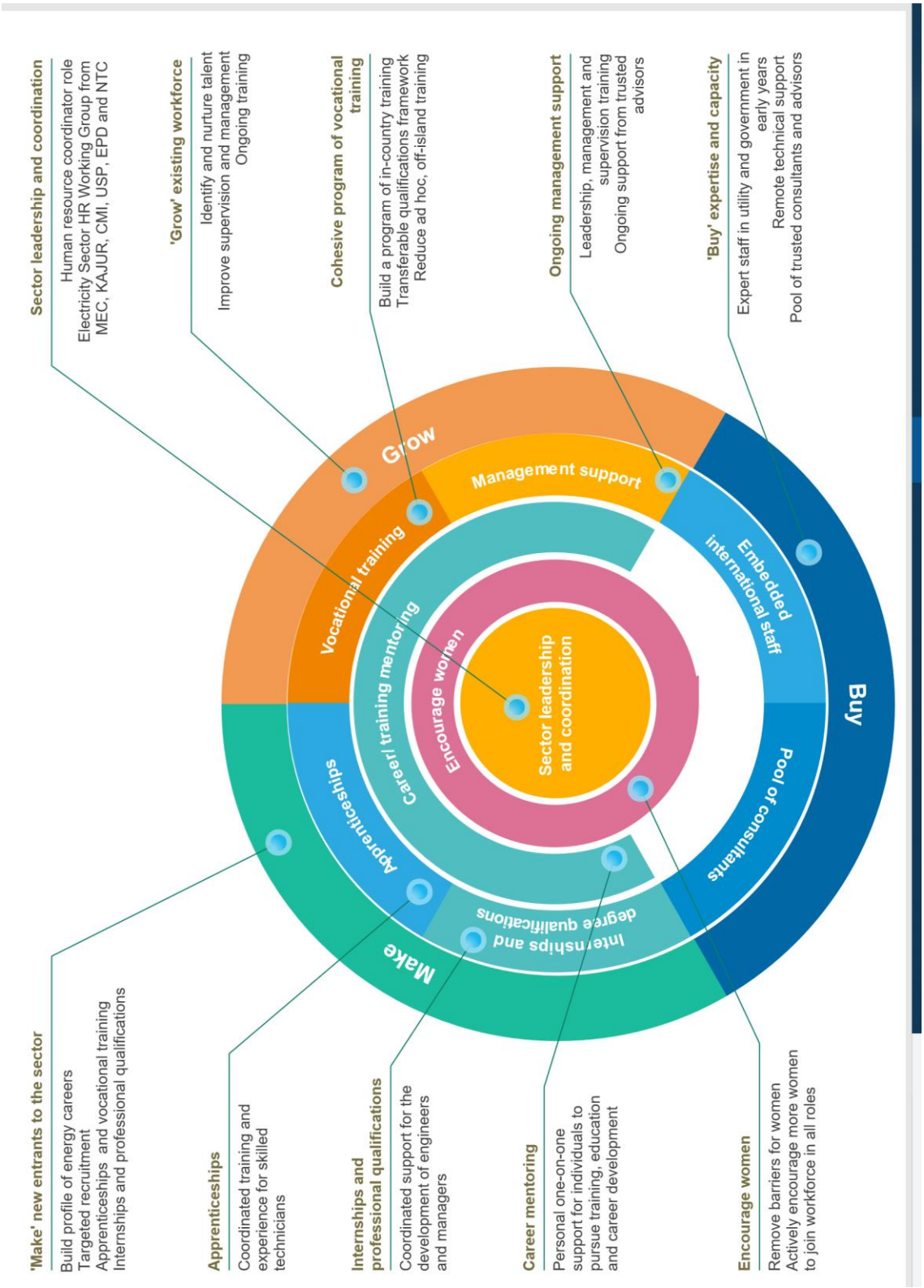

Figure 3: summary of HR strategies

Strategies and initiatives

Sector coordination

RMI Electricity HR Working Group

There are many organisations and individuals involved in bringing this vision of an effective and highly skilled electricity workforce to life, and they will need to work together in a coordinated fashion. Making this work will require persistence and innovation.

