

## FESC PROGRESS REPORT November 2014

**Title Page:** NSF Solar Energy Pathways.

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Institution: Public Utility Research Center, University of Florida

Partners: Richard Boampong, Deniz Kazanci, Amanda Phalin, Michelle Phillips

Project Time Period: 2013-2018

Date: October 3, 2014

### Summary

Research regarding economic issues and incentives involved with Solar PV.

### Goals and Objectives

The research is addressing three key questions.

1. What is being done to implement thin film solar technologies in developing countries, what problems are being encountered, and how are the problems being overcome?
2. What are the successful applications of thin film solar technologies in developing countries?
3. What are the key product features, economic characteristics, supply chain needs, and support systems for successful implementation of earth abundant kesterite-based, thin film PV materials?

**Project Activities, Results and Accomplishments** (This is the main body of report and may use other headings such as Research Description, Results, etc. – author’s choice. Items that should be included are accomplishments, benefits to the state and how funds were leveraged.

Post-doc Amanda Phalin and graduate student Richard Boampong identified the target countries, namely India, Kenya, and South Africa, but gathered information on other countries as well. The specific research questions include:

- What do thin film solar programs look like in these countries? What is the government implementing? What is the private sector producing and selling?
- What problems have adopters in these countries (e.g., customers, businesses, governments, and utilities) had/overcome in implementing thin film solar technologies/programs (e.g., were there certain products that were not adaptable and why)?

- What were the keys for the successful products (e.g., price points and price design, physical characteristics of products, distribution channels)?
- How successful are/were thin film products in competing against existing PV, retail electricity, consumer fuels (e.g., kerosene), and the choice of no electricity?
- What is the thin-film technology used for (e.g., electricity generation vs. solar heating for cooking)?
- Do the thin-film products tend to be on- or off-grid?
- What support systems have to be in place (e.g., maintenance and repair, consumer education, and financing)?
- What type of government restrictions or support matter?

Over 100 papers, reports, and articles from academic journals, researchers, NGOs, governments, and inter-governmental organizations have been identified and reviewed.

The markets for renewable energy in our target countries look similar and can be divided into two main broad categories: On-grid renewable energy projects and Off-grid projects. On-grid renewable energy projects allow investors to supply energy to the already existing grid to supplement the under-capacity installed supply of energy and to improve on the unreliability of energy supply. It is normally implemented in urban and peri-urban areas where there is a power infrastructure in place already. Off-grid system comprises all the other renewable energy projects using stand-alone generators, residential home system for homes or small renewable energy units such as small solar lanterns and cooking stoves. While in some countries these different categories of off-grid systems can further be categorized into three main segments, there are no clear distinction between these categories in other countries and the same government regulation is used for all off-grid projects. For the purpose of this project, we categorize the different off-grid renewable energy systems as separate and distinguishable so that the market for renewable energy in our target countries or in developing countries as a whole can be grouped into the following five broad segments:

1. On-grid renewable energy projects: Products for utility-scale and customer-scale applications where the power generated is sold to others, including to the utility.
2. Small Off-grid Systems: Products primarily for residential solar home systems, especially in rural areas, and for small-scale commercial photovoltaic (PV) applications, such as kiosk lighting and mobile phone charging.
3. Large Off-grid Systems: Products providing power for larger institutions, such as schools, health centers, and missions in rural areas and for water pumping. These products are mainly solar PV.
4. Solar Powered Base Stations: Products primarily for powering mobile phone and broadcasting base stations, for and tourism establishments.
5. Small Units: Products that power specific small applications, such as solar lanterns and solar cooking stoves.

Detailed country case studies are being developed for each category.

Junior Economist Michelle Phillips is looking at the regulatory environment in Brazil and institutional features that are relevant for PV adoption.

Benefits to the state include having a better idea of what other cities and countries are doing to incentivize solar PV use, and a better understanding of the complexities of PV adoption/incentives.

**Concluding Remarks**

This project is ongoing. Future planned areas of study include research on what characterizes cities and countries that adopt PV's.

**Patents**

N/A

**Publications**

N/A

**Attachments**

N/A

**Title Page:** Energy Sustainability Course (Undergraduate level)

PI Name: Mark Jamison

Institution: Public Utility Research Center, University of Florida

Project Time Period: Fall 2014 and Spring 2015

Date: October 3, 2014

### **Summary**

A general business class for upper level undergraduates, “The Economics of Sustainable Energy” is being offered in Fall 2014 and Spring 2015.

### **Goals and Objectives**

The class provides students with fact-based and analytically rigorous discussions of the economic realities of sustainable energy. Key topics include energy markets and regulation, analytical techniques, environmental policies, economics of fuels, energy efficiency, and case analysis.

**Project Activities, Results and Accomplishments** (This is the main body of report and may use other headings such as Research Description, Results, etc. – author’s choice. Items that should be included are accomplishments, benefits to the state and how funds were leveraged.

- Lectures are currently being taught in-class for UF undergraduate students.
- The course will be recorded and made available to non-students. This will allow Florida citizens to better understand utilities and topics relating to sustainability from an economics perspective.
- Students will participate in a forum in which they will discuss issues related to sustainability in Florida.

### **Concluding Remarks**

This project is ongoing.

### **Patents**

N/A

### **Publications**

N/A

### **Attachments**

N/A