

DE-EE0006514
Trust for Conservation Innovation/Global Cool Cities Alliance
Accelerating the Deployment of Energy Efficiency and Renewable Energy
Technologies in South Africa
Final Report

The project seeks to increase the deployment of U.S. energy efficiency (EE) and renewable energy (RE) technologies and services in the South African marketplace. The five-point strategy will deploy and implement activities to reduce barriers to deployment by improving product awareness for the South African market; market and policy intelligence for U.S. manufacturers; product/service availability; local technical capacity at the workforce, policymaker and expert levels; and ease of conducting business for these technologies/services in the South African market.

The following report covers activities undertaken between February 1st, 2014 and January 31st, 2016, as described in the project's Statement of Project Objectives (SOP).

Task 1

Identify and engage South African and U.S stakeholders from industry, NGOs, government, and academia. Leverage existing South African relationships developed under the GSEP initiative.

Milestones

Milestone 1.1: Complete. List of U.S. technologies and companies interested in exporting to South Africa and working with the project team. Each project team partner reached out to its market sector/membership to promote the project.

U.S. and South African representatives from Dow Chemical have also engaged closely and partnered on both joint ventures and in efforts to host the conference described in Task 7. Dow Chemical co-hosted the conference in May 2015. During this reporting period, Dow Chemical has continued to work with project team members to engage other large companies to provide leveraged funding to develop building energy analyses to support the inclusion of cool surfaces in the South African national energy code. Dow has provided funding to support the analysis and committed to acquire matching funds from other companies. Inclusion of cool surfaces in the code will significantly grow the market for cool surfaces, which is currently in its infancy, and generate significant demand for U.S. manufacturers and service providers.

During the National Fenestration Rating Council annual meeting in March 2015, WinBuild along with representative of NFRC met with interested companies such as Milgard, Guardian Industries, PGT Windows, and Eastman Chemical. They briefed about the opportunities in South Africa. After some follow up, PGT and Milgard sent in their regret, as their executives were not interested in selling into South Africa at this time. Eastman Chemical is still considering the opportunities. Guardian is now considering whether to develop manufacturing capacity in South Africa.

The team supported the drafting of a joint venture between Empores, a U.S. manufacturer of intelligent, efficient transformers, and Specialized Solar Systems, a South African provider of solar technologies. The team introduced a small technical consulting firm, Global Citizen, to South African government officials. Global Citizen is working on reflective surfaces, water harvesting and providing solutions for material recapture on urban mines while generating energy by renewable means. The team also met with Mothusi Pahl of Alphabet Energy to discuss opportunities for joint ventures in the EE and RE market. WinBuild Inc. visited South Africa to attend the Working group meeting in Uppington and !Kheis municipality, also had meeting with SANEDI and manufacturers. Development of a manufacturing hub where U.S. manufacturers would be able to establish their assembling units was discussed with !Kheis municipality. !Kheis approved project team member PEER to plan for the establishment the hub and committed to provide free land and amenities to attract businesses. Empores was introduced to several potential large customers and product distributors in the South African market. !Kheis has recently included a number of U.S. technologies in their Integrated Development Plan to secure national government funding. The project team continues to advise the municipality as they put out a bid to expand the EE and RE technologies included for deployment and to link U.S. providers with local officials.

As part of establishing the building envelope performance laboratory, University of Pretoria, under advice from the DOE team, purchased U.S.-made equipment from Devices and Services including a reflectometer, spectrophotometer, and an emissometer.

In addition, the project team gave presentations describing the opportunity to participate at several conferences including the American Council for an Energy Efficient Economy's Summer Study on Energy Efficiency in Buildings (August 2014), Washington DC Green Building Symposium (September 2014) the Chemical Films and Fabrics Association (September 2014), Single-Ply Roofing Institute's Member Meeting (October 2014), and United States Green Building Council's Greenbuild Conference (November 2014, October 2015, and October 2016).

