EDITOR'S NOTE

Innovations in Indian Energy Efficiency space - Addressing both climate and developmental needs

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Scrubinising MEEP’s lack of success and what we can learn from it

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Tracing the journey of InnovateToINSPIRE Challenge 2019

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Recap of INSPIRE 2018
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Dear Reader,

The quest for increased energy security and access is rooted in perpetual innovation. There is potential for enhancing the efficiency of energy usage across a multitude of sectors. Energy efficiency has firmly weaved itself into the heart of India’s energy conservation efforts. There has been increased spotlight on the role and efficacy of energy efficiency in helping India achieve its energy goals. While there have been pathbreaking initiatives such as the Unnat Jyoti by Affordable LEDs for All (UJALA) and Street Lighting National Programme (SLNP), that have transformed the market for energy efficient technologies in India, some other initiatives have been hampered by issues in their implementation. These relatively less successful projects though, offer key learnings and will help fine tune future initiatives.

In this newsletter, we examine the importance of innovation in ramping up India’s energy efficiency efforts and take a critical look at the lack of success of certain energy efficiency projects, in a bid to glean key insights for upcoming endeavors. We take a look at how the InnovateToINSPIRE Challenge 2019 has garnered significant interest from budding innovators and entrepreneurs. The challenge has received entries in the realms of Grid Management, Energy-Efficient Technologies, Clean Energy, E-Mobility and Financial Instruments and will help identify potential innovative solutions to help India achieve its sustainability goals. The article ‘Innovations in Indian EE space- Addressing both climate and developmental needs’ assesses the definition, role and challenges of innovation in the field of energy efficiency. It also explores the merits of energy efficiency as a tool for climate mitigation. We then move to the article, “Scrutinising MEEP’s lack of success and what we can learn from it”, which is an introspective look at the lack of success of the Municipal Energy Efficiency Program (MEEP), despite its immense potential. The article provides some invaluable nous regarding the implementation of energy efficiency projects and some potential roadblocks that can be obviated.

In sum, with India’s energy conservation gathering steam, the role of innovation cannot be repudiated. While it is important to devise path-breaking initiatives, the unsuccessful projects serve as important cautionary tales and offer insights for future initiatives.
Energy efficiency’s role in climate change and development

Energy efficiency (EE) is one of the cheapest climate mitigation options. Since 2000, EE alone has been responsible for 12% less energy usage and GHG emissions in 2017. While primary energy demand grew by 39%, global economy grew by nearly 85%, indicating decoupling of economic growth and energy use\(^1\). However, in 2018, total energy intensity improvements (primary energy use per unit of GDP) globally, decreased for the first time in almost a decade. At 1.3%, the rate of energy intensity improvements was half of that for the period 2014-17. According to the IEA, weak implementation of policies for energy efficiency (specifically mandatory codes and standards, market-based instruments and incentives) and strong demand from emerging, energy-intensive economies including India, had contributed to this slow down.

As per India’s Nationally Determined Contribution (NDC), EE is a critical element in India’s arsenal in the fight against climate change. EE in two of India’s largest energy consuming sectors - buildings and industries - has been identified as a critical enabler of India’s vision of achieving 33-35% emissions intensity target by 2030. Between 2000 and 2017, India’s EE policies have prevented 6% additional energy use, reducing emissions of 145Mt CO\(_2\) and preventing 5% additional fossil fuel imports. Most of these reductions have come from the industrial sector. But progress in other sectors, most notably buildings and transportation, has been slow.

EE is also a critical enabler for achieving SDGs. It not only makes electricity access affordable, but also improves health and productivity of occupants in better buildings making consumption sustainable and resource efficient.

Given the urgency of the climate problem and addressing developmental aspiration of millions of Indians, innovations are needed in these sectors to tap into efficiency gains as quickly as possible. Innovations are also needed to accelerate clean energy transition.

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What is innovation?

Innovation means an out-of-the-box solution to address pressing challenges, and leveraging opportunities in the society. According to Josef Schumpeter, who is considered as the founding father of entrepreneurship and innovation, in order to maximise the contribution of innovation to social and economic change, it is not enough to focus only on the novelty of the idea; a thorough understanding of its adoption and subsequent use or misuse is also needed. In other words, an innovation includes not only a new way of doing things (also called invention) but also the act of putting it into practice. It is in the latter that the role of governments as policy and decision makers becomes important.

