Engineers Without Borders
Humanitarian Engineering Research Program

Research Project List
October 2015

Engineers Without Borders
Engineers Without Borders Australia (EWB) works in partnership with organisations, both within Australia and overseas, to provide disadvantaged communities with the resources, knowledge and technologies they require to live a life of opportunity free from poverty.

The Research Program
EWB’s Humanitarian Engineering Research Program is an initiative that harnesses the skills and passion of academics and students at Australia’s leading universities to tackle pressing humanitarian issues. The aim is to produce valuable new knowledge and technologies that improve the lives of people in disadvantaged or marginalised communities.

To achieve this aim EWB connects students and academics to development organisations through collaborative humanitarian engineering research projects. Previous research projects include:

- Sedimentation tank design for rural communities in the hilly region of Nepal; for Nepal Water for Health.
- The design of low-cost dust masks for stone quarry workers in India; for Santulan.
- An investigation into sanitation options for rural Kien Giang Province, Vietnam; for Habitat for Humanity Vietnam.

Further examples of research outcomes can be found at www.ewb.org.au/jhe.

Projects are scoped by EWB in partnership with the development organisation and, depending on the goals, may be suitable for students at either a PhD level or more often as part of a one or two semester final year thesis. It may also be possible to conduct projects as part of a students industry based learning.

Available EWB projects are published in this list as well as online www.ewb.org.au/available-research-projects. Applications to be a part of the research program are submitted through the webpage above.
The projects included in this document are just the first set for 2016, more projects will be added online as they become available, please visit www.ewb.org.au/research to stay up-to-date with the latest available projects.

EWB Project Support

EWB works hard to provide significant student support to ensure impactful research outcomes. Support includes:

• Provision to students of a mentor from one of EWB’s corporate partners, where appropriate.
• Access to EWB’s network of members with expertise in a core theme of EWB e.g. Water, Energy, Education, Shelter.
• Training to enhance researchers understanding of human centred design and appropriate technology.
• An invitation to the EWB Research Forum, an opportunity to share new knowledge and network with the development community.
• Media and PR promotion of research projects in organisation and Australian publications.

How to get involved

To apply for one of the research projects listed in this document simply go to www.ewb.org.au/available-research-projects. More information about the research program can be found at www.ewb.org.au/research. If you are interested in supervising a EWB project or would like to collaborate with EWB please contact EWB’s research coordinator Dr Nick Brown n.brown@ewb.org.au.

Students are strongly encouraged to find an academic supervisor before submitting a project application. In the case where there is more than one group interested in a project, EWB will investigate avenues to share the project. If this is not appropriate, EWB will allocate projects based upon the strength of the application.

Disclaimer

With a significant time between when the projects are first released and the start of the next semester there is a chance that a project brief will change slightly if the need of the community partner changes. All projects are correct at the time of printing.
Project List

Energy

The utilisation of biodigesters for the provision of energy to communities living in refugee camps
A refugees right to electricity, is a standard possible?
The optimisation of communal lighting in refugee camps
Development of an easy to use portable mobile phone charging system for use in mass displacement scenarios
The design of an emergency cooking solution for newly displaced refugees
Temporary off grid power generation for refugee camps
Access to energy for refugees in urban contexts
The development of a low-cost renewable cooking solution for refugees
The design of a portable lantern for use in areas without electricity
Access to cooking fuel as a human right
A holistic approach to reducing indoor air pollution
The design of an improved cookstove that meets cultural and social practices

Water, Sanitation and Hygiene

The removal of arsenic from drinking water in Cambodia using sand filters
Designing a Titanium based reaction system to treat drinking water in Cambodia
A review of sanitation technologies for communities living in challenging environments: focus on the Mekong Delta
The current state of household level biodigester technology
Quantifying the health impacts of poor sanitation in challenging environments
An investigation into sanitation in challenging environments in a global context
An investigation into the success of development projects relating to the provision of sanitation solutions in challenging environments
Investigation into drinking water safety in rural Timor-Leste
Optimising the components of soap to improve hygiene and health

Structures

Incorporating traditional construction and material preparation techniques into modern practices for communities in the Mekong Delta

Education

A review of education practices in Timor Leste with respect to the training of engineers

Development Practice

Improving health impact evaluations and reporting in humanitarian engineering projects
An analysis of demographic data relating to communities in the Mekong Delta 36

**Assistive Technology**

- Improving the functionality of upper limb 3D printed prosthetics 38
- Enabling confidence and bringing a little fun to prosthetics 39
- Materials analysis and optimisation of 3D printed prosthetics 40
- The conversion of a Cambodian tuk-tuk to be wheelchair accessible 41

**Business Development**

- Leading practice for scaling social enterprises: the business of biodigesters for floating villages 43
- Payment methods for technologies in marginalised communities: case study energy access in rural Mexico 44
Energy

The utilisation of biodigesters for the provision of energy to communities living in refugee camps

<table>
<thead>
<tr>
<th>Project Brief Code:</th>
<th>A2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thematic Area:</td>
<td>Energy</td>
</tr>
<tr>
<td>Style:</td>
<td>Design</td>
</tr>
<tr>
<td>Country Focus:</td>
<td>Refugee</td>
</tr>
<tr>
<td>Partner Organization:</td>
<td>UNHCR</td>
</tr>
<tr>
<td>Research Group Location:</td>
<td>Any</td>
</tr>
</tbody>
</table>

Background

In 2012 the UNHCR estimated that a third of the planet's 10.5 million refugees lived in refugee camps (UNHCR 2013). In the same year just four camps in Kenya contained a total of 500,000 refugees (UNHCR 2013). At camps like these the supply of cooking fuel by aid agencies is not always sufficient to meet the demands of refugees. In order to meet the shortfall refugees often resort to unsustainable practices including deforestation. The UNHCR are interested in determining if the energy gap could be bridged by using biodigesters at either a household or community level. Biodigesters convert organic waste, specifically human and animal excrement, into biogas which can be burnt.

Aims and Objectives

The aim of this study is to help refugees in energy poverty by introducing a sustainable solution. Specifically, to determine how biodigesters can be incorporated in the supply of sufficient cooking fuel to a refugee household. Considerations should be made into, at what scale (household, community or wider scale) biodigesters should be implemented and how biodigesters could be incorporated into new camp designs, or retrofitted at existing camps. Different phases of humanitarian response should also be considered and how the applicability of biodigesters may change.

Thoughts should also be made to the replacement of traditional latrine facilities and designs for the distribution of biogas to households. Agencies, such as the UNHCR, are interested to see how effective biodigesters would be at supplying fuel and what other technologies or methods would need to be employed to ensure sufficient fuel is provided to each household.

One possible extension of this project would be to look at other added values biodigesters can bring to a community such as through the provision of a waste management solution or a source of agricultural fertiliser.

Expected Deliverables

A report presenting possible designs, or concepts, displaying how to incorporate biodigesters in refugee camps. It should explore the implementation of biodigesters and their link to use as a cooking fuel provider for either household, community or larger scale implementation.

The research team are also expected to disseminate the outcomes of their research to the broader humanitarian community, this could include an academic style paper presented at the Humanitarian Engineering Research Conference or through the Journal of Humanitarian Engineering.

Fieldwork

No fieldwork is required for this project

Conditions and Applications

The conditions for participating in the research program along with the application form can be found at www.ewb.org.au/research-project-applications. Please quote brief code A2 on your application.
A refugees right to electricity, is a standard possible?

Project Brief Code: A3
Thematic Area: Energy
Style: Review
Country Focus: Refugee
Partner Organization: UNHCR
Research Group Location: Any

Background

War and conflict tends not to discriminate between rich and poor; both Gulf Wars saw many middle-class families leaving their homes and seeking refuge. The current civil war in Syria has again led many middle-class refugees.

A Telegraph newspaper article in 2007 ran a quote from a spokeswoman that indicated that the UNHCR is not well equipped to deal with middle-class refugees, “We have the tents and medical intervention kits and everything but what do you do for people who don’t want to live in camps or queue up for basic food?”. The UNHCR has found that middle-class refugees also have different energy demands and expectations from aid agencies. Some of the first refugees to leave Syria did so in cars and vans carrying higher powered electrical devices such as laptops, fridges and air conditioners. Although this trend is subsiding there are still many refugees with demands for relatively large demands for electricity.

The “traditional” major household electricity demand for refugees covers: lighting, mobile phone charging with a relatively small demand for refrigeration (principally for keeping drinks cool). Middle-class refugees have additional demands, including say laptop charging and air conditioning.

Aims and Objectives

This project will investigate the idea that energy could be considered a basic human right and that, as such, every refugee has the right to a certain amount of electricity, in both camp and non-camp contexts.

According to the World Energy Council the average Australian electrified household consumes just under 7,000kWh of electricity per year compared to an electrified Ethiopian household where annual use is approximately 500kWh. With this in mind the research team will have to investigate the standards of electricity that a refugee could consider a right determining if that amount varies on social, economic, geographic factors? What is the minimum level of energy that a refugee could realistically demand?

Expected Deliverables

The research team are expected to produce a guide for energy provision to refugees, including a decision on the factors energy rights should be based on. Ideally the research team would also produce a model or tool that can be used by the UNHCR to predict likely energy demands for camp planning.

The research team is also expected to disseminate the outcomes of their research to the broader humanitarian community, this could include an academic style paper presented at the Humanitarian Engineering Research Conference or through the Journal of Humanitarian Engineering.