The team connected a U.S. cool coatings manufacturer called Topps Products to several South African stakeholders such as !Kheis, SANEDI and Gauteng Province Department of Infrastructure and Development. Topps has recently hired a local representative to grow the South African market for cool coatings. Topps is one of several U.S. manufacturers that is now bidding for work on an ongoing project in Northern Cape to coat 500 dwellings.

As a result of these efforts, 22 U.S. companies are participating currently. See Appendix A for a full list.

Milestone 1.2: Complete. Map of market stakeholders in South Africa. The project team identified relevant stakeholders in the EE/RE space including government entities, private sector representatives, and academic institutions/technical experts.

Milestone 1.3: Complete. Host organizational meeting for U.S. and South African stakeholders. The project team, including both U.S. and South African partners, met several times to finalize project responsibilities, goals, and timelines. The project team decided that individual outreach participating companies would be more cost effective and result in greater success than a large in-person meeting.

Task 2

Gather policy, program, and market information on South Africa to identify opportunities and specific barriers to help U.S. firms deploy EE and RE products. Create a roadmap for leveraging existing South African policy and market conditions to grow EE and RE market for U.S. companies and institutions.

Milestones

Milestone 2.1: Complete. The project team completed the initial report on current South African policies that support EE and RE product deployment and reported in the 7.31.14 Report. The team continues to gather any new policies and information on market conditions that are relevant for U.S. manufacturers and will issue updates via the Global Cool Cities knowledge platform described in Task 3.1.

Milestone 2.2: Complete. Recommendations guide for U.S. companies to leveraging South African policies for export market development.

The project team has drafted a report, guideline, and supporting presentation covering both Milestone 2.1 and 2.2. SANEDI provided a review and the approved final version is available here. (<http://www.globalcoolcities.org/south-africa-energy-efficiency-and-renewable-energy-exchange/>)

Task 3

Develop and implement an online platform for exchanging experience in developing and implementing clean energy technology policy and reducing barriers to deployment. The platform would also include the trainings and deliverables described in other Tasks.

Milestones

Milestone 3.1: Complete. As part of the 7.31.14 report, Global Cool Cities Alliance completed the website for knowledge sharing of relevant materials generated by the project and other resources for EE and RE technologies, standards, and policies. The site is housed on the Global Cool Cities Alliance website at: <http://www.globalcoolcities.org/south-africa-energy-efficiency-and-renewable-energy-exchange/>. GCCA continually updates the site with relevant documents, presentations, and reports detailing South African EE policy, procurement policies, case studies and more. Although the DOE project is substantially complete, GCCA will continue working with SANEDI to ensure new content from South Africa is made available from the platform.

The site has uploaded videos taken at the !Kheis demonstration sites and linked to the presentations/notes from the Powering South Africa conference described in Task 7. It

also includes materials (presentations, notes, etc.) from training visits taken by team members to South Africa, including the most recent trip by WinBuild and the University of Florida covering building energy modeling and cool surface residential modeling.

In 1Q 2016, a major upgrade to the website was required to improve security and to maintain uninterrupted access to the site.

Task 4

Provide technical support to develop an effective building and renewable component energy performance rating and labeling programs following the U.S. model and to serve as a basis for government incentive programs that distinguish high-quality, high-performance products and technologies from low-cost, low-quality products in the marketplace. Harmonized models for performance ratings will reduce barriers for technology deployment and cost.

Milestones

Milestone 4.1: Complete. Business plan for launching product testing/simulation lab facilities including equipment requirements, simulation tools, Q&A and certification protocols. The business plan has been completed and provided to the South Africa Cool Surfaces Association (SACSA), the AAAMSA Group and to the Thermal Insulation Products and Systems Association (TIPSASA). Much of the SACSA membership, and the focus of cool surfaces activity, has shifted to TIPSASA.

An agreement is in discussion between TIPSASA, SACSA, AAAMSA and the University of Pretoria to host a building envelope testing facility. The facility will utilize testing procedure recently approved by the South African Bureau of Standards. The University of Pretoria is nearing completion of the lab that will allow for building simulations, window modeling, and cool surface performance testing. Testing equipment from Devices and Services (a U.S. company) has been purchased per the business plan described in Milestone 4.1 and has been delivered to the lab. The lab was officially opened in June 2016, in conjunction with another week of training on equipment usage and energy simulations in South Africa.

