



BRIDGING SKILLS GAP IN THE CARIBBEAN



innovation
for life



Ira A. Fulton Schools of
Engineering
Arizona State University

AUTHORS

RUURD SCHOOLDERMAN / BULENT BICER / ADRIANA M. VALENCIA

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Table of Contents

1. BRIDGE: Building Capacity in SE, ICT & Entrepreneurship	7
2. Workforce Projections SE & Related ICT	9
3. SE Industry Characteristics and needs	12
4. BRIDGE Program Activities and results	15
4.1. Program Components and Objectives	15
4.2. Program Partners made important contributions	15
4.3. Capacity Building and Institutional Strengthening	15
4.3.1 Faculty Training	16
4.3.2. Student and Professional Training	17
4.3.3. Field Excursions	20
4.4. Female Participation and Gender Outreach Strategy	22
4.5. Academic and Professional Partnership	24
4.6. Online BRIDGE Platform	26
5. Lessons Learned and Remaining Needs	27
5.1. Lessons Learned	27
5.2. Remaining Needs and Recommendations for Future Programming and Interventions	32
5.2.1. SE Future Programming Needs	32
5.2.2. ICT Capacity Building	35

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1. BRIDGE: Building Capacity in SE, ICT & Entrepreneurship

The demand for energy in the Caribbean region is expected to increase by 3.2% annually in the next two decades (> 80% in this time period).¹ At the same time, the Caribbean region's energy policy calls for a fundamental transformation of the energy sector through sustainable energy (SE).² In line with this, Barbados, Jamaica and Trinidad and Tobago have set targets for sustainable energy with different levels of ambition. Trinidad and Tobago wants to reach 5% renewable energy (RE) by 2020 (from a current 0%). Jamaica has a goal of going from a current more than 10% RE to 30% by 2030.³ Barbados aims to reach 30% RE by 2030, although more ambitious targets have been mentioned by the government, such as to have RE contribute 65% of total peak electrical demand by that same year.⁴ It is eminent that the mix of energy sources⁵ (which for the most part has been highly fossil fuel dependent) will then likely continue to be diversified to include more sustainable energy sources (e.g. energy efficiency and renewable energy), due to concerns and raised awareness over volatile prices of fossil fuel prices, the uncertainty of available fossil fuel reserves, and, to some extent, the desire to be more sustainable.

The demand for sustainable energy in Caribbean

economies is matched by the increasing demand for information and communication technologies (ICT), which is crucial for regional and global integration as well as for increasing competitiveness. This observation was one of the main conclusions from an IDB Caribbean Policy Dialogue on Science, Technology, and Innovation held in 2011.⁶ Taking advantage of broadband connectivity requires the availability of human capital for developing ICT solutions and services that respond to local and regional needs. For the Caribbean, a region characterized by stagnant productivity levels over the last decade, this digitalization would represent significant gains⁷ for the region's economies.

¹ World Bank. 2010. Meeting the Electricity Supply/Demand Balance in Latin America & the Caribbean.

² Caricom Energy Policy, Trinidad 2013 - cms2.caricom.org/documents/10862-caricom_energy_policy.pdf & Caribbean Sustainable Energy Roadmap and Strategy C-CERMS, 2015 <http://www.worldwatch.org/cserms/baseline-report>.

³ There are currently 70MW RE installed in the country: 32MW wind and hydro from the public/private utility Jamaica Public Service Company (JPSCo) and 38.5MW wind from Wigton Windfarm Limited, which plans to expand capacity up to 62.5MW. The remaining installed capacity is 560MW of steam (oil-fired), combustion gas turbines, combined cycle, diesel capacity.

⁴ Barbados Intended Nationally Determined Contribution. 2015. This document also states that the country aims to achieve a 22% reduction in electricity consumption by 2029 compared to a business as usual scenario. Installed RE capacity in Barbados has increased five-fold from 1.6MW in 2013 to over 9MW in 2015 mostly due to the RER. In terms of utility-scale RE, BL&P has developed a 10MW solar farm with 44,000 photovoltaic panels at Trents, St. Lucy and is analyzing the feasibility of building a similar facility elsewhere on the island (Caribflame 2016). In this way, the estimated RE capacity in Barbados is 19 MW out of BL&P's installed capacity of 239.1 MW, bringing RE capacity penetration to 8%.

⁵ The concept of sustainable energy refers to the ability to use of energy in a way that meets current needs without compromising the ability of future generations to meet their own energy needs and minimizing harm on the environment. Sustainable energy includes the efficient use of energy resources (including production, use, reduction in transmission losses, and conservation), as well as renewable (e.g. non-depleting) energy, such as wind, solar, hydro (with careful environmental considerations), geothermal, waste to energy (e.g. incineration and gasification) and bio-energy (including biofuels and biomass cogeneration such as bagasse, rice husks and wood chips from residual timber processing), and ocean energy (which also produce low, minimal or zero net levels of carbon dioxide/carbon dioxide equivalent emissions (CO₂e)).

⁶ The Policy Dialogue on Innovation in the Service Sector, held in Belize on December 5th and 6th 2011, concluded that the Caribbean region would benefit from investment related to developing ICT capacity in the private sector and accelerating the deployment of broadband infrastructure. Specifically, participants, presenters and organizers concluded that, "the many strengths in the Caribbean offer promise for the future, especially if they can include leveraging green growth and sustainable tourism prospects, near-shoring opportunities, and increasing broadband connectivity in the region."

The growing demand for sustainable energy drives the need for trained labor to fulfill the demand for experienced and skilled technicians and other professionals and individuals at various levels, who are capable of designing, developing, installing, operating, advising about, maintaining, and managing the aforementioned energy related systems.⁸ In addition, it is expected that increased training and education in ICT is crucial, as ICT skills are particularly important for the development of a “green” and “smart” economy. Finally, as new technologies emerge, so do new business opportunities, driving the need for supporting entrepreneurship both for small businesses and medium and larger organizations that need to innovate their business models to adapt to a changing business environment.

To contribute and address the above needs, the BRIDGE Program was launched in May 2014 and concluded in June 2017. BRIDGE stands for Building Capacity and Regional Integration for the Development of a Generation of Entrepreneurs (BRIDGE) in Sustainable Energy and Information and Communication Technologies. The program focused on the development of human capital, while encouraging gender equality in order to meet the expected future demand for technicians, professionals and entrepreneurs in the sustainable energy (SE) and ICT sectors. The program covered Jamaica, Barbados and Trinidad and Tobago.

This publication provides an overview of the program’s activities and achievements, and identifies needs that remain. This document is structured as follows: Section 2 provides a discussion of projected workforce needs in SESE and related ICT. Section 3 provides an overview of industry needs. Section 4 discusses the activities and achievements of the program. Finally, Section 5 concludes with a discussion of lessons learned and identifies continued needs in the region. The chapter also includes recommendations about how these needs may be addressed in future programming.



⁷ Estimates show that a 10 percent increase in broadband penetration in developing countries is associated with a 1.38 percentage point increase in economic growth (World Bank, 2010).