Fieldwork

No fieldwork is required for this project

Conditions and Applications

The conditions for participating in the research program along with the application form can be found at www.ewb.org.au/research-project-applications. Please quote brief code A3 on your application.
The optimisation of communal lighting in refugee camps

Project Brief Code: A4

Thematic Area: Energy

Style: Experiment

Country Focus: Refugee

Partner Organization: UNHCR

Research Group Location: Any

Background

In 2012 the UNHCR estimated that a third of the planet’s 10.5 million refugees lived in refugee camps. At a household level camp refugees demand electricity for lighting, charging mobile phones and to a lesser degree for keeping drinks cold. At the community level lighting in public places is essential to ensure a safe and successful camp environment. When the supply of electricity is limited (e.g. a camp using off grid power generation such as solar) or when the costs of grid power are expensive, refugee camp administrators and planners must determine how best to utilise the available power to provide adequate camp lighting. Unfortunately personal attacks are not unheard of in refugee camps.

Imagine you only had 100 units of power available for lighting public spaces and buildings in a refugee camp. Concentrating lighting in specific areas would allow activities such as education, religious meetings and trade (e.g. a market). However, if that lighting used up too many units of power then there might be insufficient power for adequate street lighting and so residents may feel unsafe or unable to get to those activity centres.

In the developed world many countries have standards that cover the provision of light (e.g. lighting to a level of 150 lux/m² in places of business), yet these standards may be impossible to adhere to in refugee camps.

Aims and Objectives

The objective of this research project is to determine how power for lighting can be best used in a refugee camp setting. Ultimately this will help refugee managers plan future camps.

The research team should investigate the minimum standards of lighting required for people to carry out basic tasks and potentially to determine levels of light people feel comfortable with. This may require a significant testing regime with volunteers in Australia.

Expected Deliverables

The research team is expected to produce a report on the minimum standards of lighting required for basic tasks with a particular focus on determining how these requirements should influence the planning and prioritisation of lighting in refugee camps, assuming a limited supply of power.

The research team are also expected to disseminate the outcomes of their research to the broader humanitarian community, this could include an academic style paper presented at the Humanitarian Engineering Research Conference or through the Journal of Humanitarian Engineering.

Fieldwork

No fieldwork is required for this project

Conditions and Applications

The conditions for participating in the research program along with the application form can be found at www.ewb.org.au/research-project-applications. Please quote brief code A4 on your application.
Development of an easy to use portable mobile phone charging system for use in mass displacement scenarios

Project Brief Code: A5
Thematic Area: Energy
Style: R&D
Country Focus: Emergency
Partner Organization: UNHCR
Research Group Location: Any - Students at RMIT will be supervised by Dr Richardt Wilkinson

Background

During 2012, an average of 23,000 persons per day were forced to leave their home, purely due to conflict or persecution (UNHCR 2013). Some of these displaced people relocate to other areas within their country (internally displaced people) whereas others will have to cross borders to find safety. Agencies such as the UNHCR use transition areas to hold refugees crossing borders temporarily before sending them to a more permanent place of refuge. During the initial stages of a refugee emergency thousands of people might cross a single border in a day; whilst the transition zones are supposed to be temporary sanctuaries, refugees can find themselves in these zones for weeks. Whilst most basic needs are met by aid from agencies like the UNHCR, there is a lack in the ability to provide communication facilities for refugees to contact their families and friends.

The mobile phones of refugees will run out of power over time and without recharge options these refugees will be left out of contact with their friends and family or receive information.

Aims and Objectives

The aim of this project is to improve the connectives of refugees in mass displacement scenarios by ensuring they have a way to charge their mobile phones.

The research team should look to develop an easily portable mobile phone charging station that can be “parachuted” into a remote region i.e. it should be able to fit into the back of a truck or into a plane. The station should be easy to use and be robust enough for challenging environments it might be used in. As grid power cannot be provided, the design must utilize an off grid or manual power supply. The system should be able to supply enough power for approximately 100 people per day to charge their phones.

After the emergency phase of a refugee crisis the wait time in a transition is significantly reduced. As such the charging station should be able to be easily modified so that it can be transported to a refugee camp or urban setting and used as a “pay as you go” charging point which promotes business opportunities for refugees.

Expected Deliverables

The research team is expected to produce a design for the mobile phone charging station. A proof of concept or constructed prototype would be preferable.

The research team is also expected to disseminate the outcomes of their research to the broader humanitarian community, this could include an academic style paper presented at the Humanitarian Engineering Research Conference or through the Journal of Humanitarian Engineering.

Fieldwork

No fieldwork is required for this project.

Conditions and Applications

The conditions for participating in the research program along with the application form can be found at www.ewb.org.au/research-project-applications. Please quote brief code A5 on your application.
The design of an emergency cooking solution for newly displaced refugees

Project Brief Code: A6
Thematic Area: Energy
Style: R&D
Country Focus: Emergency
Partner Organisation: UNHCR
Research Group Location: Any

Background

During 2012, an average of 23,000 persons per day were forced to leave their home purely due to conflict or persecution. These people often have little time to prepare for their departure. One item most displaced people carry is a cooking pot; dry rations are either taken from the home or made available by emergency aid organisations. Whilst basic cooking activities need to be carried out by refugees, cooking fuel is often not available in sufficient quantities.

Many refugees will revert to using a three stone fire, essentially three rocks placed in a triangle with a pot sitting on top, fuel is placed between the stones and under the pot. The heat of a three stone fire can be controlled relatively easily by pushing or removing long sticks into or from the fire. They can also be adapted to different sized cooking pots and, assuming rocks are freely available, refugees only need to collect and carry the firewood. The disadvantages of the three stone fire are that they are not especially efficient with much of the heat lost to the surrounding environment. The fires also rely on the collection and burning of firewood which may not always be readily available and may take valuable time to collect. If there are many families or refugees taking the same route to a place of refuge the natural resources on that route may become quickly depleted. There are also other drawbacks to using three stone fires which can be found here: http://www.appropedia.org/Three_stone_cooking_fire.

Aid and development organisations are interested in developing a fuel or device that allows displaced people to conduct basic cooking activities e.g. boiling a pan of water, whilst they travel to a place of refuge. The solution must be cheap enough that it can be deployed widely, provide enough power to provide a family with cooked food and be easily transportable. Durability is not a critical element - the focus is on the phase of response where refugees are either on the move or are living in transit sites and collective centres. From this situation they will ideally transition to a more sustainable cooking solution.

Aims and Objectives

The objective of this research project is to develop or recommend a cookstove / fuel solution that can be used by refugees in transition. It is expected that the project team perform a critical analysis on the cooking solutions currently available for this context. If an appropriate solution cannot be identified then the project team should look to develop their own solution which could be a modification to an existing design to make it for example cheaper, more mobile, more efficient.

The project teams proposed cooking solution must be cheap and compact enough that it can be deployed widely i.e. the UNHCR could easily store many thousands in a warehouse and then ship them to an area as required. Regarding the cooking solutions function, the fuel and stove combination should provide enough heat to provide a family of 5 (with only a single pot) to prepare a basic cooked meal twice a day for one week before a fuel re-charge would be required. Price is always a concern with no specific target but rather the solution should perform its job at the minimal of cost.

The solution needs to be easy to transport, as anything too cumbersome will be discarded and refugees revert to using a three stone; however, durability is not a critical consideration. The focus is on the phase of response where refugees are either on the move or are living in transit sites and collective centres. As such the stove only needs to last as long as it takes a refugee to reach a more permanent camp (assume 1 week maximum); from this situation they will ideally transition to a more sustainable cooking solution.
Expected Deliverables

Ideally the project team will deliver a proposed design, preferably with a tested prototype and a supporting report that summarises the advantages of the stove against others that are available. Criteria to use and compare solutions against could include cost, size, portability and ease of use. The accompanying report needs to include a section on what makes you believe that refugees will use your design and stop using a 3 stone fire. The accompanying report should take no longer than 10-15 minutes to read in order for the reader to obtain a good understanding of the proposed design.

The research team is also expected to disseminate the outcomes of their research to the broader humanitarian community, this could include an academic style paper presented at the Humanitarian Engineering Research Conference or through the Journal of Humanitarian Engineering.

Fieldwork

No fieldwork is required for this research project.

Conditions and Applications

The conditions for participating in the research program along with the application form can be found at www.ewb.org.au/research-project-applications. Please quote brief code A6 on your application.
Temporary off grid power generation for refugee camps

Background

The UNHCR aims to end a person’s refugee status either through repatriation, local integration or resettlement. This means that refugee camps, set up to house thousands of refugees, are supposed to be temporary. Much of the infrastructure deployed at a refugee camp is either reused as part of a settlement in the host country or reused elsewhere.

The design of non-permanent power infrastructure, especially suitable for refugee camps, may differ significantly from mainstream solutions. The UNHCR are interested in determining the best way to generate and distribute electricity in refugee camps. This may be through a mixture of techniques e.g. micro-grid solar for communal lighting and small diesel electric generators for mobile phone charging. In some instances refugees bring small scale electricity generation equipment with them; a businessperson may recharge phones using a small generator they brought to the camp.

This project will investigate and critique the range of power generation and distribution techniques that could be deployed in a refugee camp. Importantly, all technologies considered must be able to be relocated or integrated into local communities as a development solution when a refugee operation is shut down. Whilst the majority of camps will serve tens of thousands of refugees, some camps serve considerably more. Therefore, analysis will have to consider a range of scenarios including geography local resources and camps of various sizes.