Milestone 4.2: Complete. The project team held a workshop in South Africa for building envelope component energy simulation, testing, and modeling that was reported on in the 7.31.14 report. The project team (including WinBuild and Lawrence Berkeley National Lab) traveled to South Africa to host a series of trainings for building model simulation software and fenestration testing procedures. The training culminated in an exam to certify participants as building energy modelers. The workshops included 14 participants, of which 5 participants passed the exam.

WinBuild, University of Florida, and Lawrence Berkeley National Lab led a week of training covering simulations, equipment usage, and establishment of a Cool Roof Rating Council. The training on cool surface testing laboratory equipment included 1 Assistant professor and 7 post-graduate students from University of Pretoria and 1 industry representative. EnergyPlus and Design Builder Training included 15 people from

government agencies, industry, and academia. The Therm and Window Simulation training included 40 people from industry and academia. The full curricula and class materials are available on Dropbox by request.

Task 5

Support capacity building for policymakers by providing best practices and training assistance for policy design and implementation to reduce technical and economic barriers to the deployment of EE and RE technologies. Train the policy developers to use energy savings assessment tools.

Milestones

Milestone 5.1: Complete. Report on global policy best practices for spurring RE and EE market development with a gap analysis based on current practice in South Africa. The project team continues to provide materials, reports, and presentations to support SANEDI's efforts to raise local awareness of the benefits of EE, RE and cool surface technologies.

The project team has also been working with local stakeholders to install pilot U.S. cool roof coatings and to measure the impact on a variety of structures in the Northern Cape region (Kimberley). The team is gathering temperature readings from above, below and at the roof's surface. Preliminary measured results conducted by Ngonga CC (Edwina Pedro) assisted by TeaYehm Holdings and Peer Africa show as much as a 19% reduction in surface temperatures when comparing the baseline roof to the interventions. This data will further enhance SANEDI's efforts to grow demand for these technologies and organically grow markets at the municipality level. During this reporting period, the team assisted in developing the final report on a comprehensive demand side management, passive design, and cool surface pilot in !Kheis. The team has also supported the development of a final report presentation documenting a cool coatings pilot in Duinveld that will be presented to the South African Department of Energy to encourage further support of the market. The test found indoor temperature swings were decreased by 33 degrees Celsius. In both cases, the project team provided close support for the development of measurement methodology, data gathering and analysis, and final review.

In addition, the project team is helping to organize a side-by-side comparison of cool roof coatings and traditional roofs using a school in the Soweto area of Johannesburg. The location of the pilot is very advantageous and will give policymakers, financiers, and major project developers a nearby example to experience for themselves.

In a prior report, WinBuild Inc. provided a brief to the South African Energy Minister, and Deputy Director General of Department of Energy, about the work being done under the US-SA project.

The team also provided support to SANEDI to work with the South Africa Bureau of Standards (SABS) to adopt ASTM testing standards for cool surfaces. During this

reporting period, SABS adopted and published the Cool Roofs Rating Council's 5 ASTM standards:

1. ASTM C 1371 = SANS 1789 - determination of emittance of materials near room temperature using portable emissometers
2. ASTM C 1549 = SANS 1982 - determination of solar reflectance near ambient temperature
3. ASTM E 903 = SANS 1932 - Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres
4. ASTM E 1918 = SANS 1981S - Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field
5. ASTM E 1980 = SANS 1980 - Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces

SABS also officially allows any product that has been tested and labeled by the CRRC to qualify in South Africa as well. There are other equivalent ISO standards that are also acceptable.

The team is now supporting SANEDI as it works with multiple stakeholders to include the cool surfaces standards and performance requirements in the building code re: EE requirements for new buildings.

NFRC and WinBuild provided capacity building for SANEDI staff and provide educational and training trip related to best practices for certification program development and renewable energy technologies deployment.