⁸ The tourism industry is a clear example of a sector that has a growing need for trained individuals in sustainable energy (in tourism agencies and tourism services, such as hotels). In fact, one of the findings of the IDB’s CHENACT project is that in-house technical staff is needed to advocate for clean energy implementation.

2. Workforce Projections SE & Related ICT

As mentioned in the first section, Barbados, Jamaica and Trinidad and Tobago set targets for future SE deployment. Based on these national SE goals, it is estimated that over the next 10 years there will be a need, on average, for 150 fulltime equivalent (FTE) employees annually during construction and installation. In addition, there would be a projected 50 FTE jobs during operation and maintenance (with a majority in solar photovoltaic (PV) in all three countries combined. Around 100 additional FTE positions can be created if each country reaches a 15% energy savings target (based on their current electricity consumption).

These estimates are based on projected SE growth as presented in national policy documents. The projected number of installed capacity per SE technology is then multiplied with an industry benchmark for potential job creation in installation and operation and maintenance.⁹ The FTE estimates are on the lower range of the benchmark number. The infographic on page 10 provides a conservative medium-range projection of workforce needs and breakdown between training levels.

It is expected that a majority of the workforce needs will be in the private sector, especially concerning installation of solar and energy efficiency measures. However, the public sector will likely see an increased demand in SE professionals for positions related to policy development, permitting, and inspection of installations.

Overview of Sustainable Energy Workforce Needs Projections for Three Countries Combined.

Alternatively, the SE related ICT needs are estimated to be in the range of 75 to 150 FTE annually over the next decade. Projected needs are particularly concentrated in the areas of data management, as more data will be exchanged

between producers and consumers. In addition, as a result of this increased interaction, it is expected that there will be a greater ICT demand to improve the customer service interface. This will likely have a strong mobile application and web-interface component.

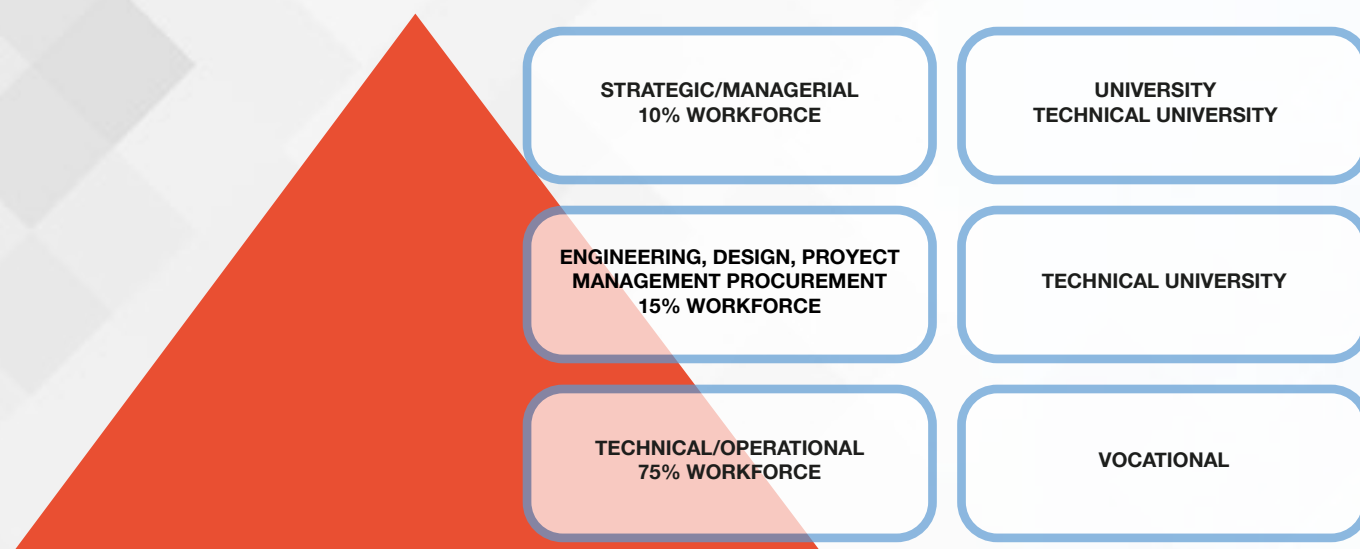
The table on page 11 provides an overview of the ICT related projected job needs, industry gender split and educational pipeline. Overall, it appears that there are enough graduates in the pipeline.

However, it is harder to assess whether the SE sector will be able to compete with other sectors that recruit ICT skilled workforce and whether graduates have the right skillsets. The key ICT needs identified are areas to focus on as they are expected to be of importance for SE support.

It is important to note that in the ICT programs assessed, females represent 38% of the students and graduation rates showed a similar split. This may actually be higher than the global trend, where approximately 30% of the ICT workforce is female. However, research reveals that women often drop out of the workforce over time, a phenomenon known as the “leaky pipeline.”¹⁰ A future program should therefore pay attention to recruitment and retention of women in the ICT field to capitalize on this investment and available human resource.

⁹ Wei et al (2010), “Putting renewables and energy efficiency to work: How many jobs can the clean energy industry generate in the US?” Energy Policy 38 (2010) 919–931.

¹⁰ The analogy refers to losing female talent, in which women enter the workforce but then they are lost “through voluntary termination at a rate two or three times faster than men once they have attained the experienced, mid-career, Manager/Senior Manager level of their careers.” See Gender Advisory Council and PWC UK. 2008. The leaking pipeline: Where are our female leaders? March.



Note: Workforce estimates based on BRIDGE Needs Assessment 2014 and 10 year timeframe.
Gender split based on industry survey findings.

TECHNOLOGY	CONSTRUCTION & INSTALLATION TOTALS	O&M TOTALS
SOLAR	100 FTE	50FTE
ENERGY EFFICIENCY	50FTE	30FTE
WIND	50FTE	20FTE
TOTALS	200FTE	100FTE

S.E. Workforce needs projections totals based on proposed S.E. growth projections policy documents.

TECHNOLOGY	TECHNICAL / OPERATIONAL	ENGINEERING / PROJECT MANAGEMENT	STRATEGIC / MANAGERIAL	FEMALE GENDER SPLIT IF STATUS QUO OF 23%
SOLAR	110FTE	25FTE	15FTE	43FTE
ENERGY EFFICIENCY	57FTE	15FTE	8FTE	24FTE
WIND	60FTE	13FTE	7FTE	20FTE
TOTALS	227FTE	53FTE	30FTE	97FTE

S.E. Workforce Projections skill level and gender-split break-down.

1. Workforce estimates based on BRIDGE Needs Assessment 2014 and 10 year timeframe.
2. Assumes 10% ICT component in support of S.E. jobs for low end and 20% for high range.
3. Industry gender split based on 2012 OECD world-wide findings.