Aims and Objectives

The aim of this project is to increase access to electricity for refugees through off the grid power generation. The research team should conduct a review of the issues faced in providing electricity to refugees and come up with innovative solutions. The key factors are that infrastructure must be temporary. Whilst the research team might take an overview of the issue of power generation and distribution an equally valid option is to dive in and focus efforts on a very small aspect of the larger picture. This could be design an effective way to provide power to an individual house or the better design of a streetlight.

Expected Deliverables

The research team is expected to produce a report for the UNHCR and EWB summarising the findings of their research. This should include any recommendations for implementation or next steps.

The research team is also expected to disseminate the outcomes of their research to the broader humanitarian community, this could include an academic style paper presented at the Humanitarian Engineering Research Conference or through the Journal of Humanitarian Engineering.

Fieldwork

No fieldwork is required for this research project.

Conditions and Applications

The conditions for participating in the research program along with the application form can be found at [www.ewb.org.au/research-project-applications](http://www.ewb.org.au/research-project-applications). Please quote brief code A7 on your application.
Access to energy for refugees in urban contexts

<table>
<thead>
<tr>
<th>Project Brief Code:</th>
<th>A8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thematic Area:</td>
<td>Energy</td>
</tr>
<tr>
<td>Style:</td>
<td>Review</td>
</tr>
<tr>
<td>Country Focus:</td>
<td>Refugee</td>
</tr>
<tr>
<td>Partner Organisation:</td>
<td>UNHCR</td>
</tr>
<tr>
<td>Research Group Location:</td>
<td>Any</td>
</tr>
</tbody>
</table>

**Background**

The iconic image of refugees is row upon row of white tents in a sprawling emergency camp. But the reality is that only one-third of the world's 10.5 million refugees now live in camps. Like 3.5 billion other people on Earth, refugees have been steadily moving to cities and towns, a trend that has accelerated since the 1950s. More than half the refugees UNHCR works with now live in urban areas. In the future, more and more refugees will be trying to survive in cities and towns, as will former refugees who return to their homelands and those displaced inside their countries. With this dramatic change in displacement dynamic comes a shift in the priorities of a displaced population with regards to energy; bio-mass based cook stoves, fuel efficient or otherwise, can be of little use in an urban jungle where bio-mass has limited accessibility.

**Aims and Objectives**

The aim of the study is to improve refugee access to energy within urban contexts. The research team should start by identifying what is meant by an urban context and how this meaning varies in different parts of the world. The team should then identify the energy needs of urban populations and determine how UNHCR could adapt its programming to best meet the energy needs of urban refugees and internally displaced people. This may well look at, for example, the provision of vouchers to facilitate access to electricity services.

**Expected Deliverables**

The project team should produce a report and develop a set of leading practices for agencies such as the UNHCR to deliver access to energy to meet the most pressing needs of urban refugee. The leading practice guidelines will be submitted to the UNHCR for review.

The research team are also expected to disseminate the outcomes of their research to the broader humanitarian community, this could include an academic style paper presented at the Humanitarian Engineering Research Conference or through the Journal of Humanitarian Engineering.

**Fieldwork**

No fieldwork is required for this research project.

**Conditions and Applications**

The conditions for participating in the research program along with the application form can be found at [www.ewb.org.au/research-project-applications](http://www.ewb.org.au/research-project-applications). Please quote brief code A8 on your application.
The development of a low-cost renewable cooking solution for refugees

Project Brief Code: A9
Thematic Area: Energy
Style: Design
Country Focus: Refugee
Partner Organisation: UNHCR
Research Group Location: Any

Background
Ensuring access to the energy required for cooking is a major challenge faced by both displaced persons and the aid organisations working to assist them. Refugees often depend on firewood as their main source of cooking fuel, which has negative impacts on health when burnt and negative impacts on the environment when burnt and collected. In some instances, however, the collection of firewood is not even an option. This could be for a number of reasons, including where wood resources are depleted due to over extraction, refugees not being allowed to leave the camp or where the government has banned firewood collection. Therefore, there is an urgent need to find alternative cooking fuels to firewood.

The Office of the United Nations High Commissioner for Refugees (UNHCR) has over 60 years of experience across the world in responding to refugee protection and needs, including access to energy. UNHCR is looking to collaborate with research groups to develop a cook stove powered by renewable energy to reduce reliance on unsustainable energy sources.

Aims and Objectives
The aim of this project is to develop an innovative cooking solution for refugees. The research team should begin by examining existing technologies and practices, considering that the developed solution may be a balance between the implementation of technology and a change in user practices. It is possible that the most appropriate solution simply helps refugees move away from their reliance on unsustainable and inappropriate cooking practices rather than introducing a new technology.

Expected Deliverables
The project team should look to develop a set of technical design specifications or a set of recommendations. If the research team develop a technical solution ideally a proof of concept prototype should be produced that could be tested in the field.

The research team are also expected to disseminate the outcomes of their research to the broader humanitarian community, this could include an academic style paper presented at the Humanitarian Engineering Research Conference or through the Journal of Humanitarian Engineering.

Fieldwork
No fieldwork is required for this research project.

Conditions and Applications
The conditions for participating in the research program along with the application form can be found at www.ewb.org.au/research-project-applications. Please quote brief code A9 on your application.
The design of a portable lantern for use in areas without electricity

Project Brief Code: A11
Thematic Area: Energy
Style: Research & Development
Country Focus: Mexico
Partner Organisation: Ilumexico
Research Group Location: Any

Background

Approximately 24 million people in Mexico live in rural townships of less than 2,500 inhabitants each. Over 8,500 of these rural townships are very remote with no access to electricity services. A government owned electricity utility in Mexico manages and distributes electricity via a national inter-connected grid, however, the high per-capita cost of extending and maintaining transmission lines to these remote and dispersed communities prohibits national grid distribution to these communities.

In these remote townships the greatest demand for electricity is for lighting. Lighting at home enhances quality of life by extending work, study or other communal activities into night time hours. Burning expensive fuels such as kerosene provides minimal lighting whilst creating harmful indoor air pollution. Whilst diesel generators have been used for electricity generation, they are not reliable and require the purchase of diesel fuel. The size and remoteness of these communities makes them ideal for the application of standalone off-grid lighting solutions.

Social enterprise Ilumexico, based in Mexico City, focus on distributing appropriate technologies such as solar lighting to these off grid remote communities. As well as focusing on community development, social integration and accessibility, Ilumexico are interested in the technological innovation and development of the solar lighting units themselves.

Aims and Objectives

The aim of this study is to develop a robust and reliable portable solar powered lantern for distribution to remote rural Mexican communities. The research team need to design and prototype the lighting, electronics and charging system as well as the body of the lantern.

Expected Deliverables

The research team is expected to develop a prototype solar lantern to be presented to Ilumexico. The end user should be at the centre of every stage of the design with considerations made into where the lanterns could be manufactured.

The research team is also expected to disseminate the outcomes of their research to the broader humanitarian community, this could include an academic style paper presented at the Humanitarian Engineering Research Conference or through the Journal of Humanitarian Engineering.

Fieldwork

No fieldwork is required for this research project.

Conditions and Applications

The conditions for participating in the research program along with the application form can be found at www.ewb.org.au/research-project-applications. Please quote brief code A11 on your application.
Access to cooking fuel as a human right

Background

In 2013 approximately 11 million people globally were newly displaced due to conflict or persecution, of which 2.5 million were refugees. One of the issues facing refugees is the immediate requirement for access to cooking facilities and, perhaps more importantly, access to cooking fuel.

Cooking, heating and lighting, represent the three major demands for energy in refugee camps that can be satisfied by burning basic fuels, such as biomass. A recent study found that the consumption of firewood equivalent in refugee camps is approximately 0.7 kg per person per day. However, demand for fuel is often greater than that which can be provided by aid agencies, if it can be provided at all. Refugees are often forced to search for fuel in order to bridge the gap between demand and supply. This can lead to unsustainable practices including devastating local deforestation. In some instances cooking fuel is not available at all and refugees have no basic human right to demand it.

Unlike cooking fuel, access to food is covered by minimum standards. The World Health Organisation recommends a mean energy requirement of 2,100 kCal per person per day in emergency situations. This value is used by the world food program and UNHCR for the provision of food in refugee contexts. However, this food is not normally distributed in a directly edible form but rather as dry rations (such as grains, rice or pulses) that need to be cooked. Whilst the provision of the 2,100kCal is covered as a human right the energy that is required to cook that food, and therefore access the nutritional energy, is not.

Aims and Objectives

The objective of this research project is to determine weather the cooking fuel required to unlock the energy contained within dry rations should be considered as a human right. The research team need to look at how food calories are delivered and consumed and also look to suggest guidelines for the amount of cooking energy that could be realistically be demanded by a refugee.

Expected Deliverables

The research team are expected to produce a short report that details the research findings, the report should also contain recommendations for next steps to be presented to the UNHCR.

The research team is also expected to disseminate the outcomes of their research to the broader humanitarian community, this could include an academic style paper presented at the Humanitarian Engineering Research Conference or through the Journal of Humanitarian Engineering.

Fieldwork

No fieldwork is required for this project.

Conditions and Applications

The conditions for participating in the research program along with the application form can be found at www.ewb.org.au/research-project-applications. Please quote brief code B9 on your application.
A holistic approach to reducing indoor air pollution

Background
Lack of access to modern energy services remains a huge barrier to sustainable development. Worldwide 2.6 billion people rely on burning biomass (wood, coal, charcoal, and animal waste) to meet their daily cooking and heating needs. Along with deforestation, cost of purchase or labour required one of the largest negative consequences of burning biomass is the resulting indoor air pollution; it is estimated that this pollution is responsible for 4.3 million deaths per year mainly due to respiratory disease.

