



Global Indian Business Council

SMART VILLAGE ROADMAP 2017

ROADMAP FOR ENERGY INDEPENDENCE

Executive Summary

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Executive Summary

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ROADMAP

This morning some 300 million Indians woke up to a day without basic access to electricity or other energy resources. This deprives them of education, opportunity and participation as full citizens. The Smart Village Roadmap 2017 conference on Rural Energy Independence in Atlanta, Georgia, USA, on March 17, 2017 brought together a unique set of dedicated experts in technology, marketing, education and logistics, businesspeople, industrialists, volunteers for Non Governmental Organizations, medical doctors, and social workers from around the world. Hosted by Georgia State University's J. Mack Robinson College of Business and organized by the Global Indian Business Council, the conference was sponsored by commercial and private entities all over the USA, with crucial support from the Consulate General of India in Atlanta. This report discusses a roadmap to bring *full energy independence* ('Urj Svavalambi') to the 660,000-plus villages where over 70 percent of India lives.

Urj Svavalambi: ROADMAP TO ENERGY SELF-RELIANCE



Figure 1: Roadmap

The roadmap is a carefully-sequenced bottom-up plan to break out of the difficult challenges of education, local buy-in, technology ownership, skill development, wealth creation, financing, transport and communication logistics and enterprise growth that are needed for sustainable rural growth. The plan can complement the top-down electric power grid where it exists, but is independent of it. It starts with the

village school and teacher as the pioneer, In succession, solar photovoltaic power, education and skills training prepare the villager for a climb through technology and enterprise ownership. It proceeds to clean water resources, biogas heat and power, solar thermochemical fuel generation, and rural enterprise. Collaborative micro-financing, Internet of Things connections, BlockChain technology for electronic business, advanced rural-based clean manufacturing, and leap-frog approaches for package delivery and maintenance, drive onwards to a future of plentiful clean energy and reversing urban migration. India will lead the world by example and demonstrate modern villages that respect and nurture ancient culture and tradition.

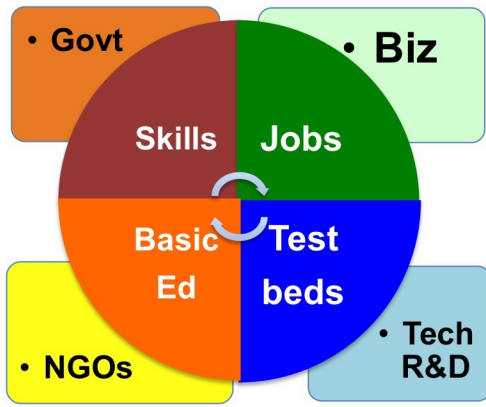


Figure 2: Synergies and partnership towards rural energy self-reliance (Urj Svavalambi)

We are off to a fast start. A private donor funded the first 5 systems. They have been installed at village Single Teacher Schools (STS) in Tamil Nadu by the Swami Vivekananda Rural Development Society (SVRDS), with Corporate Social Responsibility (CSR) help from TEX Biosciences, a suburban Chennai industrial concern, as well as an AAMCO battery plant. The 5th system was installed at the Training Centre of the Single Teacher Schools program, at one of the villages. In the next step, funding through the India Development and Relief Fund (IDRF) based in Maryland, USA, has been arranged, sufficient to install 95 more village school PV systems.

There is no plan for us to ‘electrify homes’. Our focus is to bring renewable energy systems to every village through the school, making a difference to education. The school Teacher and students are the pioneers to adopt technologies and demonstrate how to generate productivity, employment and entrepreneurship. We see a new tech-savvy generation growing up in rural India, leading the revolution to literally empower the villages. The exponential growth needed from the first installation will come through wealth generation guided by Corporate Social Responsibility (CSR) resources in a partnership with villagers, the NGOs, skills training programs, and business.

Villagers trained using CSR resources on the first systems, are installing all subsequent systems, as a self-propagating skill and employment generation template. Replication and adoption of the SVRDS template in other States is being pursued. Beyond the

first 1,000 we expect CSR and small-business interests to take the roadmap forward towards all villages and ignite growth.



Figure 3: First four PV systems installed at village Single Teacher Schools, Tamil Nadu 2017

In the next installment, we plan to start setting up biogas reactors, initially to produce cooking gas sufficient for one home.

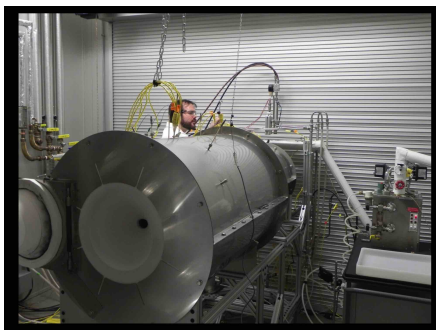


Figure 4: Thermochemical Reactor to Generate Liquid Fuel from Leafy Waste

Moving ahead, clusters of such generators will be set up at villages that have ‘Goshalas’, sheds and fields where aged cattle are given a safe place to reside. These generator clusters combined with PV electric power, will be able to purify and store the biogas as Methane, and use it to operate gas turbine generators to produce electricity. Methane-augmented ammonia-burning generators will take clean-burning, carbon-reducing technology further, with cattle (and human) urine providing part of the ammonia. The technology of solar thermochemical fuel generation promises a revolution in rural India. Using waste grass and other vegetation in pellets coated with certain salts, bio-reactors heated to over 1000K by concentrated sunlight generate syn-gas, a mixture of carbon monoxide and hydrogen, as well as liquid hydrocarbon fuels,

usable in transportation. Present laboratory reactors are already large enough to address the fuel needs of a village.