Innovations must address EE barriers

Despite its importance as a first fuel with multiple social, environmental and economic benefits, EE has not received adequate attention or priority due to several institutional, technical, financial, market and information barriers. Innovations in EE are needed to address some of the common barriers described below:

- Market- The diffusion of EE technologies is usually a slow process. Irrational electricity tariffs and split incentives (where economic benefits of energy savings do not accrue to those who invest in EE) aggravate the diffusion and market adoption processes further.
- Technical- Lack of technical capacity or capabilities to implement or install EE measures on the ground, especially in cities.
- Financial- Limited availability of finance for meeting upfront costs of investments in EE and a general perception that EE investments are complicated and financially risky
- Institutional- Limited human capacity at the local level in cities to implement EE actions

Innovations in EE must address three types of needs

In addition to addressing some of the common barriers, innovations in new products, processes, services, technologies of business models must respond to new requirements, unmet needs, and existing market needs

- New requirements: Digitalisation has been continuously making consumers smarter. Internet of Things (IoT) and Artificial Intelligence (AI) based smart devices, and smart controls are entering global and Indian markets, and the next big thing on smart solutions must facilitate seamless integration of EE with on-site and off-site renewable energy generation. Technologies that are preparing for a future of decentralised energy generation, where consumers will also be prosumers, exist in labs today. In such situations, plug-and-play solutions for EE retrofit that significantly reduce a household’s consumption, allowing for interaction with not just the utility but also their own on-site renewables, will enhance consumer experience. As countries work towards achieving net zero carbon buildings, innovations in utility business models that encourage off-site renewable energy procurement for all consumer categories are the need of the hour.
- Unstated needs: Currently the EE space in India has failed to address the needs of a vast majority of off-grid/unelectrified consumers or consumers in weak grid situations. EE must be an enabler of clean, affordable energy that meets health needs (e.g. a health center or clinic running critical equipment in remote off/weak-grid area) or livelihoods (e.g. a farmer working with limited electricity, providing for storage and transportation of its produce) and other developmental needs. Innovations in EE must also address the

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unarticulated needs of the urban poor, who consume and pay for electricity differently from others in the city and typically rely heavily on secondhand appliances and equipment. Innovation must meet the needs of MSMEs that run on tight expenditures to be competitive and may have weak balance sheets. Innovations in financing of loans for EE technologies and services to MSMEs must be re-examined.

- Existing market needs: The building sector is yet to find scalable innovations for existing infrastructure. Innovative retrofits that go beyond changing equipment and can impact heating and cooling energy use in existing buildings, and specialised products for envelopes in different building typologies are needed. For new buildings, given the emphasis on fast, scalable mass affordable housing, innovations are needed in wall and roof assemblies that have low U-values and low embodied carbon and can be quickly installed or constructed.

In all these needs, innovation needn’t be radical or disruptive, it can also include incremental improvements in products, processes or services (for e.g. serpentine heat exchangers that have 90% fewer joints than current heat exchangers, preventing leakage of refrigerants in HVAC systems).

**Government’s role in spurring innovations**

In India, two types of policies have been implemented to encourage innovations in EE.

1. **Mission-oriented policies**: The policies that address specific challenges by providing new solutions which work in practice (e.g. National Mission on advanced ultra-supercritical technologies for cleaner coal utilization)

2. **Invention-oriented policies**: These concentrate on the R&D phase of the innovation cycle. These policies have led to establishment of research councils and publicly-funded research organisations including centers for excellence. The urgency with which EE needs to be accelerated across all sectors requires an innovation policy framework that goes beyond these policy types and policies and programs that address the entire lifecycle of innovations.

For innovations on EE to succeed in the market, system-oriented policies that consider interaction between different parts of the system and the inherent barriers must be designed. For e.g. this could mean a revamping of government procurement policies that help innovations enter the government market or introduce financing instruments for early stage/pilot stage ideas that have been developed in labs but haven’t been tested. The innovation cycle may involve risks, and structural changes in the government machinery may be needed or made more malleable to welcoming innovations, testing them, identifying required changes, if any, for eventual dissemination or diffusion.
One of the major reforms with tremendous energy saving potential under the AMRUT mission is MEEP i.e. Municipal Energy Efficiency Program, as energy costs generally account for a large portion (Nearly 60%) of the operating expenses of supplying water in India. Energy use in municipalities is usually rather inefficient because of the use of old, outdated equipment, inadequate maintenance, limited financial options for purchasing efficient equipment, and sometimes a lack of knowledge and awareness of the options for efficiency improvement on the part of municipal staff.

Municipal water supply, treatment and waste-water treatment and processing systems are often characterised by outdated pumping systems, inefficient design, leaks and losses. The studies have shown that energy efficiency improvements in the range of 25%-40% can be achieved with a range of technical options including but not limited to energy efficient pumps, system optimisation and reduction of leaks and losses. The energy audits conducted by EESL in about 320 AMRUT Cities under MEEP Program have also shown a potential of 36% energy conservation. The options involve more complex technical solutions, for example system optimisation, higher investments and comparatively longer payback periods than lighting or building retrofitting projects.

