CAPACITY DEVELOPMENT AND WATER SECURITY FOR KIRIBATI

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ABSTRACT

Kiribati's is a sovereign state in Micronesia whose ocean territory spans 3.5 million km^2 but the 33 coral atolls and isles that make up the total land area covers just 0.2% of this. As most of these atolls lie only a few meters above sea level, Kiribati is being drastically affected by climate change and the resultant water security issues.

Over half of Kiribati's 110,000 population is located in the city of South Tarawa, making it an area with one of the densest land uses in the world. This puts a great toll on the limited remaining land and resources. The recharge zones of the delicate freshwater lens are under pressure from the presence of squatting communities, and the difficulties in managing human waste on the small atoll pose a challenge for its ongoing environmental management. This paper outlines the scoping component of the Tarawa Solar Distillation Water Supply Project, a two-year project to deploy solar distillation technology in Kiribati to demonstrate the suitability of this technology as a sustainable alternative potable supply for households and remote communities in the Pacific. Solar distillation cells use solar energy (of which there is plenty in the Pacific) to evaporate water, which is then collected on a hydrophilic plastic sheet as condensate. The benefit of this technology over many others currently in use is its ability to treat brackish groundwater and sea water with low to no energy demand. This project seeks to examine not only the technological viability of these cells, but also how they will be accepted and used within the local cultural context.

This project is being undertaken by the Kiribati Ministry of Infrastructure and Sustainable Energy (MISE) with Engineers Without Borders NZ (EWBNZ) providing technical and project support. The objective is that MISE implement the activity from concept to completion and in so doing build their project management capacity. EWBNZ's technical involvement in the project also aims to assist MISE in developing their capacity to later deploy this technology themselves, with the wider engineering sector in Tarawa. In addition, the use of local engineers who understand the cultural and social context in which the technology is being applied will ensure that the technology is appropriate and valued by the community, and by extension will continue to be maintained over its entire design life.

Major partners of this project include MISE, The Pacific Community (SPC) and Volunteer Service Abroad (VSA). It is funded through the Ministry of Foreign Affairs and Trade (MFAT) New Zealand Aid Programme, which delivers NZ's official support for developing countries.

KEYWORDS

Solar distillation, aid, water security, capacity building

PRESENTER PROFILE

India has been a part of Engineers Without Borders New Zealand for the past 5 years and is currently project managing the Tarawa Water Supply Solar Distillation Project in partnership with MFAT, MISE and VSA. She has recently returned from visiting Tarawa, where she met with local stakeholders and scoped out the project ahead. India also works as a Water Resources Engineer with the WSP Opus Water team in Wellington, focusing on water supply risk assessments and hydraulic modelling.

1 INTRODUCTION

The Tarawa Water Supply Solar Distillation Project is a three-stage project which focusses on two major outcomes; to address water security challenges across Kiribati by testing low-energy solar distillation technology, and to increase the capacity of the local government infrastructure team by introducing contract management practices for application to other larger projects.

At the time of preparing this paper, the project was reaching the end of the scoping phase and preparing for the following implementation phase. This paper describes the overall project and how the scoping phase has impacted the project.

2 DISCUSSION

2.1 LOCAL CONTEXT AND WATER SECURITY CHALLENGES

Kiribati is an independent Micronesian nation that is most widely known on the international stage as a poster-child for climate change. This nation spreads over 3.5 million km^2 with 33 island atolls totalling a land area of just 0.2% of this at 811 km^2 (Index Mundi, 2018). Tarawa is an atoll in the Gilbert Island chain and is the capital of the Republic. As the nation's capital, Tarawa is a hub that populations from outer islands migrate to, and now has over 50% of the country's total 110,000 population, increasing pressure on vital natural resources.

Tarawa has a maximum elevation of just 3 metres above sea level, which is not an uncommonly low elevation for Kiribati atolls. This makes it incredibly vulnerable to king tides and any major storm swells. With minimal available land, there are no surface water sources for drinking water, and instead the nation predominantly relies on rainwater harvesting and the delicate brackish groundwater lenses that sit beneath these atolls. The wet season in Tarawa lasts from November to April with an average of 2100 mm total rainfall, and the extremes of the rainfall range are from 4000 mm to just 150 mm of rain in a year (Kiribati Meterology Service, Australian Bureau of Meterology, CSIRO, 2011). With droughts increasing in length and over-population increasing pressure and damaging the freshwater lenses, the ability to convert the available seawater surrounding these islands is highly desirable. Reverse osmosis plants exist in Tarawa, but at a high maintenance and energy cost. It is currently not considered a feasible technology for the outer islands.


Photographs 1 and 2: An example of the crowded nature of South Tarawa communities and risk to water sources.

The existing and future climate of Kiribati presents a vast range of challenges for organisations and government. The Ministry of Infrastructure and Sustainable Energy (MISE) is the main in-country partner for this project, along with SPC (The Pacific Community). MISE's Water and Sanitation Engineering Unit (WSEU) is responsible for ensuring there are reliable and safe water supplies and sanitation facilities across Kiribati. By increasing the capacity of the governing body for water access, this will have a wider reach across the nation's communities. MISE engages with both the Drought Committee and the Water and Sanitation Committee, and it is through these existing connections that the project will engage with local communities.