Engineers and development practitioners have primarily relied on the implementation of improved cookstoves (which are more efficient than traditional stoves) to reduce indoor air pollution. A previous study conducted at Monash University in collaboration with EWB found that there is a disparity between the performance results of improved cookstove when tested in the lab and in a real world setting. This was found to be because lab tests represent ideal situations rather than accounting for a range of real world contextual variables. The study suggested the need for a holistic approach to cookstove testing that considers the influence of variables beyond the cookstove itself such as ventilation and fuel moisture content.

Aims and Objectives
This research project will identify the important contextual variables influencing indoor air pollution and build educational aids for development organisations to use to teach the importance of these factors to cookstove users.

The research team should also look to investigate the potential barriers to having this holistic approach adopted. This could be the fact that although ventilation is an important part of reducing indoor air pollution it might not be possible for a household to improve their ventilation easily.

The holistic approach always needs to be tied back to the users of the solution, biomass reliant communities may have no way to measure the moisture content of fuel scientifically, therefore any technical output has to be converted into a useable form e.g. sawdust characteristics can be used as a crude indicator of weather a fuel is suitable for combustion.

Expected Deliverables
The research team is expected to produce a short report that can be shared with development organisations highlighting the importance of a holistic approach when considering improved cookstove roll out. The research team could also produce educational resources that could be used by development organisations to teach end users about the importance of factors such at ventilation and fuel moisture content.

The research team is also expected to disseminate the outcomes of their research to the broader humanitarian community, this could include an academic style paper presented at the Humanitarian Engineering Research Conference or through the Journal of Humanitarian Engineering.

Fieldwork
No fieldwork is required for this research project.
Conditions and Applications

The conditions for participating in the research program along with the application form can be found at www.ewb.org.au/research-project-applications. Please quote brief code **B18** on your application.
The design of an improved cookstove that meets cultural and social practices

Background

Worldwide 2.6 billion people rely on burning biomass (wood, coal, charcoal, and animal waste) to meet their daily cooking and heating needs. There are many negative consequences of this practice, with the resulting indoor air pollution leading to responsible for 4.3 million deaths per year. Improved cook stoves (ICS) are promoted as the primary means of reducing the negative effects of biomass reliance, however in many cases ICS have failed to achieve sustained adoption. ICS are too often designed without consideration of the social and cultural practices of the recipient community. When the end user is not put at the centre of the design the improved cookstoves do not perform as expected, failing to significantly reduce wood consumption or smoke production, consequentially households return to using traditional stoves. This also leads to the practice of stove stacking, whereby a household will simply supplement their traditional stove with a improved cookstove rather than solely using the improved stove.

Traditional stoves such as the three stone fire are cheap, flexible and offer a high level of control that allows users to adjust heat output to suit their cooking needs. Testing has shown that given local constraints, enhanced control allows three-stone fires to achieve higher thermal efficiency than some ICS.

Aims and Objectives

The aim of this project is to design a cookstove to bridge the gap between traditional cookstoves and highly engineered ICS; a cookstove that offers the benefits of a traditional stove by remaining cheap, simple and versatile, yet reduces heat loss and inefficient combustion through simple and clever design. The cookstove should be developed as a stepping stone that allows households to make the first step up the energy ladder and out of energy poverty.

Incorporation of a drying rack or some other mechanism/module for pre-drying fuel would add value to the stove and increase efficiency

This project should be commenced with an analysis of cookstove user preferences and the shortcomings of current ICS. Given the diversity in preferences and cooking practices amongst different biomass reliant communities it is recommended to conduct the project with a specific target community in mind.

Expected Deliverables

The research team is expected to deliver a proof of concept for a halfway house cookstove that reduces indoor air pollution but noes not change the user experience too dramatically.

The research team is also expected to disseminate the outcomes of their research to the broader humanitarian community, this could include an academic style paper presented at the Humanitarian Engineering Research Conference or through the Journal of Humanitarian Engineering.

Fieldwork

No fieldwork is required for this research project.

Conditions and Applications

The conditions for participating in the research program along with the application form can be found at [www.ewb.org.au/research-project-applications](http://www.ewb.org.au/research-project-applications). Please quote brief code B20 on your application.
Water, Sanitation and Hygiene

The removal of arsenic from drinking water in Cambodia using sand filters

Project Brief Code: A15
Thematic Area: WaSH
Style: Experimental
Country Focus: Cambodia
Partner Organisation: Agile Development
Research Group Location: Any

Background

In rural Cambodia around 100,000 families rely on groundwater, extracted from wells, for their supply of irrigation and household water. A survey found that in 73% of cases the water in these wells had levels of arsenic that exceeded the World Health Organisational guidelines of 10 µg l⁻¹; many of the contaminated wells are located along the Bassac and Mekong river banks. The symptoms of arsenic poisoning can take more than 10 years to develop meaning that it is hard to show to those affected that there is a link between drinking the groundwater and getting poisoned.

Sand filters present a low-cost and simple way of removing the arsenic content from groundwater. They have been implemented with reasonable levels of success in communities in Bangladesh. Agile Development, an organisation working with communities in Cambodia is interested in finding out what modifications or improvements are required to make sand filters a feasible option in Cambodia. This includes incorporating traditional design or manufacturing techniques.

Aims and Objectives

The aim of this project is to determine the viability of using sand filters to remove arsenic from groundwater in Cambodia. The research team should consider the cultural and social aspects of the context when coming up with a solution.

With 100,000 families as potential beneficiaries, the best option may not be a filter to be used at the household level but rather one that can serve a whole community. Other water technologies such as ceramic filters have been popular in Cambodia as they can be manufactured locally and have low cost; the sand filter solution should emulate this. The research team should look to conduct experiments to prove the effectiveness of their design.

Expected Deliverables

The research team are expected to deliver EWB and Agile Development with a short report which outlines the feasibility of using sand filters in Cambodia and which describes any modifications that need be made to sand filters to make them more appropriate for the Cambodian context.

The research team is also expected to disseminate the outcomes of their research to the broader humanitarian community, this could include an academic style paper presented at the Humanitarian Engineering Research Conference or through the Journal of Humanitarian Engineering.

Fieldwork

No fieldwork is required for this research project.

For those students interested in learning more about development engineering EWB operates design summits to Cambodia. More information can be found at www.ew.org.au/designsummits
Conditions and Applications

The conditions for participating in the research program along with the application form can be found at www.ewb.org.au/research-project-applications. Please quote brief code A15 on your application.
Designing a Titanium based reaction system to treat drinking water in Cambodia

**Background**

In Cambodia an estimated 30% of the population do not have access to improved drinking water, even more lack access to microbiologically safe drinking water. Consuming this water can lead to diseases such as diarrhoea, a big killer of children under the age of five.

Titanium dioxide (TiO$_2$) based photocatalytic oxidation has been demonstrated as a potential method to treat water. Among other semiconductors currently available, TiO$_2$ is considered to be an attractive option for its high photoreactivity; economy; non-toxicity; chemical and biological inertness; and photostability. Agile Development, a development organisation working with communities in Cambodia, is interested in finding out if photocatalytic oxidation is a suitable point of use treatment system for drinking water.

**Aims and Objectives**

The objective of this research is to develop a reaction system using TiO$_2$ as photocatalysts for the purification of water for a community in Cambodia. The research team will need to first determine if this is a suitable treatment system before coming up with a proof of concept or tested prototype.

Considerations should be made for local materials and manufacturing capability as well as the scale that the technology should be implemented at, e.g. household or community. Other water technologies such as ceramic filters have been popular in Cambodia as they can be manufactured locally and have low cost. The photocatalytic method should emulate this.

**Expected Deliverables**

The project team should create a short report which summarises the feasibility of using this chemical system in Cambodia with designs considered. Ideally the research team should have a working proof of concept or prototype.

The research team is also expected to disseminate the outcomes of their research to the broader humanitarian community, this could include an academic style paper presented at the Humanitarian Engineering Research Conference or through the Journal of Humanitarian Engineering.

**Fieldwork**

No fieldwork is required for this research project.

For those students interested in learning more about development engineering EWB operates design summits to Cambodia. More information can be found at www.ew.org.au/designsummits

**Conditions and Applications**

The conditions for participating in the research program along with the application form can be found at www.ewb.org.au/research-project-applications. Please quote brief code A16 on your application.
A review of sanitation technologies for communities living in challenging environments: focus on the Mekong Delta

Background

Challenging environments are considered to be difficult geographical and/or geological conditions, where conventional sanitation designs have proven unsuccessful. In Cambodia alone, 4.14 million people (~27% of Cambodia’s population) live in areas affected by flooding, high groundwater, floating, riverbank or coastal conditions impacting their ability to access appropriate and improved sanitation solutions at all times. Sanitation options, such as a dug latrine, may flood and overspill when on a floodplain or may not even be feasible to construct such as for houses situated on a lake.

Much of HFHV development work is conducted in the Mekong delta which experiences severe flooding as rivers swell during the monsoon season. Flooding particularly affects areas close to the mouth of the Mekong river where tidal processes mean there is nowhere for the water to flow. During a flood, where water could be anywhere from 50cm to 2m deep, local populations will either move to another dwelling in another area or move to a higher floor in their own dwelling. Inhabitants are often left with little choice but to defecate directly into the flood water. After the flood has receded it is often left to the communities to tidy up and repair damage. This process of flooding and receding could be for a few days. A lack of improved sanitation facilities leads to the spread of disease and illness.

Engineers Without Borders Australia (EWB) established a sanitation in challenging environments program in Cambodia to share knowledge on this important topic in an effort to increase awareness on the issues faced, provide a platform for collaboration, knowledge sharing and innovation.