An Electricity Roadmap Working Group already performs the function of coordination across the whole Roadmap. A separate working group focused on HR development should be formed to include the key institutions MEC, KAJUR, CMI, USP, NTC, EPD, DIDA, RMI Scholarships Board. This group would need to engage with development partners offering scholarships and/or training. Progress in HR development could be reported at specified times to the President, Minister and Chief Secretary's Office. Giving this high level of political attention will help ensure progress.

Sector-wide Human Resource Coordinator role (expert role) and Utility Human Resource Manager role

It is recommended that a highly skilled and motivated HR development professional, with experience in the sector, be hired for an initial period of three years in a sector-wide human resource coordinator role. This role is critical to establishing the entire HR development program. This person would have the responsibility for the following:

- Convene and facilitate the HR Working Group
- Support MEC and KAJUR(and other key organisations) to establish apprenticeship and intership programs, and to implement other changes
- Support MEC and KAJUR with targeted recruitment
- Facilitate funding and resources to establish a cohesive vocational training program
- Work with development partners to access funding for the HR program
- Mentor and coach individuals to undertake apprenticeships, training, and to access scholarships and undertake professional qualifications.

It is also recommended that a second, experienced HR manager be embedded in MEC/ KAJUR to implement better recruitment and performance management process, as well as supporting interns and apprentices.

Cross-cutting strategies

Career and training mentoring

Support should be provided to individuals to map out career aspirations and to identify pathways, including education, internships or apprenticeships, training.

One of the issues that came up in discussions with stakeholders was around barriers to pursuing and completing higher education. While scholarships provide incentives and enable the student financially, navigating the application process for scholarships and course entry, and then the life of study at an academic institution can often be challenging. The heavy workload and difficulty of engineering courses will be an additional barrier.

Initially we propose that the Human Resource Coordinator fulfils the role of mentor and counsellor to individuals. The Coordinator can work to encourage uptake of all available scholarships, for example those offered by NZ, which have renewable energy as a priority. The Coordinator can try to understand barriers and difficulties faced by Marshallese

students pursuing technical or engineering qualifications and work with those students individually to support them and connect them with student support services in the country they are in. Lessons learned can be used to tailor support for future students.

The HRC would provide similar support to others who show promise in pursuing a more vocational path through apprenticeships, training and increasing levels of responsibility at the utility. This should be integrated with a broader push to encourage able students to go into STEM areas at school level, targeting scholarships with a premium, providing career counselling and mentoring for the often difficult years of study.

Encouraging women

The Marshall Islands has already taken one step towards supporting women in renewable energy through the attendance of three outer-islands women at the Barefoot College in India[1] for 6-months of training in installation, repair, and maintenance of solar systems.

The first step to encouraging women to join the RMI's energy sector should be to ensure adequate separate toilet facilities and a safe working environment for technical and field jobs. A quota (or at least a target) for the number of women included to apprenticeship intakes should be considered. Interested women should be encouraged to apply for roles, apprenticeships and engineering study through social media and personal contacts. Women already in the sector should be supported by the HRC to encourage more women to work in the sector by using social media, attending career fairs, science fairs and other presentations to university and school students as well as through social networks in person and online. Links should be established with the Pacific Power Association (PPA) Gender Champions Initiative should be made to see what other ideas can be explored – see https://www.ppa.org.fj/gender-portal/.

"Twinning" with another utility

Tonga Power has had a long-standing 'twinning' relationship with NZ power company, NorthPower. This arrangement has resulted in linemen seconded to NorthPower and trained to NZ standards. It is recommended that MEC/KAJUR seek opportunities to form a relationship like this. One possibility is a twinning arrangement with Kaua'i Island Utility Cooperative or another Hawaiian electricity company. Working with a utility in Hawai'i would have multiple benefits of being close to the RMI and easy to get to, no need for working visas, working with a similar 110V system, and that Hawai'i has equally ambitious renewable energy targets for island systems, promoting shared learning. Renewable energy and electrical engineering courses are available at University of Hawai'i, where many Marshallese already attend.

'Make' new entrants to the sector

A highly skilled Marshallese energy workforce requires long-term planning and sustained effort. For this to work, the RMI electricity sector must make a commitment to attract, retain, and develop the best employees available in the job market. Beyond that, it will be important to increase the interest and quality of teaching in STEM subjects at high school and elementary school to build the potential pool of candidates.