With support from the project team, SANEDI has established a major partnership with the Gauteng Province Department of Infrastructure Development to install cool surfaces on government structures (primarily schools) within the province, South Africa's most populous.

Milestone 5.2: Complete. Policy recommendations for South Africa to adopt global best practices. The project team is working closely with SANEDI and with local municipalities to identify local policy and program gaps. In the original SOPO, these gaps were to be collated into a written report for SANEDI. SANEDI has requested that we not develop such a report in favor of policy support from the team on an ad hoc basis.

Task 6

Support EE and RE workforce development and certification programs in existing South African educational institutions such as Further Education & Training (FET) colleges.

Milestones

Milestone 6.1: Complete. Curriculum for skilled workforce training in EE and RE technology deployment. Project team is gathering existing job training materials to compile and curate for South African training facilities including cool coatings applications.

The project team has been using pilots described in Task 5.1 to hone on-the-job training programs for applicators. The monitoring and measurement aspect is supported by project team experts and is also building capacity by showing developers and researchers how to accurately and correctly take temperature readings of the roof assemblies.

The project team also facilitated a three-way partnership between the University of South Florida, the University of Florida, and the University of Pretoria to developing analytical and modeling capacity in South Africa. These skillsets are essential to building the market in South Africa by backing the technology claims with local results. This partnership was officially recognized in a signing ceremony during the Powering South Africa conference described in Task 7. In May, the team met with the Dean of Engineering School of the University of Pretoria and the head of the National Energy Efficiency Hub that is housed there to explore next steps and discuss an action plan for deliverables related to this new partnership. During this reporting period, the project team facilitated 3 online meetings between the universities. The group agreed to develop a joint 4-course certificate program in energy modeling, solar power basics, solar plant design. The specific courses have been selected, and each partner is currently in the process of securing internal approvals to finalize the certificate. In its current form, the program would be made available by University of Pretoria to its students with content licensed from both University of Florida and University of South Florida.

The team is working with in-country partner TIPSASA to design and implement workforce training on building envelope and cool surfaces applications in conjunction with a large national government tender to convert a large community (approximately 1 km²) in !Kheis to cool surfaces.

The project team has also been working with local stakeholders to install pilot U.S. intelligent transformers in !Kheis Municipality to measure the impact of energy savings realized by use of the technology. Extensive training has been provided to the locals for carrying out energy audit work, and also to install the units. The team is monitoring the energy data, initial results have show saving of 20-25%. Based on the results there has been a raised demand for the technology to address the current energy crises in South Africa. During this reporting period, the project team held several training sessions at the Northern Cape Rural FET College covering basic electricity management, usage of the highly efficient Empores transformers, and maintenance/ongoing commissioning.

In a prior period, demonstration projects in !Kheis municipality (see Task 7, Milestone 7.3) afforded an opportunity to undertake local job training and skill development efforts. On-site training undertaken at !Kheis was recorded on video and is in the process of being edited into usable training materials. The Project team met with the National Roofing Contractors Association to discuss leveraging their existing training materials in South Africa. A video describing the !Kheis activities is available here:
<https://www.youtube.com/watch?v=632XTka0pdQ>

Jay Cruz of Milenium Solutions provided training to local entrepreneurs in !Kheis on how to mix paint and primer using his company's formulation and materials.

Greggory Cates, President & CEO, Global Citizen, Inc. also visited !Kheis and has agreed to pilot his technology for conservation of water evaporation and generation of renewable energy. He is also going to provide solution to manufacture low-income housing using structural insulated panels coated with cool coatings.

The SANEDI Cool Coating Heat Island Project Plan for RDP/informal dwellings in Duineveld was finalized and being executed. Approximately 500 houses will be painted under this project to study the temperature effect of cool coating. Milenium Solution paint is being used for the project.

Milestone 6.2: Complete. Roadmap to develop, pilot, and implement skilled workforce certification program. Members of the project team (including WinBuild Inc and University of South Florida) met with FET college representatives in August to discuss needs, goals, and opportunities to partner formally on the development of the workforce certification program. A memorandum of understanding between Northern Cape Rural FET College and the University of South Florida (a project team partner) was agreed upon and signed subsequent to the meeting. The MOU forms a partnership between the two entities to develop curriculum and advise on renewable energy technology installation and maintenance.