Key ICT Needs areas

- Project Management
- Data Analysis
- Mobile App Development
- Web Development
- Database Management
- Report Development

	PROJECTED NEED ALL THREE COUNTRIES COMBINED	INDUSTRY GENDER SPLIT 70% MALE 30% FEMALE	EDUCATION PIPELINE 62% MALE 38% FEMALE
TOTAL S.E. RELATED ICT NEED ANNUAL PROJECTION-LOW END 10% COMPONENT	20FTE	14 MALE/6 FEMALE	56 MALE/34 FEMALE ANNUALLY
TOTAL ICT NEED ANNUAL PROJECTION- HIGH END 20% COMPONENT	40FTE	28 MALE/12 FEMALE	56 MALE/34 MALE ANNUALLY

Table 1. SE-related ICT Workforce Needs Projections for Three Countries.

3. SE Industry Characteristics and Needs

The current SE industry in Barbados, Jamaica and Trinidad and Tobago is relatively small. The BRIDGE study identified and contacted 17 companies that are specifically active in the SE field in these three countries. The surveyed companies are most active in solar, particularly solar water heaters and PV, and energy efficiency (including energy auditing). Combined, they employed approximately 188 FTE at the time of the assessment. The figures below provide an industry snapshot.

Based on the industry responses, the sustainable energy needs assessment identified that employers in general are looking for more practical skills. They seek opportunities for technical professionals to receive targeted training in SE technology such as solar PV installation and energy auditing and building retrofitting to enhance existing technical and installation skills.

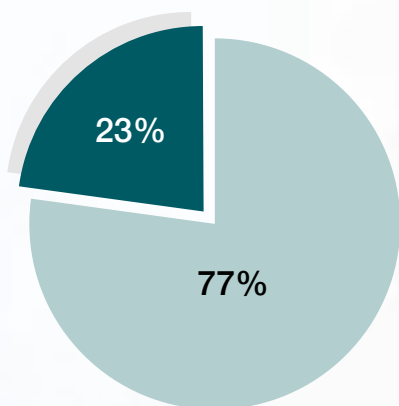
Fifty percent of industry respondents indicate that educational institutions do not meet their training needs and 100% indicated they utilize in-house training for their workforce. Educational institutions have an opportunity to generate revenue and strengthen their programs if they can tap into this professional training and certification market. In addition, the lack of a locally trained and certified workforce may result in crews being brought in from outside the country on a project basis, resulting in higher installation costs and missed local economic opportunities.

Based on the findings above, the industry needs assessment identified the following priorities concerning the SE field, which guided the design of the BRIDGE implementation program:

1. Applied training in solar PV system design and installation.
2. Energy auditing, energy efficiency and reporting.
3. Customer service and entrepreneurship, including project management and reporting
4. Development of hands-on training lab infrastructure and internship program.

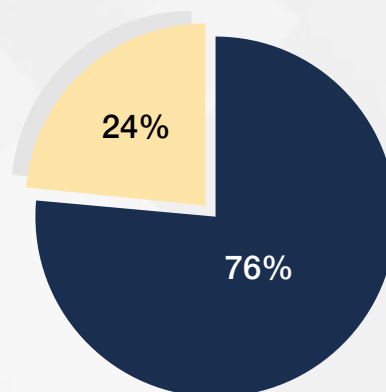
SE Industry Snapshot.

GENDER OF THE EMPLOYEES



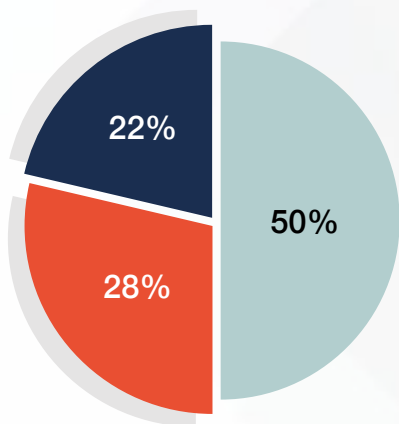
● FEMALE ● MALE

EMPLOYEES AND SUBCONTRACTORS

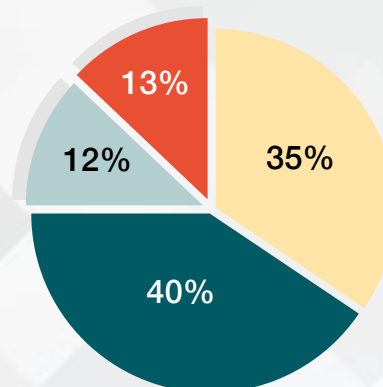


● EMPLOYEES ● SUBCONTRACTORS

EXPERIENCE OF THE EMPLOYEES



● UP TO 5 YEARS
● UP TO 10 YEARS
● BEYOND 10 YEARS



● SEMI-SKILLED WORKERS
● SKILLED/INDEPENDENT WORKERS
● SUPERVISORS/TECHNICIANS/INSTRUCTORS
● MANAGERS & EXECUTIVE PROFESSIONALS



4. BRIDGE Program Activities and Results

4.1 Program Components and Objectives

The BRIDGE Program consisted of the following components:

1. Educator training to strengthen the SE curriculum.
2. Training of students and professionals.
3. Strengthening the university industry partnership through excursions and an internship program.
4. Creation of an online portal to link students, education and industry.

The implementation of the program resulted in the following accomplishments:

BRIDGE Program Accomplishments

SE and ICT sector needs assessments carried out for all three countries. Included evaluation of education programs and industry needs.

Educational strengthening through:

- 50 faculty trained
- 146 individuals trained (172 training units)
- 199 field excursions
- Gender outreach contest in 3 countries

Implementation of a successful internship program:

- Facilitated 64 internships total, split between 30 SE and 34 ICT. 9 of these internships were international, that is, done outside of the participating countries.

Designed, built and launched the BRIDGE Learning & Innovation Platform (BLIP) <http://blipportal.com>

4.2 Program Partners Made Important Contributions

The BRIDGE Program was successful in mobilizing substantial support from a number of international program partners. Scottish Development International (SDI), in partnership with the Edinburgh Center for Carbon Innovation (ECCI), supported five internships and sponsored with its education and industry partners a number of training events. General Electric delivered lighting design training, sponsored a student lighting design contest, facilitated five internships and sponsored five students to visit their Neela Research Campus in the United States. The GIZ-REETA program funded solar PV training laboratories and sponsored travel stipends for faculty training. National Renewable Energy Laboratory (NREL) delivered three week long energy auditing training in all three countries. The Netherlands Organisation for Applied Scientific Research (TNO), in association with Arizona State University (ASU) co-sponsored three students to participate in a sustainable island development Summer School on Aruba, and ASU provided PV panels to one of the beneficiary institutions for its training lab.

4.3 Capacity Building and Institutional Strengthening

A major part of the BRIDGE resources were focused on this component. The two main objectives of this program component were to train faculty / educational staff in SE topics and to train students and professionals. A third objective was to strengthen the linkage between academia and industry and real world applications through field excursions to SE companies and sites. It is important to note that throughout the program, the project team aimed at contributing to increase female participation in the SE field.