As per the data published by CEA, there is a potential of 4800 MUs in energy savings, avoidance of an additional capacity of 3300 MW resulting in 3.9 Million Tonnes of CO2 emission reduction, per annum. In addition to reduced energy consumption and electricity bills, energy efficient improvement projects also lead to other benefits for a municipality, such as improved service quality and reduced emissions of pollutants and greenhouse gases.

Municipal Energy Efficiency Program (MEEP), a typical ESCO project aimed to identify the inefficient pumps and set a baseline of energy consumption and delivery parameters for the replacement of existing inefficient pumps by energy efficient pumps. In spite of addressing the basic challenges of technical know-how, implementation capacity and access to financing being faced by the Urban Local Bodies (ULBs) and even after submitting 323 Investment Grade Energy Reports (IGEA) to the respective ULBs and Urban Development Departments of various States during last two years, the programme still has not progressed to the actual replacement of existing inefficient pumps with energy efficient ones.

While the business model proposed by EESL covers the designing of new pumps on current operating parameters, the ULBs’ first and foremost concern is meeting the increased water demand at increased head during the life of the replaced pump. The existing oversized pumps do not match with the system curve and hence operate on significantly reduced efficiency. If the existing pumps are replaced with same size energy efficient pumps, there will not be any significant energy savings except marginal efficiency improvement caused due to vintage of pumps. The present model is not able to cater to this particular demand of the ULBs. The proposed pumps, in case of significantly reduced water table may not be able to supply the required quantity of water. However, a separate annuity model without much insistence on energy savings was also suggested, to enable the installation of bigger size pumps.

High ROE levied on the project was another issue raised by the ULBs. The ROE is as per the guidelines of Electricity Regulatory Commission for such type of energy efficient projects. However, due to earlier erratic payment pattern of the ULBs, EESL is not in a position to extend any discount on the ROE. Considering the
previous defaults in payments by ULB’s for the Street Light Program, EESL is also cautious in dealing with the respective ULBs.

Few of the ULBs had raised concerns regarding the methodology adopted for carrying out the energy audits and the preparation of IGEA reports. The Energy Audit Agencies have used the audit methodology duly described in the energy audit guide books published by Bureau of Energy Efficiency.

The project also didn’t get the requisite commitment from the municipalities. The nodal officers of the ULBs were changed frequently and the decision making, and ownership was also absent at their end. It was seen that the MEEP project, due to its business model was on the least priority of Urban Development (UD) Departments.

Despite the fact that energy conservation and climate improvement are the need of the hour, MEEP Program could not achieve its intended objectives in practice and it did provide some valuable lessons to the project execution team.
With the rapid growth and ongoing developments taking place in our surrounding, the energy demand has also catapulted. The growing consumption of energy has led to unsustainable use of the limited energy resources, causing significant damage to the environment. Therefore, there is an urgent need to devise innovative energy solutions that can enable the growth of sustainability and profitability, symbiotically. The InnovateToINSPIRE challenge was borne out of the need to take this mission forward, with Hackathons being organized in four different cities - Jaipur, Bengaluru, Mandi, and Delhi, to support the cause. The main objective of the InnovateToINSPIRE Hackathon was to identify top workable business solutions that can potentially transform the energy efficiency sector around the data being captured through EESL's programs. The challenges brought forth were Smart Meter Data Analysis, Street Light Centralized Control & Monitoring Systems (CCMS) Data Analysis and Electric Vehicle Charger Data Analysis.

InnovateToINSPIRE also conducted roadshows in ten different cities - Guwahati, Mumbai, Chennai, Mandi, Bengaluru, Kolkata, Ahmedabad, Delhi, Kanpur, and Jaipur. The roadshow centered on encouraging the energy enthusiasts to submit their solutions related to the energy realm, which could bring about a significant shift in the developing world.

The challenges put forward were in the field of Improved Grid Management System, Energy-Efficient Technologies, and Innovation in the space of clean energy, Innovation in the domain of E-Mobility and Financial Instruments to support & sustain Energy Efficiency innovations.

Through the journey, InnovateToINSPIRE saw over 2000 participants participating in Roadshows and Hackathons, and an estimated reach of over 2 million was generated on digital and social media platforms. Additionally, there was a campaign done specially to target energy sector startups, energy-centric accelerators, and incubators and the initiative was spoken about in various colleges with the help of IncubateIND fellows who did regular meetups and sessions within their peer groups in various colleges.

Over 850 ideas were submitted and the evaluation process is on. The selected top 5 winners in each category shall be rewarded with grant/prize money of Rs. 5 lakhs each.

EESL has selected over 13 projects from the entire initiative and has now started mentoring and incubating them to fine-tune their solutions further and is keen to deploy ideas in physical formats soon.
Recap of INSPIRE 2018

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