Raise the profile of the sector and make it attractive

There is a need to raise the profile of the electricity sector as an exciting place to work, with good career opportunities, salaries and benefits. Messages presented could include

[1] https://www.barefootcollege.org/solution/solar/

information about the RMI Electricity Roadmap, the exciting new developments in renewable energy, the need for a skilled workforce, exciting career opportunities and training, and the opportunity to be part of the global climate change solution and part of the RMI's future. Channels include schools, career days, and social media (e.g. Facebook). Existing personnel can be ambassadors. Careers in renewable energy and computer programming/software development could be more appealing for young people than traditional mechanical and electrical utility career paths.

Targeted individual recruitment

Seek out individuals in RMI and Marshallese overseas. People working in the sector could reach out to their networks, social media and conversations to identify potential recruits. High school teachers can be asked to identify those students with a talent for math and science, or with an aptitude for practical skills in fixing things. Anecdotally, we have heard of at least one Marshallese person with electrical engineering qualifications from the US Military and others who have expressed interest in engineering. These people can be approached and encouraged to take a role in the RMI by the management of the utilities, the Energy Planning Division of the government. The proposed Human Resource Coordinator can help identify, mentor and support such individuals. Roles may on occasion have to be created specifically to take the opportunity to employ a qualified Marshallese person.

Good recruitment processes and career path planning

Recruitment processes for apprenticeships and jobs should include simple, clear and transparent application processes. If the RMI Electricity Roadmap is to succeed, there is a need to prioritise the skills required and to seek the best people for the RMI's future electricity system. Getting the best people for the job requires a process free of favouritism. The recruitment process for a role should include an expected career path to demonstrate the opportunity to advance, and this should be followed up with career path planning, especially for high potential individuals.

Start with schools

Get school students interested in STEM subjects and engineering through science fairs, prioritise good science and math teaching in key schools, identify and support interest early, particularly girls. Highlight the opportunities for rewarding careers in renewable energy and energy efficiency.

Internships and professional qualifications

It is proposed that the Energy Planning Department/Office, MEC and KAJUR, and any other key agency, establish an internship program following the MIMRA model described below (Box 1), enabling interns to have real-world experience and career support while pursuing professional qualifications in engineering, project management, policy development etc.

In order to support Marshallese to gain engineering qualifications, a range of supporting mechanisms should be considered. Engineering is more difficult than many other areas of study and additional counselling and support may be required to help people complete the courses. Scholarships should be targeted preferentially to skills the RMI needs, including engineering, and an additional premium on top of the regular RMI scholarship amount could be paid in recognition of the difficulty of the study. Only a few engineers are required, but the goal should be to train at least double that to enable professional mobility and loss to more lucrative overseas jobs.

Internship inspiration from MIMRA

MIMRA currently has 11 degree qualified scientists and 4 or 5 with Masters degrees. Since around 2000 MIMRA has run an internship program. Participants in the program study a degree at a University overseas, and during the major break, return to Majuro to work at MIMRA for around 2- 3 months. Screening of candidates is done so that only those who have already completed a 2-year associated degree at CMI, or those who have already shown their commitment to working on RMI natural resources and environmental issues are given an internship. The interns are provided with a modest stipend. Interns are allocated a mentor from staff officers and given a specific project to work on. The success of the program is even more remarkable in that there has been very good retention- only one or two interns did not go on to have a career at MIMRA. When we asked former interns what attracted them to MIMRA and why they stayed, the answer was that they were passionate about the coral reefs and marine environment and wanted to go scuba diving as part of their job. We think that working on the RMI's renewable energy system will provoke similar passion and commitment. Early in the program in the 2000s, interns worked closely with world-class international marine scientists, conservation, fisheries and aquaculture experts. In some cases, it was their experience being taught by these experts at CMI that encouraged them to go further and complete Bachelors and Masters degrees. Over time, those interns have taken over the role of the expat scientists and are now the ones leading the work and inspiring the next generation of interns.

Box 1: MIMRA Internship model

Apprenticeships

An apprenticeship is the training of a new generation of trade practitioners with on-the-job training and accompanying study, leading to competence over a period of several years. Apprenticeships typically last 3 to 7 years and result in certification. Apprentices would be paid a lower salary but would also be paid during their time at training.