Autonomous as well as remote-piloted Uninhabited Aerial Vehicles promise to leapfrog the road infrastructure, enabling direct fast delivery and pickup of packages even at remote villages. In the long term, we project that drone delivery will become cheaper and more viable for the small entrepreneur, than even today's urban last-mile-delivery options. The synergies built into the roadmap are shown below. This convergence of interests and resources is a key feature of our roadmap.

SUMMARY PLAN



Figure 5: Leapfrogging Infrastructure: Drone Delivery to Villages is a viable prospect

To bring 1kW of renewable power to all 660,000 of Indian villages, would take only about \$1.3B - a number that seems shockingly low, making one wonder why this has not happened yet. However, installing generators is not enough: they must generate income and employment to be sustainable and grow. The roadmap starts with education. One-teacher schools run by carefully-selected NGOs in tribal villages are chosen for the first Solar PV installations.

The first installations are done by a for-profit vendor who also provides customer support and initial training, becoming a consultant to the NGO as the project moves forward. The manuals

are translated into the local language by the teachers, and the kids grow up comfortable with technology.

Skills training and employment generation using the energy system is the next step. the NGO partners with local CSR providers to institute training using various tools and machines. The first skill taught is how to install and maintain the PV systems, moving on to sewing machines, power tools, and floriculture as a retail business with eventual global business reach using IoT and Blockchain technologies.

Biogas systems are introduced next in each village school. The first standalone systems will provide only gas heat, useful for cooking. Clusters of 4 or more units will permit gas purification and compressed storage, using compressors driven by the

PV power. A new generation of multi-skilled Energy Experts will be trained in each village. At 50 units, Internet of Things (IoT) technology will begin to tie the systems. DC micro grids will be incorporated.

Corporate Social Responsibility plans will be tapped to go beyond 10,000 systems. Skill Development and a quasi-commercial model will enable 100,000 systems and beyond.



Figure 6: Ultimately, we aim for a rural India that is happy and proud of its diverse heritage, culture and nationality, and able to deal as equals with the best all over the world. The picture is from a performance in Atlanta in February 2016, by a visiting troupe of Ekal Vidyalaya alumni. Graduates of the Single Teacher Schools.

The 2nd iteration will bring in thermochemical systems to localize fuel production. As the number of systems grows past a million, public-private partnerships with firm ties to the research leading edge will bring full energy self-reliance, build the rural economy, and reverse urban migration. The twin monsters of fuel imports and environmental pollution will never be allowed to dominate again.

SMART VILLAGE ROADMAP CONFERENCE

The full 124-page report captures the proceedings of the first Smart Village Roadmap conference hosted by Georgia State University (GSU) and the Global Indian Business Council in Atlanta, Georgia, USA, in March 2017. This tested the model of assembling a truly diverse group, all focused on the aim of empowering the world starting with rural India.

Invited presentations came from the Consul-General of India in Atlanta, Shri Nagesh Singh, Professor Jane Davidson of U. Minnesota on thermochemical fuel generation, Dr. Balakrishnan Ganesh and Gautam Matthey of UPS Inc on the logistics of reaching 660,000 villages including UAV delivery, Ms. Sarah Hillware, an expert on empowering women in Africa, who works at the World Bank, Professor Vijay Madiseti of Georgia Tech on the Internet of Things and BlockChain, Prof. Rajendra Singh of Clemson U. on solar PV, Prof. Jagdish Sheth of Emory U. on Corporate Social Responsibility resources, NGO volunteers Dr. Vijay Vemulapalli of VIBHA and Mrs. Manjula Reddy of Ekal, Shri Malla Reddy on skills training, and Prof. R. Natarajan of Vellore Institute of Technology on the role of Indian academia.

Of the organizers, Professors Dan Bello, Dean of International Business and Sushil Nifadkar of GSU welcomed the participants, Shri Dhiru Shah of GIBC spoke on rural business and microfinance, Shri Ashwin Patel of GIBC spoke on waste incineration and efficient choollhas to reduce pollution, as well as examples on improving schooling in India, and Professor Narayanan Komerath from Georgia Institute of Technology introduced the Roadmap. The audience was truly diverse as well, with interests ranging from technology and business in the USA and India, to social workers intent on applying the lessons to similar problems in Africa.

SPONSORS



The Conference was sponsored by entities including the following:

1. Georgia State University, J. Mack Robinson College of Business
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5. SEWA USA
6. Amruth Ayurveda
7. Asian American Store Owners Association
8. Global Technologies Corporation
9. Ekal Vidyalayas

We at the Global Indian Business Council appreciate and are grateful for their support. In addition, we are deeply grateful for the support, encouragement and facilitation provided through the strenuous efforts of the Consul General of India Shri Nagesh Singh, and the staff of the Consulate General of India in Atlanta.