4.3.1 Faculty Training

Fifty educators were trained from multiple educational institutions, including: University of the West Indies (UWI), St. Augustine, Mona & Cavehill Campuses, University of Trinidad and Tobago (UTT), the University of Technology, Jamaica (UTech,Ja.), Jamaica's Human Employment and Resource Training Trust, National Training Agency, Caribbean Maritime Institute (CMI), Barbados Community College and Samuel Jackman Prescod Polytechnic. The objectives of these trainings were to provide educators with more applied hands-on experience and to improve curricula that could be incorporated into existing courses or delivered as short (20-40 hour) workforce development courses through certificate programs.

The educator trainings included:

- 1. Solar PV installation**, energy auditing and lighting (ASU, Mabbett and G.E.) - Jamaica, 10-day training.
- 2. Energy auditing**, provided by NREL, and delivered in all three countries, 4-day training.

3. Entrepreneurship, provided by Napier University- Barbados, 4-day training.

Lesson Learned:

The BRIDGE program focused on enhancing existing curricula with more applied training rather than developing completely new courses. The rationale was to enable faster uptake in the programs as the administrative processes for new course approval can be time consuming. With more resources and administrative support from the academic institutions, new courses can be developed and curricula can also be modified.

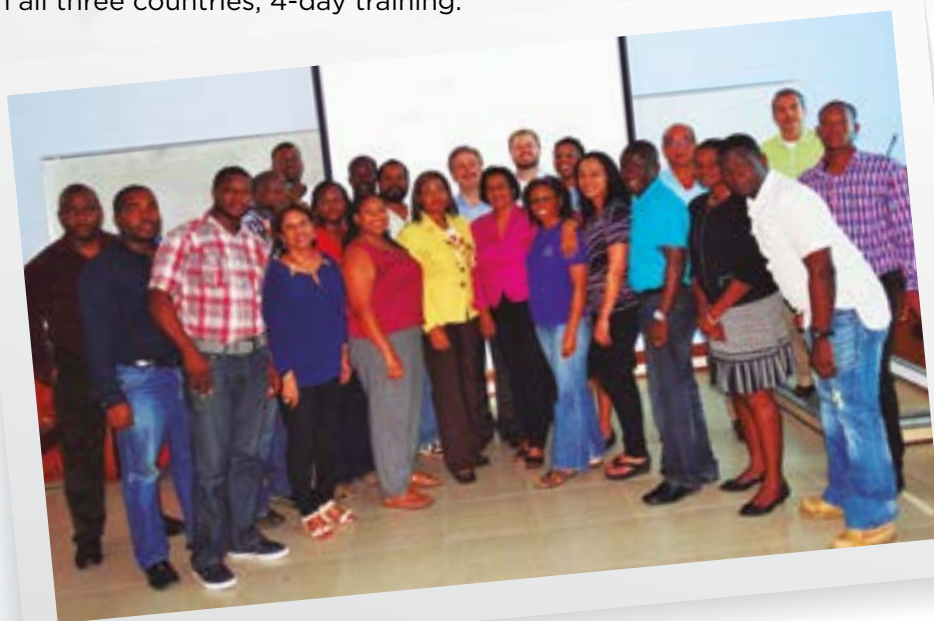


Image: BRIDGE Program - Two week faculty training, Mona Campus - January 2015.

4.3.2 Student and Professional Training

A total of 172 training units were delivered to students and technical professionals. Some people participated in more than one training and a total of 146 individuals were reached. These trainings included:

- 1. Solar PV installation** - a five-day training on Trinidad and Jamaica by ASU. Participants were eligible to sit for the North American Board of Certified Energy Practitioners (NABCEP) entry-level exam following the training.
- 2. Custom solar PV inspector training** - three-day training on Barbados, delivered in conjunction with ASU Solar PV installation training, which was funded through a separate program (Barbados Competency-Based Training Fund).
- 3. Energy auditing - four-day** training delivered in all three countries in partnership with NREL.
- 4. Entrepreneurship - four-day** training delivered on Barbados; included participation of all relevant Barbados entrepreneurship programs, both government and educational institutions. Faculty from Trinidad (2), Jamaica Mona (2) and U-tech (2, sponsored by GIZ) participated as well.
- 5. G.E. Lighting Contest** - a hands-on lighting retrofit assignment designed and guided by a G.E. team of lighting design experts. The contest combined lighting design and retrofit training with a team challenge to prepare and present a business proposal to retrofit a real building.

The above trainings strengthened local technical hands-on skills. However, higher level workforce training should be made available in order to build a competent and robust local workforce, for example, at the level of Certified Energy Manager or higher levels of NABCEP certification for Solar Installation and technical sales as well as (small) wind installation certification. A future BRIDGE effort should focus on continuing to strengthen the ability of institutions to deliver professional training as well as develop (regional) certification standards for energy auditing and solar system design and installation that can be locally delivered.



Images: Solar PV installation training using the Mobile Training Labs and P.V. Mock Roof, at UWI Mona Campus.

The table below provides an overview of the educator, student, and professionals who participated in trainings, by country and gender.

COMBINED	TOTAL	MALE	FEMALE	FEMALE RATIO
Educators	50	32	18	36%
Students	53	31	22	42%
Professionals	93	73	20	22%
Total	196	136	60	31%
Trinidad	Total	Male	Female	Ratio
Educators	15	8	7	47%
Students	17	8	9	53%
Professionals	25	21	4	16%
Total	57	37	20	35%
Jamaica	Total	Male	Female	Ratio
Educators	16	11	5	31%
Students	12	9	3	25%
Professionals	14	12	2	14%
Total	42	32	10	24%
Barbados	Total	Male	Female	Ratio
Educators	19	13	6	32%
Students	9	5	4	44%
Professionals	54	40	14	26%
Total	82	58	24	29%

4.3.3 Field Excursions

A total of 199 field trips were organized. The majority of the field trips were integrated as site visits in conjunction with trainings. Eight students benefitted from an international multi-day excursion. Five students from the lighting contest's top two teams, visited the G.E. Neela lighting campus. Three students participated in the TNO-ASU-University of Aruba's one-week Sustainable Energy Summer School. This program concluded with an independent research project and poster presentation during a public event with representatives from Aruba's government, the utility sector and the tourism industry.

Images: Field visits and a student produced poster (next page).



BRIDGE G.E. Lighting Contest Winners at Neela Park G.E. Campus, Cleveland, Ohio.



ELECTRIC VEHICLES IN ARUBA



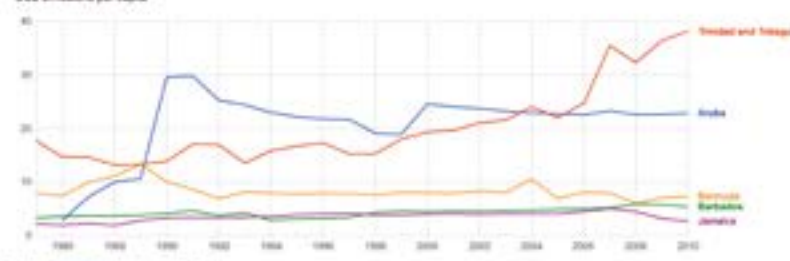
Jonathan Ramlochan

INTRODUCTION

Aruba aims to become 100% sustainable by the year 2020; to achieve this, Aruba not only has to implement alternative renewable energy generation systems but also implement more efficient means of consuming energy. Though not in the 2020 plan, the Electric Vehicle provides a means of reducing the island's dependence on fuel, reduce carbon emissions, capable of load balancing on a smart grid when renewable energy sources are implemented and has the capability of utilizing 'cleanly' generated electricity unlike its internal combustion counterpart. Currently, the Electric Vehicle implementation in Aruba appears to be 'unmotivated', therefore, this project seeks to motivate.