Aims and Objectives

The objective of this research project is to identify proven sanitation technologies that are suitable for implementation in challenging environments. It would be very useful if the research team conducted an analysis into the spread or uptake of these technologies separating those that show good results in the laboratory but fail to impress in the field.

Not only should the research team investigate technologies that have worked but also summarise those that haven’t so that the same mistakes are not made again. To this end the team should highlight shortfalls in the technology (that could be investigated further) or shortfalls related to other issues e.g. technology A was technically very good, but no uptake in the community for cultural reason B.

If there is time the research team should also describe what an ideal solution might look like, i.e. what the solution would be if the communities living in challenging environments in Cambodia and Vietnam had access to the resources of people living in a highly developed nation.

Expected Deliverables

The research team are expected to present EWB and HFHV with a short report that includes a review of sanitation technologies with recommendations for which systems should be used and where there are gaps in the technology. As a bonus the research team should provide recommendations for steps required to implement these proven technologies on the ground.
The research team are also expected to disseminate the outcomes of their research to the broader humanitarian community, this could include an academic style paper presented at the Humanitarian Engineering Research Conference or through the Journal of Humanitarian Engineering.

Fieldwork

No fieldwork is required for this research project.

Conditions and Applications

The conditions for participating in the research program along with the application form can be found at www.ewb.org.au/research-project-applications. Please quote brief code B4 on your application.
The current state of household level biodigester technology

Project Brief Code: B8
Thematic Area: WaSH
Style: Review
Country Focus: Global
Partner Organisation: Engineers Without Borders (EWB)
Research Group Location: Any

Background

Biodigesters use anaerobic digestion processes to treat collected human and animal waste. One of the major benefits is that biodigestion produces valuable resources such as biogas, fertiliser and water. If correctly stored and distributed the biogas can be burned as a cooking fuel. This makes the biodigester an ideal technology in places with both sanitation and fuel issues.

Biodigesters have been used in Cambodia for many years. However, due to flooding and other challenging conditions some of the existing biodigester technologies are not appropriate to for the context. Since 2008, Engineers Without Borders Australia (EWB) has partnered with international development organisation Live & Learn Environmental Education to develop floating biodigesters that can be used by households living in floating houses. EWB has also been investigating the use of biodigesters for use by families in refugee camps. The supply of cooking fuel by aid agencies in these camps is not always sufficient to meet the demands of refugees. In order to meet the shortfall refugees often resort to unsustainable practices including deforestation.

Aims and Objectives

The objective of this research project is to determine the potential impact that EWB can have with regards to championing biodigesters at a household level. The team should investigate how biodigesters have been used at a household level to date, summarising the advantages as well as the factors that are limiting their use. The research team should look to create a decision making tool that can assist humanitarian engineers and development workers identify if biodigester technology would be suitable for a families needs and if so which technology could be chosen.

Expected Deliverables

The research team are expected to provide EWB with a short report that summarises the main findings of the research and provides recommendations for ways EWB can support the spread of household level biodigester technology.

The research team are also expected to disseminate the outcomes of their research to the broader humanitarian community, this could include an academic style paper presented at the Humanitarian Engineering Research Conference or through the Journal of Humanitarian Engineering.

Fieldwork

No fieldwork is required for this research project.

Conditions and Applications

The conditions for participating in the research program along with the application form can be found at www.ewb.org.au/research-project-applications. Please quote brief code B8 on your application.
Quantifying the health impacts of poor sanitation in challenging environments

**Background**

Challenging environments are considered to be difficult geographical and/or geological conditions, where conventional sanitation designs have proven unsuccessful. In Cambodia alone, 4.14 million people (~27% of Cambodia’s population) live in areas affected by flooding, high groundwater, floating, riverbank or coastal conditions impacting their ability to access appropriate and improved sanitation solutions at all times e.g. a simple pit latrine cannot be used for a house floating on a lake.

Engineers Without Borders Australia (EWB) has established a sanitation in challenging environments program (SCE) in Cambodia to share knowledge on this important topic in an effort to increase awareness on the issues faced, provide a platform for collaboration, knowledge sharing and innovation.

Much is known about the negative impacts (environmental, economic, health) of inadequate sanitation in non-challenging environments, however the SCE team have found a lack of knowledge and information around the negative impacts in challenging environments. Current practices around sanitation, in say a floating environment (house on a lake), is that residents deficit directly into the lake. At the moment we can say that the lack of sanitation contaminates the water, but that’s about as detailed as we can get with the information that we have.

**Aims and Objectives**

The aim of this project is to improve the health of those living in challenging environments by creating and sharing new knowledge in the effects of poor sanitation practices. The research team should review and summarise existing work on health impact from poor sanitation and research on waterborne diseases to show the effect on people living with adequate sanitation in challenging environments. The research team should not just stop at health but investigate the impact income and education.

The research team need to investigate exactly how water is sourced and used in these communities, how is bottled water seen, do communities chance drinking unimproved sources of water instead of paying for clean water. The research team should also investigate social or cultural restrictions, for example dedicating into a lake becomes the problem of everyone who relies on that lake as a supply of water, not just the individual. To the same end what is the point of one person in a community changing their sanitation practices if no one else in the community does.

The research team could also investigate all of the possible nock on effects, e.g. nutrition and food security risks (people may buy drinking water but if they are washing their food in this water they could be significant health effects-diarrhoea leading to malnutrition etc).

**Expected Deliverables**

The research team is expected to deliver a short report to EWB summarising the findings of their investigation.

The research team is also expected to disseminate the outcomes of their research to the broader humanitarian community, this could include an academic style paper presented at the Humanitarian Engineering Research Conference or through the Journal of Humanitarian Engineering.
Fieldwork

It is expected that the majority of this investigation will be conducted as a desktop review with plenty of interviews with EWB’s current and past field volunteers as well as other development practitioners with experience in Sanitation in challenging environments. No fieldwork is required for this research project.

For those students interested in seeing sanitation systems in action in Cambodia and learn more about development engineering EWB operates design summits to Cambodia. More information can be found at www.ew.org.au/designsummits

Conditions and Applications

The conditions for participating in the research program along with the application form can be found at www.ewb.org.au/research-project-applications. Please quote brief code B10 on your application.
An investigation into sanitation in challenging environments in a global context

Background

Challenging environments are considered to be difficult geographical and/or geological conditions, where conventional sanitation designs have proven unsuccessful. In Cambodia alone, 4.14 million people (~27% of Cambodia’s population) live in areas affected by flooding, high groundwater, floating, riverbank or coastal conditions impacting their ability to access appropriate and improved sanitation solutions at all times. Sanitation options, such as a dug latrine, may flood and overspill when on a floodplain or may not even be feasible to construct such as for houses situated on a lake (pictured right: the red roof house is on stilts with the blue roof house floating above and on a lake in Cambodia).

Engineers Without Borders Australia (EWB) established a sanitation in challenging environments program in Cambodia to share knowledge on this important topic in an effort to increase awareness on the issues faced, provide a platform for collaboration, knowledge sharing and innovation.

The opportunity has arisen to support the work of EWB and its partner organisations working in sanitation in challenging environments by looking at the issue at the global scale.

Aims and Objectives

The objective of this research project is to determine and demonstrate the extent of sanitation in challenging environments at a global scale. The research team should quantify the issue, for example identifying how many people could be affected, and then go on to categorise areas that are considered to be challenging. This categorisation might include factors such as population density (rural, peri-urban, urban), type of challenging environment, poverty/income level. The research team should conduct a critical analysis of this information to determine if there are crossovers between environments across the world.

Expected Deliverables

The research team is expected to provide EWB with a report which contains a summary of the research findings. This report should include suggestions and observations from a critical analysis of the data relating to sanitation in challenging environments. In addition to this a key output of this research will be visual material for demonstrating the extent of the issue.

The research team is also expected to disseminate the outcomes of their research to the broader humanitarian community, this could include an academic style paper presented at the Humanitarian Engineering Research Conference or through the Journal of Humanitarian Engineering.

Fieldwork

It is expected that the majority of this investigation will be conducted as a desktop review with plenty of interviews with EWB’s current and past field volunteers as well as other development practitioners with experience in Sanitation in challenging environments. No fieldwork is required for this research project.
For those students interested in seeing sanitation systems in action in Cambodia and learn more about development engineering EWB operates design summits to Cambodia. More information can be found at www.ew.org.au/designsummits

Conditions and Applications

The conditions for participating in the research program along with the application form can be found at www.ewb.org.au/research-project-applications. Please quote brief code B12 on your application.
An investigation into the success of development projects relating to the provision of sanitation solutions in challenging environments

Background

Challenging environments are considered to be difficult geographical and/or geological conditions, where conventional sanitation designs have proven unsuccessful. In Cambodia alone, 4.14 million people (~27% of Cambodia’s population) live in areas affected by flooding, high groundwater, floating, riverbank or coastal conditions impacting their ability to access appropriate and improved sanitation solutions at all times. Sanitation options, such as a dug latrine, may flood and overspill when on a floodplain or may not even be feasible to construct such as for houses situated on a lake (pictured right: the red roof house is on stilts with the blue roof house floating above and on a lake in Cambodia).

Engineers Without Borders Australia (EWB) established a sanitation in challenging environments program in Cambodia to share knowledge on this important topic in an effort to increase awareness on the issues faced, provide a platform for collaboration, knowledge sharing and innovation.

