IITB-Monash Research Academy

Indian Institute of Technology Bombay | MONASH University

An Indian-Australian research partnership

Project Title:	Creating sustainable ecosystem for off-grid energy: solar photovoltaic technologies for attaining and sustaining electricity access	
Project Number	**IMURA0819**	
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Research Clusters:

Highlight which of the Academy's CLUSTERS this project will address?
*(Please nominate JUST **one.** For more information, see www.iitbmonash.org)*

1	*Material Science/Engineering (including Nano, Metallurgy)*
2	***Energy, Green Chem, Chemistry, Catalysis, Reaction Eng***
3	*Math, CFD, Modelling, Manufacturing*
4	*CSE, IT, Optimisation, Data, Sensors, Systems, Signal Processing, Control*
5	*Earth Sciences and Civil Engineering (Geo, Water, Climate)*
6	*Bio, Stem Cells, Bio Chem, Pharma, Food*
7	*Semi-Conductors, Optics, Photonics, Networks, Telecomm, Power Eng*
8	*HSS, Design, Management*

Research Themes:

Highlight which of the Academy's Theme(s) this project will address?
(Feel free to nominate more than one. For more information, see www.iitbmonash.org)

1	*Advanced computational engineering, simulation and manufacture*
2	*Infrastructure Engineering*
3	***Clean Energy***
4	*Water*
5	*Nanotechnology*
6	*Biotechnology and Stem Cell Research*
7	*Humanities and social sciences*
8	Design

The research problem

Define the problem

The research problem focuses on energy poverty. Over 1.2 billion of the world's population live without access to electricity and over 250 million of these people live in India, mainly in rural areas. Expanding access to sustainable electricity has significant social and environmental benefits. Access to electricity helps meet one of the basic material needs that supports further human development. Quite simply,

without light in the evening hours, students cannot study. In addition, expanding access to sustainable electricity, for instance in the form of solar power, helps to address the health and environmental risks associated with other sources of generating electricity.
The scientific problem addressed by this study focuses on the provision and uptake of solar photovoltaic energy applications. This includes issues relating to technology diffusion and uptake. It also examines cooperation within and performance of the network of governmental, NGO and business actors involved directly and indirectly in provision.
The project will assess the implementation and performance of the Solar Urja through Localization for Sustainability (SoULS) Program and will draw lessons for the expansion of this program to other technologies and geographical areas. The SoULS program where 7 million lamps will be distributed in five states in India, so far approximately 3 million lamps has been disseminated. In doing so, the leaders of the SoULS have collected a wealth of evidence and experience about the design, implementation and performance of such large-scale programs. The SoULS program is being expanded to include more encompassing technologies that provide solar electricity for other activities and geographical areas. It is important that as the SoULS develops in this way, it learns fully from the lessons of its experience.
In analysing the evidence from the SoULS and related programs, and drawing lessons for future interventions, the project will draw on systems theory, social network analysis and theories of bureaucratic and administrative capacity. Each of these theoretical approaches are relevant to explaining variation in the performance of the programs over time and across villages.

Project aims

Define the aims of the project

The overarching aim of the project is to advance practical knowledge of the conditions under which programs to disseminate the availability and use of sustainable energy are successful. To achieve this overarching aim, the project will:

- Review and collate the existing quantitative and qualitative evidence. The first stage of the project will focus on the SoULS Program, which will be distributing 7 million solar lamps to school children across five states of India. This will include information on the key characteristics of the NGO, business and governmental actors that were directly and indirectly involved and key indicators of performance (e.g. use of solar lamps several months after the lamp was distributed).
- Develop theories to explain variation in performance over time and across villages. Systems theory will provide the overarching framework for conceptualising the links between the various components of the system of solar-lamp provision and use. More specific theories, such as social network analysis and theories of administrative capacity will be used to develop insights into the conditions conducive to high performance outcomes.
- Test key propositions from the theories. Some of the tests will be performed on the available quantitative and qualitative evidence from the SoULS Program. Some of the tests may require the collection of new data on key characteristics from a subset of selected villages.
- Draw inferences from the findings for similar expanded programs. The key findings from the analysis are intended to inform the future development of the SoULS program and comparable programs that seek to expand the availability of other sustainable energy technologies in other geographical areas.

Expected outcomes

Highlight the expected outcomes of the project

Advanced practical knowledge of program design, implementation and performance including processes of technology diffusion.

How will the project address the Goals of the above Themes?

Describe how the project will address the goals of one or more of the 6 Themes listed above.

Renewable energy technologies specifically solar products market is hampered by a novel set of barriers. It has been documented that many large scale solar photovoltaic (PV) implementation programs faced hurdles in the form of high dissemination cost, lack of after-sales services, poor public awareness, lack of skilled workforce and supply shortages. This has led to widespread mistrust in solar technology, especially in rural areas. This project will reveal the number of learnings, guidelines and suggest prospective measures at the policy level that may be used by various clean energy solar products dissemination programs in order for them to enhance the probability of success.

Capabilities and Degrees Required

List the ideal set of capabilities that a student should have for this project. Feel free to be as specific or as general as you like. These capabilities will be input into the online application form and students who opt for this project will be required to show that they can demonstrate these capabilities.

1) B.Tech, M.Tech or MSW in the field of Mechanical/Electrical/Energy/others similar relevant subjects (Master's degree is preferred)

2) A student with expertise in systems theory and technology diffusion. Advanced quantitative methods including skills in or capacity to learn multilevel analysis and social network analysis.

3) Should be sound in English (speaking and writing)

4) Should have passed at least any one national level test like GATE, CSIR NET, UGC NET, DBT BET

Potential Collaborators

Please visit the IITB website www.iitb.ac.in OR Monash Website www.monash.edu to highlight some potential collaborators that would be best suited for the area of research you are intending to float.

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Robert Thomson is Professor of Political Science at Monash University. He initiated a newly established multidisciplinary and international research network on Sustainable Energy in India, which brings together engineers and Social Scientists from Australia and India, funded by the Monash Materials and Energy Institute.

Dr.Chetan Singh Solanki is Professor of Energy Science and Engineering Department at IIT Bombay. He is currently leading two projects of national importance on the dissemination of affordable solar technology. The National Center for Photovoltaic Research and Education (NCPRE) houses one of the best research facilities on Photovoltaic (PV) technology in India. It is funded by the MNRE, Govt. of India, to provide R&D and education support for India's ambitious 100 GW solar mission. Prof.Solanki is one of the Principal Investigators at the center. Prof.Solanki is also the Principal Investigator in the Solar Urja through Localization for Sustainability (SoULS) project at IIT Bombay, which aims to provide solar study lamp to every child in rural India as part of its 'Right to Light' mission.

Select up to **(4)** keywords from the Academy's approved keyword list **(available at http://www.iitbmonash.org/becoming-a-research-supervisor/)** relating to this project to make it easier for the students to apply.

Energy, Energy Storage, Energy Materials; Green Chemistry and Renewable Energy