CO₂ emissions per capita



Data from World Bank. Last updated Apr 17, 2015

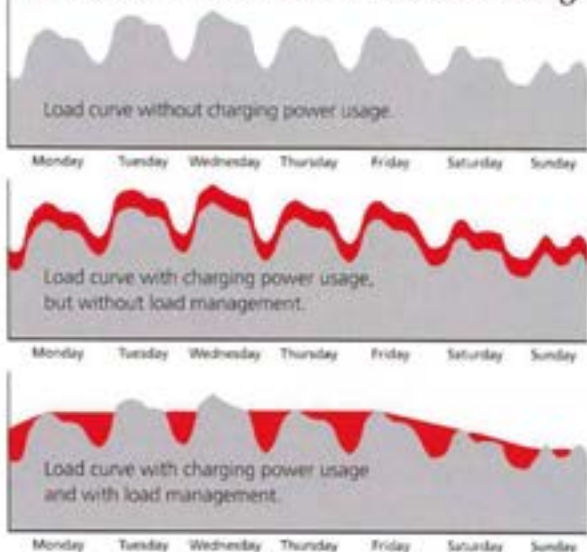
Approximately 1360 barrels of fuel is consumed by vehicles in Aruba every day. As Aruba's 2020 plan aims for 100% sustainability, the government has to reduce the use of fossil fuels, with the ultimate goal of independence. This would have benefits financially, economically and to the ecology of the island. Currently the majority of electricity is generated by fossil fuels; the electric vehicles would therefore have to be charged using fossil fuel generated electricity however when the renewable energy generation system become dominant, the electric would be able to fully utilize 'cleanly' generated electricity unlike the presently dominant internal-combustion vehicles.

The carbon emissions of Aruba to the year 2010 is significantly higher compared to other islands of similar population density. The closure of the refinery in 2012 would have mitigated the emissions drastically but due to the low ratio of cars to humans (466 cars to every 1000 inhabitants as of 2008) on the island, the CO₂ emissions of the island would still be considerable high. This can be detrimental to the tourism industry as the emissions can damage the ozone layer, resulting in a higher ambient temperatures, greater radiation penetration and environmental damage on land and in sea.

Lifetime gasoline consumption and fuel costs



The use of a Smart Grid for Load Balancing



Source: ELMAR

The usage of electricity in any country constantly varies due to societal behaviours of the population. For instance, when the majority of the population is attending school or work, the energy is lower but when they return home at night, the energy demand is higher when lights and other devices are turned on. Therefore the power generation company has to adapt to these fluctuations. One of main disadvantages of renewable energy generation is that they are inconsistent due to its inherent nature. To compensate for drastic fluctuations, a form of stored energy must be utilized which has the ability to engaged and produce in a reasonably small period of time. As the electric vehicle demands electricity, it can be used as electricity storage as well. With a smart grid, this can be used to the advantage of the power grid's stability.

Aruba's challenge is the financing of the initiative as Electric Vehicles are notably more expensive than Gas/Diesel Vehicles; the long term return on investment is highly profitable. The increase of gas prices, reduction in importation taxes on EVs and increase on Gas vehicles, considering second-hand refurbished EV resale on the island and the participation of organisations would surely streamline the implementation of Electric Vehicles in Aruba.

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Contact Information: jonathan.ramlochan@mycavehill.uwi.edu



4.4 Female Participation and Gender Outreach Strategy

The energy sector, like other infrastructure sectors, is currently lagging behind in the representation of women. The BRIDGE trainings achieved an overall female participation rate of 31%. For the student (42%) and faculty population (36%), the program exceeded or closely approximated the target. For the professional population (22%), the program did not achieve the target of 40% female participation. However, it should be noted that the participation rate was significantly higher than the workforce pool from which the program was drawing (15%). That means, however, that currently for every female technician, there are at least six male technicians.

A 2012 study by the IDB found that employment in quantitative fields improves women's livelihoods because these jobs tend to be better paid. By extension, a more financially stable female employee who is also a parent is able to better provide for her children; this, in turn, has benefits for society. Having women in leadership positions across all sectors makes good business sense. As reported in a 2016 study, women in leadership positions increased profitability, innovation and return on equity, which reflects actual performance, management efficiency, sales growth and changes in capital costs for companies.



Image: Gender outreach design competition.

The good news is that, as is evident from the BRIDGE baseline assessment, there are more women enrolling in science, technology, engineering and math (STEM) fields that lead to employment in the energy sector. In fact, the aforementioned IDB 2012 study carried out in the Caribbean revealed that 40% of students in the energy sector are women. However, the effort doesn't stop at education and it is important to make sure women stay in STEM fields and thrive professionally.

To contribute to addressing this issue, the BRIDGE Program launched a gender outreach design competition, "Women in Energy." This contest aimed to increase awareness on gender issues within educational institutions and start an active conversation between students and faculty.

As a starting point, contestants and their advisors benefited from a webinar hosted by Arizona State University and delivered by EQUATE from Scotland, an organization that promotes female participation in the STEM field. The contest participants included teams consisting of a mix of female and male graduate and undergraduate students, representing a variety of academic disciplines. A total of 25 students from all three UWI campuses participated.

Project proposals were received from a total of six teams (two from each territory), which were judged by the IDB's gender specialist and members of the BRIDGE Implementation Team. The winner and runner-ups were announced during the CARICOM Energy Week in Barbados November 2015 as a way to bring attention to this topic within the broader CARICOM region. In addition, the winning team was sponsored by the BRIDGE Program to present its proposal during the Jamaica Public Services Women in Energy conference.

Lesson Learned:

The use of contests for the G.E. Lighting Training and Gender Outreach Strategy proved to be a very effective way to engage and motivate students to develop creative and innovative solutions. In addition, these type of exercises helped develop important skills in team work, reporting and presentation skills.

4.5 Academic and Professional Partnerships

The BRIDGE assessment found that both industry and academic institutions recognized the importance of student internships as a means to offer students applied real-world educational experience and to better prepare them for joining the workforce. The program facilitated 64 internships, nine of which were international.

The BRIDGE Program's ability to provide student stipends removed an important barrier for many of the hosting organizations. This was not only the case for the smaller SE and ICT companies, but also for some of the larger public institutions that had limited budgets for student internships. The BRIDGE Program was also instrumental in pro-actively approaching organizations to identify internship opportunities, coordinating with the educational institutions to identify internship candidates and providing consistent follow-up brokering among the hosting organization, student and the education supervisor.