It is proposed that a group of new entrants who are interested in engineering, renewable energy or IT be identified through a targeted approach to high schools, college of the Marshall Islands (CMI) and through Marshallese communities living in the US. Selection will be based on aptitude, interest and motivation. As with internships, an unbiassed recruitment process will support getting the best staff.

In the first year of a program, an apprentice could be rotated through different work departments so they can learn what is involved in each area and then select the area they are most interested in. During this time the classroom study could be general across the technical areas of the utility. These areas include: electrical (generation), mechanical, distribution, renewable energy and IT. [2]

Apprentices who make good progress and show aptitude should be supported with career pathway planning, scholarships and mentoring to undertake higher level engineering study at a technical college or university.

'Grow' the existing workforce

It is important to identify and nurture talent in the existing workforce, providing support to those who have the ability and motivation to undergo further training and education, and to progressively take on more responsibility. Improving management and supervision can improve performance and motivation, help to ensure utilities are financially sustainable, and have consistent and adequate operation and maintenance practices.

Identify and nurture talent

Often there are exceptional and competent people in the existing workforce. They may already be performing well, or they may be underperforming due to poor management or supervision. These people can be identified and mentored using any of the ideas presented here, including apprenticeships and internships. Effort should be made to:

- Identify staff with potential already in the sector
- Implement career path planning for these individuals with annual review.
- Provide training and opportunities for development
- Link pay to qualifications and provide incentives for gaining certification-
- Provide paid time to attend trainings both in Majuro and in Ebeye, and bring outer island technicians to those trainings
- Nurture those with talent and high performance, including providing advancement opportunities

Cohesive in-country vocational training

There are many *ad hoc* training courses and meetings offered by development partners, often as part of projects. Short training courses offered either internationally or in-country usually offer no follow up or embedding of learnings. Training is often poorly targeted both for relevance and skill level, lacking context and too short to have lasting impact. (Note: the longer training offered by JICA is an exception to this and is considered by RMI stakeholders to be useful and relevant).

There is a need to implement a cohesive program of skill development in which trainings build on each other. There is a strong preference for training to be carried out in the Marshall Islands.

One proposal is to establish a vocational training facility at CMI. This could be a physical space where demonstration equipment can be installed and worked on. It would provide regular scheduled training for apprentices provided by in-house trainers/trade coaches, and visiting trainers. It could also provide a venue for continuing professional development for other staff, including management.

CMI also has facilities for mixed mode learning and remote internet-based learning, and could potentially deliver programs to technicians on Jaluit and Wotje remotely, at least in part.

Another option is to more fully engage in regional training facilities, such as one being planned by the PPA in Fiji, or the Palau Community College, which offers electricity sector training. To be effective, the preference is for in-country training but this needs to be

properly resourced. These options need to be further explored and a review carried out of existing training programs in the Pacific to see what approaches have worked.

A further consideration is to have assessments that allow personnel to gain a recognised and transferable qualification from the training, and assessments. Developing in-house trade coaches to support apprentices should also be an objective of a training program.

One of the key aspects of this approach is that is would mean asking development partners to divert resources currently put into *ad hoc* training and workshops, and to instead provide direct funding and TA in support of the establishment of a relevant in-country program of education, a qualifications framework and the ongoing resources required to deliver this. With around $200 million to be spent on capital equipment over the next decade, quality training to help ensure the proper maintenance and operation of that equipment would be a good investment, at an estimated 3-5% of the capital investment. There are significant spillover benefits in terms of human capital development for the RMI.

Providing sustained support for management

One key recommendation in the KAJUR Personnel and Capacity Development plan [1] is to have a dedicated organisational development specialist (international expert) work alongside KAJUR for some years to help implement structural and management changes. We consider that ongoing management support and advice would be beneficial across the sector including for utility management, government officials, Board members and ministers. ADB consultants are undertaking a comprehensive organisational review of MEC in the second half of 2018 and further specific recommendations on improving MEC's management, including with respect to HRD, should result from that. A pool of trusted consultants and advisors along with specific technical assistance projects, can be used to provide ongoing support, as they are for many utilities around the region.