The existing method of project delivery within Kiribati has been for the Government of Kiribati to directly implement them, which has led to the limiting situation where by MISE are the main service provider for all major water supplies. With the increasing ability of the private sector in South Tarawa to be contracted in to deliver these services, it is now possible for MISE to explore its role as the implementer and manager of these projects and to instead focus on facilitation and regulation of these supplies.

2.2 TARAWA SOLAR DISTILLATION WATER SUPPLY PROJECT

The technical component of the Tarawa Solar Distillation Water Supply Project aims to trial solar distillation technology at both community and household scale with the intention of improving potable water supply access in remote communities of Kiribati. The method of trialling this technology is intended to build technical capacity of both government organisations as well as local communities. The capacity development outcome of this project is for the WSEU team to gain experience in project and contract management with a smaller scale project such as this, which would then be applied on larger projects.

The project consists of three stages; scoping, establishment and monitoring, and will conclude with a decision by partners on whether the solar distillation technology trialled is appropriate for the context of communities across Kiribati. The establishment phase involves deploying a field professional with Volunteer Service Abroad (VSA) who will be placed within MISE for six months. Their role will be to manage the design, procurement, installation, operation, monitoring and maintenance of the Carocell units. Prior to the next stage, the field professional will also assist in developing the monitoring programme to collect data on the effectiveness of the units. The third stage is monitoring the units over an 18-month period, for their resilience, performance, and cultural appropriateness. The project will conclude whether the technology is an effective means of providing potable water to multiple communities across Kiribati. While the long-term intention for the technology (if appropriate) would be for use in outer island communities where water supplies are less secure, this project will trial the units on Tarawa, in communities that do not have access to the reticulated network. This will determine whether the panels will

be used as intended, while also being accessible by the project team for monitoring and maintenance.

To commence the project, the scoping phase was used as a means of meeting with relevant stakeholders in Kiribati, to determine what further influences and interests there are to consider. This has proven crucial to the project already, as major stakeholders identified early on had differing capacities to those expected, and additional stakeholders were identified and connected with.

Kiribati partners were met with at the beginning and end of the scoping trip, in order to introduce one another to the project, and then summarise the conclusions drawn from the trip. These partners included MFAT personnel working from the New Zealand High Commission, the VSA Kiribati Programme Manager, and WSEU managers. These partners all have key roles in the project and each have connections with more stakeholders that were identified and introduced before the end of the trip. Each stakeholder brings different perspectives and experiences to the project. Identifying as many stakeholders as possible while in country and being able to meet face-to-face made a significant difference to relationships.

There are non-government organisations (NGOs) and other development actors that can operate on a project-by-project basis without overarching coordination of efforts to prevent duplication. We are actively working towards preventing this by discussing the project with government agencies and other NGO's in Kiribati and asking communities about other initiatives going on in the region, to ensure we are not trying to replicate a previous project or are giving mixed messages compared to another NGO in the region.

2.3 SOLAR DISTILLATION CAROCELL TECHNOLOGY

The project is utilising the desalination Carocell units manufactured by FCubed based in Melbourne, Australia. The FCubed manufacturing warehouse was visited on route to Tarawa, Kiribati. The purpose of the meeting was to gain a more in-depth understanding of the Carocell units themselves. As a modular unit that does not require electricity unless a solar pump is specified, the Carocell units are functional and can be easily understood, operated and maintained, by technical specialists and community members alike. The technology focuses on the concept of boiling contaminated water and collecting condensation, which is a familiar concept to anyone accustomed with food preparation and boiling water. This technology was recommended for research by the project facilitator, MFAT, as a means of desalinating water without the high running costs of standard desalination units, as it requires comparatively little maintenance and is solar powered. This technology has been successfully deployed in many other nations with similar climates and water security challenges (F Cubed Ltd, 2017) but has not been tested on a large scale in Kiribati with consideration for local context.

Photographs 3 and 4: FCubed carocell arrays in Tarawa, installed by Tobaraoi Green Living.

A local distributor of the units, Tobaraoi's Green Living team, is based in South Tarawa. They have successfully installed a number of individual and array units around Tarawa for different clients and are continually developing the installations to suit the local environment. This includes consideration of the unit's resilience to the saline environment and the culture of regular maintenance for the units in a community setting. Issues already encountered include the accelerated rate of corrosion on some system components, and a lack of interest from community members to conduct necessary daily maintenance procedures. While they are not intricate maintenance tasks, the additional administration is not desirable, and the team have been assisting in ensuring the units can continue to provide a sustainable source of water despite these challenges. This local knowledge will be beneficial to the project during installation and monitoring, as the issues already identified can be considered during implementation. Green Living's experience of working within a community setting adds to the project analysis to consider whether the technology will be accepted and used as intended.