The international internships were arranged in partnership with Scottish Development International/Edinburgh Center for Carbon Innovation, G.E. Lighting and UNFCCC in Grenada. In all cases, the international internships were very enriching experiences for the students. However, it should be noted that especially for internships outside the CARICOM region, visa requirements can create a major organizational challenge and are both costly and time-consuming. Other significant barriers included travel and local housing costs, as well as identifying host organizations willing to assist and support this initiative. As a result, the program was only able to facilitate nine international internships.

Lesson Learned:

- Internships were valued by both the host and interns, and were successful in strengthening the relationship between educational institutions and industry.
- Internships had positive spin-off effects, such as reaching secondary school students with a science based summer camp and assisting an animation tech start-up.

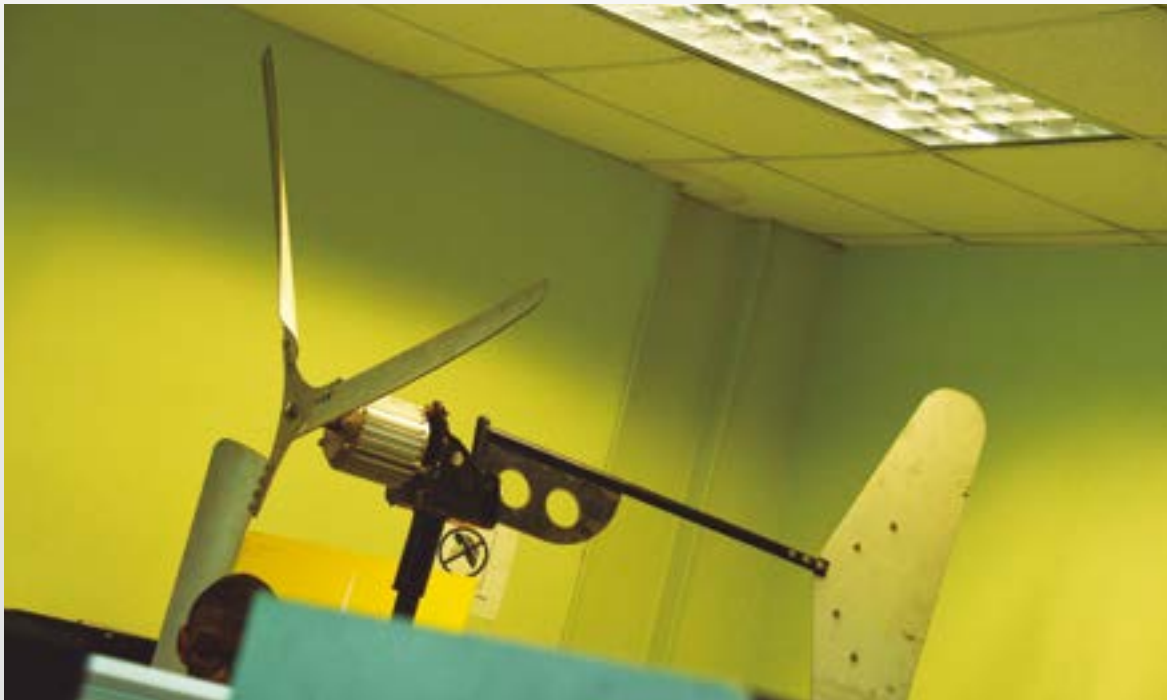
As identified earlier, the SE industry is relatively small in the targeted countries. In addition, during the execution of the program the SE market experienced a slump as oil prices dropped. This created a challenge in general to secure enough internship opportunities for SE students to achieve the target. Further, the small SE sector in Trinidad (due to low energy costs there) resulted in limited in-country internship opportunities, and a delay in the start-up of the SE graduate program in Jamaica (limiting availability of qualified internship candidates) created additional challenges. The program was able to secure over 25 ICT-related internships through a partnership with the Barbados ICT Professionals Association (BIPA), Barbados Animation Partnership (BIMAP) and Cables and Wires Telecommunication.

The BRIDGE internship program achieved some interesting spin-off benefits in addition to providing students with an opportunity to gain practical experience. Specifically, the BRIDGE supported internships with the BIMAP partnership enabled WestToonz, a Barbados based animation company, to quickly scale up staff to complete an important reference project, thus positioning the company for future business.

Another positive spin-off to highlight is the support for KimroyBailey SE & Robotics

Summer Camps in Jamaica. A large number of secondary students benefitted from the BRIDGE Program and were exposed to SE and ICT as a career opportunity with hands-on activities. The curriculum included programming, 3-D printing and SE-related projects including wind and solar. Developing these types of partnerships throughout the region help strengthen the linkage between secondary education and tertiary level STEM-related programs.

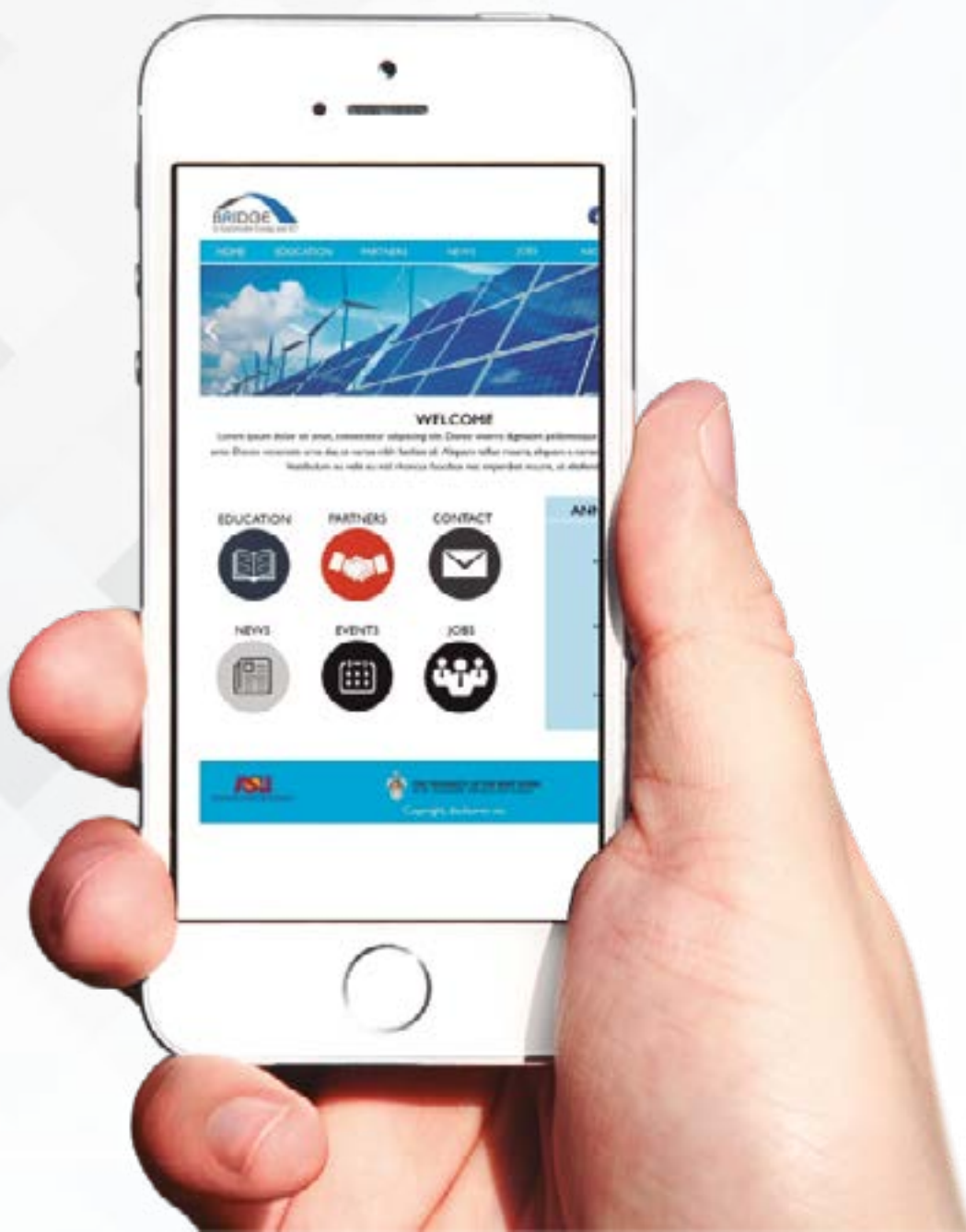
Image: Hands-on technology training, wind power turbine demonstration, KimroyBailey Summer Camp.