'Buy' required expertise and additional capacity

For this review we have not conducted a skills audit but from experience and discussion with local stakeholders it is apparent that most of the new skill sets required do not currently exist in the RMI. We therefore assume that many of the roles will need to be filled by expatriates for periods of between 2 to 10 years, dependent on the seniority and technical complexity of the role.

If there is strong commitment to implementing the "Make" and "Grow" strategies it will take a decade or more for the RMI to build the required skills and experience internally. Beyond that, there will almost certainly be an ongoing need for some international expertise due to the inherently small size of the RMI. Relationships with external consultants, trainers and specialists should be developed long-term.

Pool of trusted consultants and advisors

One of the high transaction costs for energy projects in the RMI to date has been the turnover of consultants working in the sector. Each time a new consultant comes in, unfamiliar with the context and people, RMI personnel spend an inordinate amount of time helping them come up to speed. Even then, inappropriate advice is sometimes given, which in turn generates more work/rework for local staff. Often the time spent on the ground is not enough to gain the trust of local staff or build relationships.

Consultants and service providers come with deep expertise in renewable energy systems and in island renewable energy systems. By maintaing long-term relationships they can also develop detailed knowledge of the RMI's systems and can be retained for troubleshooting. It

would be of great benefit to the RMI to establish a pool of trusted consultants and advisors who are familiar with the RMI systems and context and who have established working relationships, rather than bring in new consultants for each piece of work. It is recommended that the RMI ask development partners to support this approach, bringing in new consultants only when they have a particular skill set not otherwise adequately covered or available within the pool. Joint procurement of a panel is recommended so that the members meet all the various requirements of development partners up front, and transaction costs for procurement are reduced.

Remote technical support

The technology planned for the systems of Majuro and Ebeye and also for the solar hybrid mini-grids will remote support over the internetThis means technicians located in Australia or the United States (for example) can view the same information as technicians in Majuro or on Wotje or Jaluit and can assist in troubleshooting remotely. This in turn means that specialised engineers do not need to be on island, but can work remotely, and fly in only when absolutely necessary..

Implementing the Human Resource Strategy

Utilising existing institutions

National	Current role	Potential role
College of the Marshall Islands (CMI)	Provides high school equivalency, community extension, student development, certificate, and associate degree programs in Liberal Arts & Sciences, Elementary Education, and Nursing	Hosting vocational training centre and trade qualifications.
University of the South Pacific (USP)- RMI Campus	Marshall Islands campus of the regional university. Provides preparation/ foundation courses for students to go on and study science and engineering at university. Offers in-country MBA program.	Work with people aspiring to study engineering and management, provide counselling on university study.
MEC/ KAJUR (Combined Utilities)	RMI's electricity utilities.	Recruitment, hosting apprenticeships and interns, providing career pathways and improving management and supervision.
Energy Planning Division/ Office (EPD/O)	Currently a small office responsible for sector policy and planning coordination.	Will need to be active in the sector leadership and coordination role.
RMI Scholarships Board	Provide scholarships for Marshallese to undertake study overseas.	Targeting scholarships, promoting uptake of underutilised scholarships for engineering/ energy (such as NZMFAT, counselling students).
Division of International Development Assistance (DIDA)	Coordinate most international development assistance across several sectors, including electricity.	Facilitate process with development partners to support more strategic investment in HR.
National Training Council	Provide funding for training	Target funding for identified

(NTC)	courses.	energy sector training needs, support apprenticeship program.
International		
Japanese International Cooperation Agency (JICA)	Provide regular, in-depth training for Pacific Island countries.	Continue to provide longer off-island training courses. Provide visiting trainers as part of the in-country vocation training program.
Pacific Power Association (PPA)	Inter-governmental agency to promote the direct cooperation of the Pacific island power utilities in technical training, exchange of information, sharing of senior management and engineering expertise. There is a regional training facility being established in Fiji under the auspices of the PPA.	Continue to support all these areas, particularly in the development of senior management. Seek opportunities to utilise PPA programs and expertise in the vocational training, apprenticeship and internship programs. Explore secondments or twinning with other utilities.
Other universities e.g. UH	UH offer degrees in electrical engineering and a post-grad course in renewable energy and island sustainablility.	Work with UH to understand how these courses and faculty could support Marshallese in this area. This includes potential for expertise and staff to come from UH.
Other utilities	Some other Pacific utilities are significantly advanced in integrating renewable energy and have experience and skills that could be shared, including NZ and Hawaii.	Seek a 'twinning' relationship with another, more experienced utility to exchange staff and do learning studies, mentoring etc.
Scholarship agencies- e.g. NZ MFAT and Australia DFAT	NZ have offered scholarships with priority on renewable energy- these have been undersubscribed in the RMI.	Identify all relevant scholarships and actively target towards energy sector needs.