Determining the full impact of development projects is complex with development organisations often lacking funding for adequate or long term monitoring and evaluation. It is often not known weather a project implemented three years ago is still in use or working today. This issue is not helped by the fact that development organisations have a relatively high turnover of staff meaning that organisational knowledge is lost.

The opportunity has arisen to support the work of EWB and other organisations working in sanitation in challenging environments by providing suggestions and recommendations to them based on the success and failures of previous interventions.

Aims and Objectives

The objective of this research project is to increase the impact of the interventions and projects implemented by EWB and its partners working in the sanitation in challenging environment sector. The research team should conduct a thorough literature review including an analysis of previous projects relating to sanitation in challenging environments conducted by development organisations globally. The team should determine which interventions have been successful and why; the team should also provide recommendations for the work being conducted in Cambodia.

Expected Deliverables

The research team is expected to provide EWB with a report that includes summary of projects that have been tried with a determination of what worked and what didn’t. The report should also include suggestions for how the projects that worked could be applied to the Cambodian context.

The research team is also expected to disseminate the outcomes of their research to the broader humanitarian community, this could include an academic style paper presented at the Humanitarian Engineering Research Conference or through the Journal of Humanitarian Engineering.
Fieldwork

It is expected that the majority of this investigation will be conducted as a desktop review with plenty of interviews with EWB’s current and past field volunteers as well as other development practitioners with experience in sanitation in challenging environments. No fieldwork is required for this research project.

For those students interested in seeing sanitation systems in action in Cambodia and learn more about development engineering EWB operates design summits to Cambodia. More information can be found at www.ew.org.au/designsummits

Conditions and Applications

The conditions for participating in the research program along with the application form can be found at www.ewb.org.au/research-project-applications. Please quote brief code B13 on your application.
Investigation into drinking water safety in rural Timor-Leste

Project Brief Code: B15

Thematic Area: WaSH
Style: Investigate
Country Focus: Timor-Leste (East Timor)
Partner Organisation: Engineers Without Borders (EWB)
Research Group Location: Any

Background

Potable drinking water is essential for good health and wellbeing with universal access being part of the sustainable development goals. Within a few months of each other a number of international development workers in Lospalos, a community in rural Timor-Leste became sick with the the parasite Fasciola hepatica also know as liver flukes; these were the first reported cases of liver flukes in the country. The parasite itself is transmitted through fresh water and greens.

Although there are only a handful of reported cases in the country it is highly likely that the issue is more widely spread. This is because the known cases have involved development workers who have access to relatively good healthcare. The likelihood is that there are many unreported cases in the local community who cannot afford healthcare. Drinking water safety plans provide a systematic method of protecting water sources. They have been implemented in a number of countries and regions to ensure a step-by-step risk management for drinking-water suppliers.

Aims and Objectives

The aim of this project is to improve access to safe drinking water for communities in rural Timor-Leste ultimately leading to better health and wellbeing. The research team should investigate the risks to drinking water supply in Timor-Leste, focussing on parasites in rural communities.

Expected Deliverables

The research team is expected to produce a short report which contains recommendations and suggestions for how EWB and other development organisations working in Timor-Leste can secure drinking water sources. This study is supposed to be desktop based with EWB supporting in the access to information and contacts within the country.

The research team is also expected to disseminate the outcomes of their research to the broader humanitarian community, this could include an academic style paper presented at the Humanitarian Engineering Research Conference or through the Journal of Humanitarian Engineering.

Fieldwork

No fieldwork is required for this research project.

Conditions and Applications

The conditions for participating in the research program along with the application form can be found at www.ewb.org.au/research-project-applications. Please quote brief code B15 on your application.
Project Brief Code: B16

Thematic Area: WaSH
Style: Research and Development
Country Focus: Timor-Leste (East Timor)
Partner Organisation: Engineers Without Borders (EWB)
Research Group Location: Any

Background

Hygiene is an important part of life, washing hands with clean water and soap reduces the spread of germs leading to improved health and wellbeing. Engineers Without Borders Australia (EWB) has been collaborating with NGO’s Plan and Fraterna to improve hygiene practices in rural communities in the Eastern tip of Timor-Leste. A manufacturing facility has been set up which will produce soap to be distributed to local schools and communities. In conjunction with soap manufacturing a local co-op will train children at local schools, to assist promotion of the importance of hygiene behaviours. Eventually the hope is that the soap could be sold to hotels in the capital of Timor-Leste, Dilli.

The manufactured soap uses imported caustic soda mixed with locally sourced materials including fermented coconut oil, and leaves from local plants such as guava and papaya. Some of these plants have medicinal properties and are used to treat illnesses such as ringworm. The first few batches of soap have been manufactured using a simple recipe, however there has not been any research or science into the ingredients or methods. As the soap making process is to be completed there is an opportunity to optimise the ingredients and method in the soap to maximise health outcomes.

Aims and Objectives

The aim of this project is to improve hygiene in rural communities in Timor-Leste. The objective is to develop recommendations for how locally available materials can be used to improve the quality and health benefits of the soap. Whilst there is a lot of information available for soap recipes this project should focus on the availability and properties of local materials,

This study is desktop based with EWB supporting in the access to information and contacts within the country. Samples of the soap are available for testing.

Expected Deliverables

The research team is expected to provide EWB with a short (2-6 page) report which contains recommendations for next steps in order to improve the materials and method of manufacturing soap to maximise the health opportunities.

The research team is also expected to disseminate the outcomes of their research to the broader humanitarian community, this could include an academic style paper presented at the Humanitarian Engineering Research Conference or through the Journal of Humanitarian Engineering.

Fieldwork

No fieldwork is required for this research project.

Conditions and Applications

The conditions for participating in the research program along with the application form can be found at www.ewb.org.au/research-project-applications. Please quote brief code B16 on your application.
**Structures**

**Incorporating traditional construction and material preparation techniques into modern practices for communities in the Mekong Delta**

<table>
<thead>
<tr>
<th>Project Brief Code:</th>
<th>B5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thematic Area:</td>
<td>Structures</td>
</tr>
<tr>
<td>Style:</td>
<td>Review</td>
</tr>
<tr>
<td>Country Focus:</td>
<td>Vietnam</td>
</tr>
<tr>
<td>Partner Organisation:</td>
<td>Habitat for Humanity Vietnam (HFHV)</td>
</tr>
<tr>
<td>Research Group Location:</td>
<td>Any</td>
</tr>
</tbody>
</table>

**Background**

Since 2001 Habitat for Humanity Vietnam (HFHV) has enabled over 12,000 low-income Vietnamese families to improve their living conditions through decent homes, clean water, safe sanitation and post-disaster reconstruction and repairs. In addition, HFHV has provided training in disaster preparedness, financial education, hygiene practices, and construction skills, among others, to more than 60,000 individuals.

Much of HFHV’s development work is conducted in the Mekong delta where communities have lost traditional construction methodologies and techniques in favour of more modern practices. Families from low income backgrounds may make the roofs for their houses out of thatch, this is short lasting, often not impermeable and not resilient to other extreme weather. Supporting beams or columns are often made of wood poles and deteriorate due to termites or moisture. In the past, traditional techniques were used to treat wooden construction poles making them more resilient to termites, but such techniques are no longer adopted.

**Aims and Objectives**

The objective of this research project is to provide HFHV with recommendations for how traditional construction and material preparation techniques can be incorporated into modern and affordable dwelling construction. Ultimately with the aim that houses will be more resilient.

The research team will have to investigate traditional techniques and material preparation techniques and identify where they could support or supplement modern techniques. This could also lead to examples of low cost alternatives to modern materials such as brick.

**Expected Deliverables**

The research team are expected to deliver HFHV with a short report that contains recommendations for materials and techniques that could be incorporated into modern construction practices.

The research team are also expected to disseminate the outcomes of their research to the broader humanitarian community, this could include an academic style paper presented at the Humanitarian Engineering Research Conference or through the Journal of Humanitarian Engineering.

**Fieldwork**

No fieldwork is required for this research project, however a trip to the Mekong delta to investigate traditional and modern techniques would be beneficial.

**Conditions and Applications**

The conditions for participating in the research program along with the application form can be found at [www.ewb.org.au/research-project-applications](http://www.ewb.org.au/research-project-applications). Please quote brief code B5 on your application.
**Education**

**A review of education practices in Timor Leste with respect to the training of engineers**

<table>
<thead>
<tr>
<th>Project Brief Code:</th>
<th>B17</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thematic Area:</td>
<td>Education</td>
</tr>
<tr>
<td>Style:</td>
<td>Review</td>
</tr>
<tr>
<td>Country Focus:</td>
<td>Timor Leste (East Timor)</td>
</tr>
<tr>
<td>Partner Organisation:</td>
<td>Engineers Without Borders (EWB)</td>
</tr>
<tr>
<td>Research Group Location:</td>
<td>Any</td>
</tr>
</tbody>
</table>

**Background**

Timor Leste is one of the youngest countries in the world and has had substantial political upheaval in recent history. One consequence of this is that the engineering education system is relatively basic. Engineers Without Borders Australia (EWB) has a professional skills development project which aims to empower local engineering professionals by supporting and facilitating professional skills development of local organisations and the engineering and technical sector in Timor Leste. The professional skills project has been successful to date, but there are opportunities to enhance its impact. For example, EWB’s team in Timor-Leste has noted that with such a lack of primary and secondary education there is a need to understand how to best build leadership qualities in Timorese who show advanced technical abilities ensuring these methods fit in with existing social structures and modes of learning and knowledge transfer.