4.6 Online BRIDGE Platform

The BRIDGE Learning and Innovation Platform (BLIP) is an online regional learning and innovation platform. This online platform was designed in partnership with BRIDGE Program beneficiaries. The platform serves as a portal to connect the educational institutions, industry and students with an interest in SE and related ICT. The platform is organized as a portal that serves as a repository of relevant information, maintains up-to-date information on training and educational events relating to SE and facilitates connections between students and job and internship opportunities.

An important component for long-term sustainability of the platform was securing a hosting organization, which is being agreed with the University of the West Indies, Open Campus.





5. Lessons Learned and Remaining Needs

5.1 Lessons Learned

Applied SE trainings were well received

The BRIDGE Program has been well received by both the beneficiary educational institutions and industry. In particular, the focus on more applied topics (PV installation, energy auditing), combined with the provision of lab equipment funded by GIZ for hands-on education opportunities, has been a meaningful contribution to the BRIDGE objective of workforce development for the SE sector. The quote below from a thank you letter from the C.E.O. of one of the larger SE companies active in the region, Energy Dynamics, conveys this sentiment.

Image: Mock roof structure and solar PV modules used for training purposes.

“We had our technicians and Engineers participate in the training courses on Energy Auditing and Solar PV systems, in Trinidad, Barbados and Jamaica and the feedback from our participants was astonishing.

Further, we had one of the Bridge interns work within EDL and we were very pleased with his performance that we have since offered him permanent employment within EDL. We are therefore willing to accept another intern for a similar period.

EDL is fully supportive of the Bridge programs and urge you to consider providing additional training in the future as there is insufficient capacity in the region to implement the much needed Energy Efficiency and Renewable Energy Technologies.”

Andre Escalante



Team challenges and contests build team skills and link with applied problems

The use of contests for the G.E. Lighting Training and Gender Outreach Strategy proved to be a very effective way to engage and motivate students to develop creative and innovative applied solutions. In addition, these types of exercises help develop important skills in teamwork, reporting and presentationskills. These contests further offered top-performing student teams to gain exposure to potential employers by being highlighted at relevant events, the opportunity to present and through media attention.



Image: Example of one of the six Gender Contest teams' creative proposals.

Internship program was a success, but requires resources for ongoing support

The internship program has provided a great opportunity for students to apply skills and gain work experience. It further offered companies a low-risk opportunity to try out potential future employees. A number of interns have received job offers following their internships.

At the start of the BRIDGE Program, participating institutions did not have strong industry ties nor a strong focus on an internship program as part of the educational experience. The BRIDGE Program was critical in helping with opportunity identification and internship development. In addition, availability of internship stipends removed an important barrier for both students to do an internship (receiving some income) and host organizations, which may have projects but limited budget to pay interns. The BRIDGE Program has demonstrated the benefits of an internship program and established new relationships between the programs and industry and public sector organizations. The future sustainability of the internship program is in question, however, since both the financial support for stipends as well as the coordination capacity to facilitate internships is lacking within the institutions in the absence of the BRIDGE or a similar program.

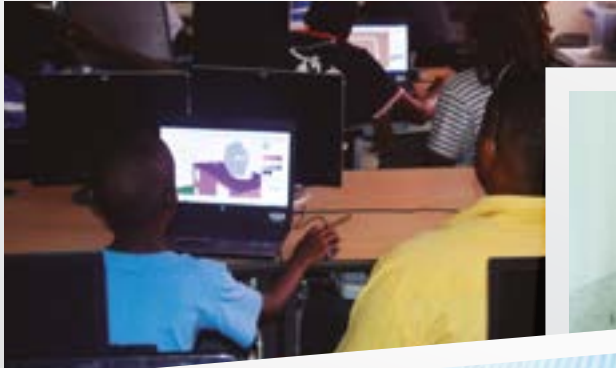
International internships are very beneficial but require strong partnerships

The international internships that the BRIDGE Program was able to facilitate offered very beneficial experiences for the participating students and helped build international relations with industry and educational institutions. However, securing (international) internship opportunities proved to be time-consuming. Visa requirements and international travel and cost of living expenses, including housing, pose serious barriers and require strong partnerships and persistence for internship opportunities to succeed.

Strategic use of internships resulted in positive additional benefits

A positive spin-off worth mentioning includes the internship program in Jamaica, where BRIDGE was able to support four SE & Robotics youth camps. A large number of secondary students benefitted from the BRIDGE Program and were exposed to SE and ICT as a career opportunity with hands-on activities. These included programming, 3-D printing and SE-related projects, including wind and solar. Developing these types of partnerships throughout the region helps strengthen the linkage between secondary education and tertiary level STEM-related programs. Another example is the support of West Toonz with BRIDGE interns, which allowed West Toonz to prepare an important reference project, positioning this animation tech start-up for future business.

Images: KimroyBaily Robotics and SE camps – supported with BRIDGE internships.



5.2 Remaining Needs and Recommendations for Future Programming and Interventions

As is evident from the preceding sections, the BRIDGE Program has had a positive impact in strengthening institutional capacity in the SE sector and in building stronger linkages between educational institutions and industry. There is a continued need for support of institutional strengthening and provision of resources to support internships and facilitation of target trainings through partnerships provided by BRIDGE. This section provides an overview and discussion of remaining needs. It also provides an indication of required resources for consideration in future program design.