Financing

The financing of the Human Resource Strategy is part of the overall discussion of how to finance the Roadmap. Below is an indicative cost summary and approaches to financing.

Component	Indicative Cost (USD)	Source of financing
Human resource coordinator	$200k/year for first three years	Seeking funding from development partners
Additional personnel		
Energy Planning Division/ Office	$200-$400k/year	Local salaries paid by RMI Government International salaries paid by development partners under TA components
Program implementation unit (13 new staff)	$2.5m/year (initially until roles can be filled locally)	Project grant funding
MEC and KAJUR staff- international (high salary)	$1m/year for several international staff	Project grant funding
MEC and KAJUR staff- local/ lower salary	$400k/year	MEC and KAJUR operations
Apprenticeships	$150k/year	MEC and KAJUR operations
Vocational training program/ centre	$500k/ year	Proportion of financing for Roadmap projects
Internships	$100k/year	MEC and KAJUR operations
Scholarships	-	Cost met through existing scholarship schemes

Next steps

Next steps:
The first step is to hire an experienced HR development professional as the **RMI Electricity HR Coordinator** for an initial three-year term. This person will have responsibility to carry out the following:

1. Convene the **RMI Electricity HR Working Group** including MEC, KAJUR, CMI, USP, Energy Planning office, the National Training Council (NTC) and the RMI Scholarships Board
2. Set up **first intake of apprentices** in MEC and KAJUR
3. Identify **first candidates for internships and engineering study**, and assist then with scholarships and applications
4. Design and implement in-country vocational training program, learning from other Pacific experiences.

References

[1] P. Muscat, “Kwajalein Atoll Joint Utility Resources Inc. (KAJUR) Personnel Training and Capacity Development Plan 2017-2022,” Asian Development Bank, 2017.

[2] S. Wakefield, “Concept Proposal - Combined Utilities Apprentice Scheme”.

[3] H. J. d. Combes, “Republic of the Marshall Islands Training Needs and Gap Analysis,” PacTVET (Pacific Technical and Vocational Education and Training for Sustainable Energy and Climate Change project), 2015.

[4] D. Nikolic and J. Curd, “RMI Electricity Roadmap Technology Pathways Report,” Elemental Power and Renewables, 2018.

Appendix A:People consulted in the preparation of this Working Paper

Name	**Organisation**
Jack Chong-Gum (CEO)	MEC/ KAJUR
Kayo Yamaguchi-Kotton	MEC
Steve Wakefield	MEC
Angeline Heine	EPD
Ben Wakefield	EPD
Irene Ta’afaki	USP
Kimber Rilometo	USP
Harry Speicher	Lineman trainer
Florence Edwards	MIMRA
Candice Guavis	MIMRA
Diane Peters	Formerly RMI Scholarships Board
Allison Nashion	National Training Council
Theresa Koroivulaono	CMI
Stevenson Kotton	CMI
Emil De Brum	CMI
Stanley Lorrenij	CMI
Mommity Subillie	CMI
President Hilda Heine	RMI President
Jennifer Tseng	DIDA
Colleen Peacock-Taylor	NTC’s Strategy Consultant

Appendix B: RMI Electricity Roadmap Human Resource Needs Assessment

The table below presents an estimate of workforce needs for 2020, 2025 and 2030, based on the technology pathways identified in the RMI Electricity Roadmap. The boxes coloured green and white are expected to be local Marshallese staff. The orange boxes are expected to be expatriate staff. The yellow boxes are expected to be a mix of Marshallese and expat staff. In this way, we can see the transition from expat to local personnel for these skilled roles.