The technological outcome of this project is for six Carocell installations - two community scale and four household scale units – to be monitored and for this data to be used to determine whether the units are appropriate for a government roll out as a sustainable water source in remote communities in Kiribati. These project installations are to be monitored for 18 months regarding their productivity, maintenance requirements, acceptance and favourability from the community, and other performance related attributes. The results will then be presented back to partners and relevant stakeholders and discussed for any future projects or research in other projects. The scoping trip highlighted that a presentation regarding progress and preliminary findings at the conclusion of the establishment phase will be necessary to continue stakeholder engagement and direct the next phase of monitoring.

2.4 CAPACITY DEVELOPMENT

2.4.1 PARTNERSHIP CAPACITY DEVELOPMENT

Capacity development is the process of individuals or organisations gaining, improving and retaining skills. This project focuses on a partnership capacity development approach, which is a two-way sharing of knowledge and experience between the two key partners, MISE and EWBNZ. This is based on principles of localisation in development, ensuring that both parties are considered equal and are capable of learning from one another.

This has been established via a Memorandum of Understanding (MOU), to ensure the partnership is well defined and that each partners' values are highlighted to one another. Capacity development is a core component of any EWBNZ project and is a shared value with other partners in this project. This MOU has been broken down to focus on the overarching partnership, and then a sub-agreement has been used for the project specifics. This is to ensure that the values of the parties are identified and that any project undertaken will be subject to these same values.

The skills that are of focus in the capacity development partnership are for EWBNZ to gain understanding and experience working with and through i-Kiribati government partners for humanitarian engineering initiatives.

The WSEU team is aiming to develop their capacity with contract and procurement practices by using this project as a trial, which can then be scaled up to their larger infrastructure projects. As MISE is already stretched to capacity with the extent and scale of existing projects, gaining contract experience would improve their ability to execute

projects. The intention here is to build capacity in an area while applying it to a practical project that has tangible community benefits. The risk is that MISE's stretched capacity restricts their ability to take part meaningfully in the project.

2.4.2 INDEPENDENT TECHNOLOGY DEPLOYMENT AND THE IMPORTANCE OF ENGAGING THE LOCAL ENGINEERING SECTOR

There are countless examples of technology being deployed in communities around the world without consideration for the appropriateness, maintainability, cultural acceptance or desire for the technology. The partners involved in this project are well aware of these issues, from either knowledge of the industry or experience of these issues in projects themselves. Being aware is one thing, but actively working to avoid these issues is essential to work towards a better outcome for communities.

By using a technology that is already supported locally by the local distributor, Tobaraoi Green Living, there is a higher confidence in the technology being appropriate for the environment. The outcomes of this project are to determine the appropriateness, acceptance and maintainability of this technology in Kiribati, as a pre-cursor to any potential larger roll-outs of this technology. There is no presumption that the technology will be automatically maintained, accepted and desired: testing these aspects form part of the project itself. If the technology is *not* maintained, accepted and/or desired, this does not represent failure of the project, merely a result, that can be incorporated into future pilot initiatives. Results of the project will be communicated broadly across the sector to interested stakeholders.

A government partner that was initially planned to be the maintenance lead has been unable to take on this role due to prior commitments and responsibilities, which was discovered during the scoping trip. Therefore, a more suitable maintenance lead must be confirmed, which will likely be a balance of the WSEU team, Tobaraoi Green Living team, and the development of local communities for minor maintenance tasks.

The project involves having a single water engineering advisor based in Kiribati for a short period (six months), whose role is to guide the WSEU team in managing and implementing the project. By working with local installers and engineering teams, existing expertise from previous projects and connections with communities can be drawn upon.

Frequently, infrastructure improvements to communities are implemented by international placements without passing on the skills that allowed it to happen. It is crucial that this field professional is there to advise, that the expertise and perspectives of local engineering professionals are incorporated into the project, and that the partner organisation team members are confident in their ability to repeat such a project without the need for an advisor to the same dependency. The local engineering sector is fully capable of replicating such a project as long as the capacity and skills development aspects of the project are undertaken correctly.

3 CONCLUSIONS

The partners each have different drivers for their involvement, as the project has multiple outcomes that partners identify with.

The technological outcomes involve testing the appropriateness and viability of solar distillation Carocells in Kiribati for a larger government run scale. This is to combat issues in the development industry where by technology is deployed without consideration for cultural or practical suitability for the community. By testing this technology specifically

within Kiribati, it will be known whether there is value in increasing deployment of this technology or whether to investigate this technology in other Pacific Island Countries (PICs). Testing also contributes to further research into improving water security in Kiribati and could improve the situation if the technology proves to be successful and appropriate in the context.

The capacity development outcome of this project is for the WSEU team, and the local engineering sector more broadly, to pick up contract management skills, to enable future MISE projects to gain the financial benefits of contracting work out to the private sector as well as improving the capacity of the team to implement other projects, and on a larger scale.

The scoping component of this project is only a small portion of it, but it has identified multiple new stakeholders and better engaged existing ones, revealed risks and challenges that will need to be addressed in later stages, and better defined the full scope of the remaining project.

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This paper was prepared by India Eiloart on behalf of EWBNZ and does not necessarily reflect the opinions or views of other partners involved.

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