**Aims and Objectives**

The object of this research project is to increase the capability of professionals in the engineering and technical sector in Timor Leste. As EWB already has a professional skills development project it is suggested that this objective could be achieved by by enhancing the impact of the existing project rather than starting a new one. To this end, the research team should conduct an investigation into the methods of learning used in Timor Leste to identify ways in which EWB can adapt its programs to provide better professional development training that aligns with that method of learning.

**Expected Deliverables**

The research team is expected to provide EWB with a report which contains a summary of the research findings and contain recommendations for adaptations that EWB could make to its program.

The research team is also expected to disseminate the outcomes of their research to the broader humanitarian community, this could include an academic style paper presented at the Humanitarian Engineering Research Conference or through the Journal of Humanitarian Engineering.

**Fieldwork**

It is expected that the majority of this investigation will be conducted as a desktop review with plenty of interviews with EWB’s current and past field volunteers as well as other development practitioners with experience in Timor Leste. No fieldwork is required for this research project.

**Conditions and Applications**

The conditions for participating in the research program along with the application form can be found at [www.ewb.org.au/research-project-applications](http://www.ewb.org.au/research-project-applications). Please quote brief code B17 on your application.
**Development Practice**

**Improving health impact evaluations and reporting in humanitarian engineering projects**

<table>
<thead>
<tr>
<th>Project Brief Code:</th>
<th>B19</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thematic Area:</td>
<td>Development Practice</td>
</tr>
<tr>
<td>Style:</td>
<td>Review</td>
</tr>
<tr>
<td>Country Focus:</td>
<td>Developing Asia</td>
</tr>
<tr>
<td>Partner Organisation:</td>
<td>Engineers Without Borders (EWB)</td>
</tr>
<tr>
<td>Research Group Location:</td>
<td>Any</td>
</tr>
</tbody>
</table>

**Background**

When engineers design humanitarian technologies to combat disadvantage they often forget that although their immediate goal was to, for example, reduce the amount of wood a cookstove burns or increasing the amount of arsenic a filter removes from a water supply, the ultimate aim was to improve the health of the recipient population. It is often easy to measure the direct, short term, impact of a technology or its performance in a laboratory but is harder to measure longer term health benefits which require extended research and the development of case studies rather than one off laboratory experiments and tests. Ideally health outcome measurements should be incorporated into the planning stage of international development projects.

**Aims and Objectives**

The aim of this research project is to maximise the health outcomes of future international development projects. To do this it is suggested that the researcher team develop a decision making tool that can be used to influence the planning stage of development projects conducted by Engineers Without Borders and other development organisations. The decision making tool should ensure that the development project will maximise the health benefits. The research team should validate the tool by using it to audit past EWB projects analysing them for trends and gaps. This project would be suitable for someone interested in international development, database development and knowledge management.

**Expected Deliverables**

The research team is expected to provide EWB with a report which contains a summary of the research findings as well as the decision making tool framework.

The research team is also expected to disseminate the outcomes of their research to the broader humanitarian community, this could include an academic style paper presented at the Humanitarian Engineering Research Conference or through the Journal of Humanitarian Engineering.

**Fieldwork**

No fieldwork is required for this research project.

**Conditions and Applications**

This research project is part of a broader collaboration between Engineers Without Borders Australia and the University of Sydney Medical School. As such, the research team, including supervisors, should be willing to participate in a wider collaboration.

The conditions for participating in the research program along with the application form can be found at [www.ewb.org.au/research-project-applications](http://www.ewb.org.au/research-project-applications). Please quote brief code B19 on your application.
An analysis of demographic data relating to communities in the Mekong Delta

Background
Since 2001 Habitat for Humanity Vietnam (HFHV) has enabled over 12,000 low-income Vietnamese families to improve their living conditions through decent homes, clean water, safe sanitation and post-disaster reconstruction and repairs. In addition, HFHV has provided training in disaster preparedness, financial education, hygiene practices, and construction skills, among others, to more than 60,000 individuals.

Much of HFHV development work is conducted through discrete projects. To gain insight into the problem the project aims to address HFHV collects a range of community and demographic data. Although this data is often used to measure the success of a particular project it may not be looked at again. Having worked for so long with various communities along the Mekong delta HFHV have a trove of data including: livelihood data, housing characteristics, health issues, gender, income and loan profiles, access to water sources, sanitation options and practices, socio-economic data, family details, type of repairs. The opportunity has arisen to assess and analyse this data to further benefit these communities.

Aims and Objectives
The aim of this research project is to maximise the impact of future HFHV projects by providing HFHV with recommendations and observations, based on trends and correlations, from an analysis of demographic data gathered from past projects.

With support from Engineers Without Borders Australia (EWB) and HFHV the research team should conduct an analysis of the available data. This should include a primary investigation into the data’s integrity (e.g. to check for missing records) and the development of a data analysis protocol. This protocol could include creating taxonomies, to allow data from one survey to be compared against data from another. The research team should then conduct a significant analysis and interpretation on the processed data. Because the data has been collected over a number of years, it is possible that the research team will be able to identify a number of trends over time among the target population which could be examined using statistical packages if relevant. As an added bonus the research team could develop recommendations and/or look to create a database so that trends can be discovered as more data is accumulated in the future.

Expected Deliverables
The research team are expected to deliver HFHV with a short report that includes a profile of the communities HFHV works with across different regions of the Mekong. The report should highlight any correlations found in the data and list recommendations for how HFHV’s projects could have greater impact.

The research team are also expected to disseminate the outcomes of their research to the broader humanitarian community, this could include an academic style paper presented at the Humanitarian Engineering Research Conference or through the Journal of Humanitarian Engineering.

Fieldwork
No fieldwork is required for this research project.
Conditions and Applications
The conditions for participating in the research program along with the application form can be found at www.ewb.org.au/research-project-applications. Please quote brief code B3 on your application.
Assistive Technology

Improving the functionality of upper limb 3D printed prosthetics

Project Brief Code: A27
Thematic Area: Assistive Technology
Style: Design
Country Focus: Global
Partner Organisation: Robohand South Africa; Enable Development
Research Group Location: Any

Background

Being able to conduct basic everyday tasks such as feeding oneself is something most people take for granted. For people who do not have the full use of a hand or arm, simple tasks can become extremely challenging. The risk is that if these everyday challenges cannot be overcome people without functional limbs can have their independence and dignity compromised. Robohand is an organisation that develops custom made assistive devices for people who have lost the use of a hand or arm. The prosthetics designed by robohand are 3D printed and aluminium CNC machined, anatomically driven, custom fitted, mechanical devices to help limb different individuals as an alternative to standard prosthetics. The 3D printing means that the cost of the devices can be kept low and also manufacture can happen wherever a 3D printer is available.

Aims and Objectives

The aim of this project is to develop a system that allows everyday tools, such as cutlery, pens, a mobile phone etc., to be easily operated by a person using a prosthetic hand; specifically the device should be incorporated into the Robohand and Roboarm system (www.robohand.net). The user needs to be able to attach the system with one hand and be cost effective. The research team should put the end user at the centre of the design using the principles of human centred design.

Expected Deliverables

It is expected that the research team deliver a proof of concept or working prototype which demonstrates the design. The research team also need to deliver a short report that details the design and explains manufacture and cost breakdown.

The research team is also expected to disseminate the outcomes of their research to the broader humanitarian community, this could include an academic style paper presented at the Humanitarian Engineering Research Conference or through the Journal of Humanitarian Engineering.

Fieldwork

No fieldwork is required for this research project.

Conditions and Applications

The conditions for participating in the research program along with the application form can be found at www.ewb.org.au/research-project-applications. Please quote brief code A27 on your application.
Enabling confidence and bringing a little fun to prosthetics

Project Brief Code: A28

Thematic Area: Assistive Technology

Style: Design

Country Focus: Global

Partner Organisation: Robohand South Africa; Enable Development

Research Group Location: Any

Background

Research by Robohand, an organisation that develops custom made assistive devices for people who have lost the use of a hand or arm, found that early acceptance of prosthetics by the user helps limb deficient kids remain independent and confident. Robohand found that by making prosthetics more interesting, with colour and design, kids’ attitudes towards their own limb changed from something they were self-conscious about to something they flaunt. As Robohand primarily uses 3D printed components as part of its mechanical devices, customisation adds little to no additional cost.

Aims and Objectives

The objective of this research project is to develop a web interface or application where limb deficient kids (or adults) can design and customise their own prosthetic. The tool should enable users to personalise their own hand or arm; this may include choosing colour schemes and adding tattoos or decals. After the design stage the interface should enable the user to either 3D print the custom parts themselves or order them from a website. The research team should use the concepts of human centred design focus on ease of use (for children) and fun.

Expected Deliverables

The research team is expected to deliver a prototype or proof of concept for the interface, this could include a demonstration of the web interface or app which would ideally be captured via video.

The research team is also expected to disseminate the outcomes of their research to the broader humanitarian community, this could include an academic style paper presented at the Humanitarian Engineering Research Conference or through the Journal of Humanitarian Engineering.

Fieldwork

No fieldwork is required for this research project.