The project team finalized arrangements to develop an industry-recognized and nationally certified (via SAQA, the South African Qualifications and Certification Committee) workforce training program in partnership with TIPSASA and the Manufacturing, Engineering, and Related Services Sector Education and Training Authority (MerSETA). The project team developed curriculum modules, received certification from SAQA and undertook the first training class of 15 students. Students spent 5 days in intense training on prepping surfaces for cool coating applications, applying cool coatings via brush and roller, and via spray mechanisms. Trainings were both in the classroom and practical field exercises. The graduates receive a nationally recognized certification good for 5 years. This process not only enhances job opportunities in rural areas, but organically provides the workforce needed to optimally apply U.S. coating products.

Task 7

Organize in-person opportunities for U.S. companies to demonstrate products and build relationships with South African businesses, governments, and other market players to advance the Administration's National Export Initiative. Educate and work with agencies such as TDA, USAID and OPIC to incentivize the U.S. manufacturers to export products to South Africa.

Milestones

Milestone 7.1: Complete. Event in South Africa to promote U.S. business development, market/funding opportunities, and relationship building with South African stakeholders. SANEDI has agreed to take primary responsibility for the logistics and hosting of the conference and is currently working with the project team to develop an agenda. The project team secured logistical, financial, and marketing support from Dow Chemical and SANEDI to host the conference on May 27th and 28th 2015 in Johannesburg.

The event convened 325 people and included representatives from academia, industry, local government, national government, the U.S. embassy, U.S. agencies, developers, and non-profit organizations. A full agenda, including most of the presentations, can be found on the SA EERE Exchange here: <http://www.globalcoolcities.org/south-africa-energy-efficiency-and-renewable-energy-exchange/>

Keynote speakers included Laird Treiber of the US Embassy, Karl Fickenscher – Deputy Coordinator of USAID’s Power Africa Initiative, Barry Bredenkamp of SANEDI, Carsten Larsen -- global marketing manager for Dow Chemical, Theresa Scheepers – municipal manager for !Kheis municipality,

The event included six discussion forums covering renewable energy, energy efficiency, and cool surfaces. The sessions highlighted new and deployable technologies, existing policies, new policy opportunities/best practices, codes and standards, and real-world technology implementation

The conference included an exhibition with booths from more than 10 organizations. The exhibition was kept small and easily accessible between sessions to maximize opportunities to build relationships and allow for more time hands-on with the exhibited technology.

At the end of the conference, a special session was held to accelerate the growth of a partnership to promote cool surfaces in South Africa. The session brought together coatings companies, insulation manufacturers, applicators, and component manufacturers (e.g., Dow). The session was a success – it attracted several new companies to become dues-paying members of the cool surfaces association and lined up key allies to include cool surfaces in the next iteration of the national building code (a process that will wrap up in 2016).

In this period, the team hosted a day-long meeting to highlight the results of the project and to explore how to maintain momentum in South Africa after the DOE project wraps up. The meeting, held in Pretoria, featured speakers from SANEDI, ESKOM, the U.S. Embassy, !Kheis, industry, academics and others. Appendix B includes the agenda and delegate list.

Separate meetings with South African Departments of Energy, Science and Technology, and Trade and Industry were hosted to further the goals of project. Specifically, the meetings focused on advancing the building envelope testing lab, the regional clean energy innovation hub in !Kheis, and the inclusion of cool surfaces in the building codes.

Milestone 7.2: Complete. Event summary and logistical roadmap to allow event to be recreated after project period. SANEDI provided a rapporteur to take detailed notes on the sessions. During this period, the full conference proceedings and summary were finalized.