	2018 [1] estimate baseline	2020	2025	2030
Phase I projects		Design	Operate & Maintain	
Phase II projects			Feasibility	Operate & Maintain
Phase III projects				
Management and Admin MEC				
C' Level	9	9	9	9
Finance & Accounting	6	6	7	6
Administration	5	5	5	5
Procurement	3	3	3	3
Customer Service	5	5	5	5
Metering	3	3	3	2
HR	2	3	3	3
IT	4	6	6	6
Total	**37**	**40**	**41**	**39**
Management and Admin KAJUR				
C' Level	3	3	3	3
Finance & Accounting	3	3	3	3
Administration	3	3	3	3
Procurement	2	2	2	2
Customer Service	5	5	5	5
Metering	2	2	2	2
HR	2	2	2	2
IT	1	1	1	1
Total	**21**	**21**	**21**	**21**
Centralised Project Management Unit				
Program Manager	1	1	1	1
Project Managers		3	3	3
KAJUR Specialist	1	1	1	1
Specialist Engineers		3	3	2
Commercial manager		1	1	1
Procurement Manager		1	1	1
Human Resource Facilitator/ Coordinator		1	1	1
Monitoring and reporting	1	1	1	1
Communications and stakeholder person		1	1	1
Total	**3**	**13**	**13**	**12**
MEC/ KAJUR Engineering, RE & BESS O&M Roles				
Electrical / mechanical / RE	2	2	5	5

	2018 [1] estimate baseline	2020	2025	2030
Engineers				
Electrical / mechanical / RE Engineer trainees		1	3	3
Automation/ Control System Engineer		2	2	2
Automation/ Control System Engineer Trainee		2	2	2
Wind operation and maintenance specialist			1	1
Wind maintenance technicians			1	1
Solar specialist		2	2	2
Solar maintenance technicians	2	2	2	2
Total	**4**	**11**	**18**	**18**
MEC operations, maintenance and general				
Shift operators	43	43	43	43
Electrician	1	1	1	1
Electrical apprentices/assistants	2	2	2	2
Maintenance engineers mech/elec/etc	4	4	4	4
diesel mechanics	11	11	11	11
Tradesmen	9	9	9	9
trades trainee	2	2	2	2
general labour	10	10	10	10
Welders	5	5	5	5
Total	**87**	**87**	**87**	**87**
MEC distribution team				
Supervisor/superintendent/foreman	3	3	3	3
Technician	2	2	2	2
Linesman	17	17	17	17
Total	**22**	**22**	**22**	**22**
KAJUR operations, maintenance and general				
Shift operators	9	9	9	9
Maintenance engineers mech/elec/etc	1	1	1	1
Electrician	1	1	1	1
Electrician trainees				
Mechanic	2	2	2	2
Mechanic trainees	6	6	6	6
Tradesmen	5	5	5	5
Supervisor	3	3	3	3
general labour	14	14	14	14
Total	**41**	**41**	**41**	**41**
KAJUR distribution team				
Manager	1	1	1	1
Linesmen	3	3	3	3
Metering manager	2	2	2	2
Total	**6**	**6**	**6**	**6**
Other Island and Atoll Operators				
Jaluit- operators - Diesel plant operators/ solar/ batteries	10	10	10	10
Jaluit diesel mechanic			1	1
Jaluit distribution	3	3	3	3
Jaluit - RE Tech			1	1
Wotje- operators - Diesel plant operators/ solar/ batteries	10	10	10	10

	2018 [1] estimate baseline	2020	2025	2030
Wotje diesel mechanic			1	1
Wotje distribution	1.5	1.5	2	2
Wotje - RE Tech			1	1
Outer island solar technicians	44	44	44	44
Total	**68.5**	**68.5**	**73**	**73**
Government				
Director- National Energy Office	**1**	**1**	**1**	**1**
Assistant Director & EE Programme Director		1	1	1
Energy Efficiency program implementation		2	3	3
Ebeye- EE program officer		2	2	2
RE & BESS Expert	1	1	1	1
Road Transport Expert		1	1	1
Sea Transport Expert		1	1	1
Regulatory Expert		1	1	1
Office Manager	1	1	1	1
Independent Regulator		1	1	1
Regulator Admin		1	1	1
Total	**3**	**13**	**14**	**14**
Grand Total	**265**	**295**	**308**	**305**