Conditions and Applications

The conditions for participating in the research program along with the application form can be found at www.ewb.org.au/research-project-applications. Please quote brief code A28 on your application.
Materials analysis and optimisation of 3D printed prosthetics

<table>
<thead>
<tr>
<th>Project Brief Code:</th>
<th>A29</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thematic Area:</td>
<td>Assistive Technology</td>
</tr>
<tr>
<td>Style:</td>
<td>Experimental</td>
</tr>
<tr>
<td>Country Focus:</td>
<td>Global</td>
</tr>
<tr>
<td>Partner Organisation:</td>
<td>Robohand</td>
</tr>
<tr>
<td>Research Group Location:</td>
<td>Any</td>
</tr>
</tbody>
</table>

Background

With 3D printing becoming a more mainstream method of manufacture there has been a number of developments in the area of 3D printed prosthetics. However, being a relatively new space there is no real rule book when it comes to material selection, especially as new materials are being made available regularly. Robohand is an organisation that creates 3D printed and aluminium CNC machined, anatomically driven, custom fitted, mechanical devices to help limb different individuals as an alternative to standard prosthetics (www.robohand.net). By using 3D printing costs are kept low and manufacture can be carried out anywhere there is a printer rather than at a specific factory.

Aims and Objectives

The objective of this study is to produce a leading practice guide that can be used by organisations like Robohand to determine the most appropriate materials to use for 3D printed prosthetics. The project team should conduct a comprehensive review of currently available materials. Experiments should be conducted to test a number of material properties that are of most concern to designers, including hygiene, strength, water resistance, heat resistance, printability and comfort. The guidelines should also explore optimum methods of production, considerations should be made for properties such as layer height and fill etc. The final guidelines will be submitted to Robohand for review.

Expected Deliverables

The research team are expected to deliver a report which summarises the findings and includes recommendations for material selection. Ultimately, a handbook should be created determining the most appropriate materials for particular 3D printed prosthetics.

The research team are also expected to disseminate the outcomes of their research to the broader humanitarian community, this could include an academic style paper presented at the Humanitarian Engineering Research Conference or through the Journal of Humanitarian Engineering.

Fieldwork and other Requirements

No fieldwork is required for this research project. The research team will be provided with the designs to Robohand’s product however they need to have access to a 3D printer; this would most likely be provided by the university.

Conditions and Applications

The conditions for participating in the research program along with the application form can be found at www.ewb.org.au/research-project-applications. Please quote brief code A29 on your application.
The conversion of a Cambodian tuk-tuk to be wheelchair accessible

Project Brief Code: B1

Thematic Area: Assistive Technology
Style: Design
Country Focus: Cambodia
Partner Organisation: The Spinal cord injury association of Cambodia (SCIAC)
Research Group Location: The ANU - Supervised by Jeremy Smith

Background

The World Health Organisation believes that as many as 500,000 globally suffer from spinal cord injuries (2013). In many cases, these injuries may result in a loss of both mobility and dignity. The Spinal Cord injury association of Cambodia (SCIAC) is a non-profit membership organisation operating out of the SOVANN Polyclinic in Battambang.

The SCIAC operates a tuk-tuk (a widely used form of motorised rickshaw in Cambodia) to help move its patients. This transportation however suffers when catering to the disabled, as patrons have to be physically lifted into the on board seating.

In partnership with Engineers Without Borders Australia (EWB) the SCIAC are seeking to provide a more dignified means in order to transport patients to and from hospital care. The process of lifting patience into and out of the tuk-tuk is also very time consuming.

Aims and Objectives

The research and design team should seek to improve the dignity and comfort of wheelchair users who rely on tuk tuk’s as a mode of transport. The tuk-tuk that SCIAC operates is larger than most tuk-tuk’s which means it can handle some of the rough roads better.

Specifically the objectives of this project are to develop a design that can be used to modify an existing tuk-tuk currently used by SIAC (shown in the photos above). Through their work with wheelchair users the SCIAC have identified a number of design requirements.

- A lift to the rear of the tuk-tuk to raise up wheelchairs,
- The ability to tie down three wheelchairs within the tuk-tuk.
- Relocating the seating so that it can be used by non-disabled people when necessary.

The implementation of a cheap and effective mode of transportation has the potential to improve the lives of many throughout the south east Asian region.
Expected Deliverables

The project team are expected to provide SCIAC with an economic and effective design manual for the modification of an existing tuk tuk to make it wheelchair accessible. The manual should include manufacturing instructions. SCIAC has very limited funds to implement the design changes, hence the overall cost should be as low as possible.

The research team are also expected to disseminate the outcomes of their research to the broader humanitarian community, this could include an academic style paper presented at the Humanitarian Engineering Research Conference or through the Journal of Humanitarian Engineering.

Fieldwork

It is suggested that the project team gain field experience by participating in the Cambodian Humanitarian Design Summit operated by EWB. In country personal from EWB’s Assistive Technology Livelihoods Project team may be available to take the research team to inspect the tuk tuk and potentially speak to people at the SOVANN Polyclinic in Battambang. As this fieldwork would be directly related to a final year research project financial assistance (e.g. travel scholarships) may be available through your university. You should speak to your university supervisor about opportunities.

Conditions and Applications

The conditions for participating in the research program along with the application form can be found at www.ewb.org.au/research-project-applications. Please quote brief code B1 on your application.
**Business Development**

**Leading practice for scaling social enterprises: the business of biodigesters for floating villages**

<table>
<thead>
<tr>
<th>Project Brief Code:</th>
<th>A31</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thematic Area:</td>
<td>Business Development</td>
</tr>
<tr>
<td>Style:</td>
<td>Review</td>
</tr>
<tr>
<td>Country Focus:</td>
<td>Cambodia</td>
</tr>
<tr>
<td>Partner Organisation:</td>
<td>Engineers Without Borders Australia (EWB)</td>
</tr>
<tr>
<td>Research Group Location:</td>
<td>Any</td>
</tr>
</tbody>
</table>

**Background**

The Tonle Sap region of Cambodia is home to 1.5 million people. The majority of this population live in floating houses on the Tonle Sap Lake or in adjacent flood prone regions. These communities have limited access to appropriate sanitation solutions with many reverting to open defecation. These practices lead to excrement entering water sources (such as the lake) with serious health consequences. Additionally these communities rely on wood or other biomass as a source of cooking fuel which produces air pollution and requires resources (time or money) to obtain.

Since 2008 Engineers Without Borders Australia (EWB) has worked with international development organisation Live & Learn Environmental Education in the development of a household level floating biodigester system for implementation in the Tonle Sap region. Biodigesters treat collected, human and animal waste by converting the excrement into valuable resources, such as fertiliser, water and biogas. Using a biodigester means excrement does not enter drinking water sources and the biogas can be burned as a clean cooking fuel.

EWB has a pilot study in the Tonle Sap region with 30 biodigester systems undergoing a testing and improvements regime. The goal of the biodigester project is to have 2,500 biodigesters installed by the end of 2017 (reaching around 15,000 Cambodians) and to scale up to a reach of 1.2 million people by 2024.

**Aims and Objectives**

The objective of this research project is to make recommendations on an appropriate business strategy for the biodigester project that will allow it to scale. The research team should investigate global leading practices for scaling social businesses that deliver appropriate technologies to disadvantaged communities. These social businesses could be bottom up (e.g. Sulabh India) or top down (e.g. Adidas India with Grameen Bank).

**Expected Deliverables**

The research team are expected to deliver a report which summarises the findings and includes recommendations for an appropriate business model.

The research team are also expected to disseminate the outcomes of their research to the broader humanitarian community, this could include an academic style paper presented at the Humanitarian Engineering Research Conference or through the Journal of Humanitarian Engineering.

**Fieldwork and other Requirements**

No fieldwork is required for this research project.

**Conditions and Applications**

The conditions for participating in the research program along with the application form can be found at [www.ewb.org.au/research-project-applications](http://www.ewb.org.au/research-project-applications). Please quote brief code A31 on your application.
**Payment methods for technologies in marginalised communities: case study energy access in rural Mexico**

<table>
<thead>
<tr>
<th>Project Brief Code:</th>
<th>B11</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thematic Area:</td>
<td>Business Development</td>
</tr>
<tr>
<td>Style:</td>
<td>Review</td>
</tr>
<tr>
<td>Country Focus:</td>
<td>Mexico</td>
</tr>
<tr>
<td>Partner Organisation:</td>
<td>Ilumexico; Engineers Without Borders (EWB)</td>
</tr>
<tr>
<td>Research Group Location:</td>
<td>Any</td>
</tr>
</tbody>
</table>

**Background**

Globally 1 in 5 people lack access to secure electricity, with the majority relying on dirty and dangerous fuels such as kerosene for their lighting. Social enterprises like Ilumexico and Pollinate Energy have been set up with the purpose of resolving this issue by distributing solar lighting to communities in need. Solar lighting removes the need to buy kerosene but the initial cost of the technology is a barrier to many. Ilumexico, who both develop lighting technology and distribute it to some of the estimated 3 million people who live without access to electricity in Mexico, are interested to determine the best approach to removing this financial barrier.

**Aims and Objectives**

The objective of this research project is to identify appropriate payment models that could be used by Ilumexico to distribute solar lights in Mexico. The team should conduct a thorough review and analysis of both payment models used for solar light distribution in other parts of the world and payment models for other appropriate technologies. The project team should critically analyse each approach. A good starting place is to look at payment methods used by solar sister (www.solarsister.org), and Melbourne based Pollinate Energy (www.pollinateenergy.org).

**Expected Deliverables**

It is expected that the research team produce a short report for Ilumexico that contains a summary of payment methodologies as well as a recommendation for the model Ilumexico should use.

The research team is also expected to disseminate the outcomes of their research to the broader humanitarian community, this could include an academic style paper presented at the Humanitarian Engineering Research Conference or through the Journal of Humanitarian Engineering.

**Fieldwork**

No fieldwork is required for this research project.

**Conditions and Applications**

The conditions for participating in the research program along with the application form can be found at [www.ewb.org.au/research-project-applications](http://www.ewb.org.au/research-project-applications). Please quote brief code B11 on your application.