Milestone 7.3: Complete. List of U.S. EE and RE technologies adopted by or planned for the GSEP pilot projects. In the 7.13.14 report, we reported that the project team worked with Milenium, a small California-based coatings manufacturer to send a container shipment of coatings to South Africa. Project partner PEER Africa then provided the coatings and application training to the !Kheis municipality in Northern Cape. The coating was applied to both the roof and walls and was very well received by the homeowner. The excitement generated by the project and its results has made facilitating cool surface applications a priority for !Kheis and surrounding municipalities.

Several local businesses have been established by PEER Africa to mix and apply coatings and are helping to meet and further stoke demand in the Northern Cape. SANEDI will be reviewing requests for government assistance to support the municipalities. SANEDI has also leveraged the awareness raised by the project to start a list of high-profile buildings and owners who are interested in converting to a cool roof, including Eskom facilities throughout South Africa. Global Cool Cities Alliance worked with Dow, Topps, and others to identify additional coatings sources to meet projected demand, as well as outreach to manufacturers of other types of cool roofs including membranes.

Empores undertook a demonstration project at !Kheis municipal office building to show the energy saving benefits with installation of their intelligent transformer. PEER Africa has done the energy and site audit of the !Kheis municipality building in preparation for the project. The results have been so encouraging that !Kheis has ordered additional transformers. This process has created “fast track” approval for other municipalities wishing to purchase the transformers using national government funds. In addition, a joint venture agreement is being developed between Empores and Specialized Solar Systems, a South African company, to facilitate broader market deployment.

Task 8

Organize capacity building training for the expert community, with a focus on training the trainers to enable continued energy education beyond the contract period. Host capacity development of South African policy makers and technical experts to improve understanding of EE and RE technology, component ratings and labeling programs, building energy simulation tools, cost benefit analysis models, and implementation of support that would assist harmonization with U.S. practice and facilitate policies and product quality assessment tools supporting EE and RE deployment and provide a means to verify compliance of product performance.

Milestones

Milestone 8.1: Complete. Workshop for South African policymakers and technical experts at the University of South Florida (USF) for solar energy technologies, biogas production, and off-grid RE generation. The workshop was held in South Africa in August 2014. Experts from USF and WinBuild held sessions for municipal leaders to advise on specific RE technologies (primarily solar thermal, solar PV, and concentrated solar PV arrays) that could be beneficially deployed in various regions and to help draft funding requests for national government support to implement the technologies. USF also met with national government officials to discuss high-impact RE technologies and

how national policies and goals might support its deployment. USF and WinBuild provided training and capacity building for SANEDI staff for development of RE research and technology development collaboration at USF and University of Florida.

Representatives from USF, University of Florida, and the University of Pretoria met in June to discuss opportunities for cross training and student/instructor exchanges. In the short term, the three institutions are working to identify existing distance learning modules that may be shared amongst them. As noted in Milestone 6.1, the project team facilitated 3 online meetings between the universities. The group agreed to develop a joint 4-course certificate program in energy modeling, solar power basics, solar plant design. The specific courses have been selected, and each partner is currently in the process of securing internal approvals to finalize the certificate. In its current form, the program would be made available by University of Pretoria to its students with content licensed from both University of Florida and University of South Florida.

The team also hosted a series of workshops in June 2016 for industry, government, and academia on building energy simulation tools, cool surface testing, and lab equipment operation described in Milestone 4.2.

Milestone 8.2: Complete. Workshop for South African policymakers and technical experts at LBNL for EE/RE building technologies, modeling, and testing protocols. LBNL participated in the modeling and testing protocols training sessions along with University of Florida and WinBuild.

Appendix A

Participating U.S. Companies List as of January 31st, 2017

1. 3M
2. Alphabet Energy
3. Clime Co International
4. Devices and Services
5. Dow Chemical Company
6. Eastman Chemical
7. Empores
8. Energy Optimizer
9. EnviroECOats
10. EPOX-Z
11. First Solar
12. Front Range Engineering
13. GAF
14. Glen Raven
15. Global Citizen, Inc
16. Guardian Industries
17. Intertek
18. Millenium Roofing Solutions
19. SunBorne Energy
20. Sundolier
21. Milgard Manufacturing, Inc
22. Topps Products