5.2.1 SE Future Programming Needs

SE programs are small and vulnerable; collaboration within and across campuses is recommended to strengthen programs.

As a general observation, the SE university-level programs in the BRIDGE-covered countries are small in terms of student population and full-time dedicated faculty. This makes them very vulnerable in terms of continuity. Programs could be strengthened by building stronger interdepartmental connections (engineering and physics, but also, for example, linkage to policy and economics). A continuation of cross-campus collaboration and a stronger focus on professional development programming are recommended for the UWI-system.

This recommendation requires mostly administrative and faculty support. A future program could provide some resources in the form of technical assistance from an outside education expert who could assist the programs and administration in strategic planning and implementation.

¹¹ See 'Caribbean Vocational Qualification'.

Workforce targeted training is an opportunity, but requires incentives and program development resources

The professional development programming, typically provided in the format of short, 3-5 day courses, serves both a clear need and taps into another income stream. However, significant time and resources are required to develop, market and execute such programs. The BRIDGE Program has provided educators with training and curriculum for Solar PV installation and energy auditing as well as training infrastructure. The interest in the trainings and feedback suggest that the investment of time and resources is worthwhile. However, acting on this requires faculty with the time and proper incentives to initiate new programs. In addition, targeting a new audience likely will require some additional marketing and administrative/logistical support.

The current situation in which one or two faculty are teaching the majority of the courses and advising students does not leave much, if any, room for new program development. This is a real constraint that requires both administrative support as well as resources (time and money).

Technical and vocational training, standards and regional reach

There are currently limited standards in place on a regional level.¹¹ The needs assessment identified this as an area of interest. BRIDGE introduced the NABCEP; however, a more local/regional standard recognizing the Caribbean island situation, in which a mix of standards exist, may be appropriate. A follow-up on the BRIDGE Program could include a detailed curriculum review and support more targeted development of tailored RE courses for vocational, certificate and degree programs.

For the development of these technical and vocational training courses, a future program may reach beyond UWI to other technical colleges with train-the-trainer events and curriculum development assistance. This is especially recommended related to installation, systems-automation, energy-efficiency (auditing, including system performance monitoring and calibration, etc.). These measures would be in response to the identified need of training a more technical workforce.

It is further observed that UWI, despite its broader regional mandate, has trouble reaching beyond its individual campuses. Travel for technical and vocational training is often cost-prohibitive. A future program should include resources to support on-island training, such as solar PV installation, maintenance and troubleshooting and energy efficiency and auditing, that could be done by upskilling the local workforce/professionals. Funding for mobile PV training units (MTTs) and energy auditing equipment – specifically for training facilities beyond UWI -- would be a helpful and relatively low-cost investment to achieve a more regional reach.

Finally, additional support to strengthen the hands-on training infrastructure at both the universities and technical colleges is critical. RE is not all theory; there is a great, continued need for hands-on training opportunities. The GIZ support for mock-roof structures to practice solar panel installation and the mobile PV training units plus instrumentation formed a critical part in the delivery of meaningful training for solar PV and energy auditing. A future program should include funding for training in the area of infrastructure hardware support.

Strengthening online program delivery/presence for broader reach and more efficient regional program collaboration across campuses

The online delivery of courses (including hybrid courses) seems to be underdeveloped both at the UWI system and technical universities. Yet these institutions have a greater regional reach (CARICOM region and beyond) and aim to serve non-traditional (working) students. Greater flexibility in delivery seems to be a growing need and could also help stave off outside (U.S. / E.U institutions) competition, which could further weaken local tertiary education institutions as they may lose the online segment of the educational market. For this reason, a future program should include resources in providing (technical) support to faculty to get their courses online, as well as training faculty in effective online delivery. It is therefore recommended to expand the online program.

Internship program continuation with stronger partner commitments

A future program should include support for an internship program. As part of program development, it is critical to secure concrete donor commitments from both local and international industry partners. It seems a reasonable request to make to the industry and public sector to partner and support interns in return for an investment in training their workforce. A future program should include some resources for an internship coordinator to liaise between students, educational institutions and internship hosting organizations.

Utility professional and policy maker/public servant training

The universities are currently filling the professional training space in a limited manner. Regional entities such as CARILEC have traditionally played a major role in facilitating these type of training opportunities at the more strategic and managerial level. Entities such as CARILEC or the newly established CCREE may

be logical partners in developing and delivering trainings for these types of audiences. It would also strengthen the link with industry.

Another specific area of need identified is RE policy workshops to provide technical assistance for policy makers and government officials. There continues to be a disconnect in the region between policy makers and the utility industry. This is, in part, the result of a lack of understanding among policy makers regarding how the energy system works and what the implications are of adding significant amounts of RE into the system. The RE transition route is impacted by policy and regulatory decisions, which can either accelerate or slow down RE deployment (and impact cost and efficiency of the system), for example, promotion of individual systems through feed-in rates, PPAs, etc., as well as understanding the social and economic consequences. Support for applied research and knowledge sharing in workshops on these topics can be beneficial to promote an informed discussion and introduce best practices at the appropriate decision-maker levels. As RE increases and its increasingly integrated into the grid, utility professionals will need to upgrade their grids, augment automation, and revise operations to manage changing loads. In addition, RE grid-integration has a strong policy component. The confluence of these factors drives a major need for continued professional education of operators, regulators and engineers.

Another key area for utility professionals involves new business models, business strategy and change management as the utility industry is experiencing a major transformation. The utility business is being disrupted and will change from electricity as a commodity to a service-focused business. This has major implications for the utility, which will have to focus on operational excellence to integrate increasing amounts of RE while also managing a more diverse set of assets. However, the industry will also have to focus on customer service and new service development in order to survive, similar to what has happened in the telecom industry over the past two decades.



5.2.2 ICT Capacity Building

To further contribute to ICT development in the region, additional partners and engagement of the informatics departments is needed. The BRIDGE ICT needs assessment identified gaps and these should be used as a starting point for future ICT program design. The areas of focus should include training in developing software and apps for mobile devices and training the educators and students/techs to develop and use ICT platforms for energy (management system automation).

Two key priorities highlighted here as a first step and also recommended in the ICT needs assessment include:

- a. Carry out an independent, in-depth evaluation of the current ICT program offerings.

It is recommended that a more in-depth assessment of the current ICT programs across the UWI and technical university systems be carried out to confirm the conclusions from the high-level needs assessment, and also, and perhaps more importantly, to engage the stakeholders who ultimately have to execute curriculum changes.

The assessment would involve an independent, in-depth evaluation of the current curriculum, as well as faculty and industry stakeholder focus group meetings to review findings and discuss recommended changes. This would be followed by the development of a detailed action plan outlining specific curriculum changes and additions, as well as a detailed cross-campus/institution implementation plan.

- b. Leverage UWI open campus or another online platform for greater cross-campus and institution collaboration and flexible access.

Work with UWI open campus and other available online educational platforms to leverage expertise, reach, and learning solutions of institution. In addition, promote collaboration to constantly update, redirect and strengthen the programs in the areas of software engineering, and mobile app and web development.

