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Securing tomorrow's energy today: Policy & Regulations
Market Transformation in Energy Efficiency

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1. Introduction

Based on various national modeling studies and the Integrated Energy Policy, it was identified that through promotion of energy efficiency and its conservation in the country, nearly 25 GW of capacity creation could be avoided in the electricity sector alone. Energy conservation potential for the economy as a whole has been estimated to be around 23% with maximum potential identified in industrial and agricultural sectors.

Considering the vast potential of energy savings and benefits of energy efficiency, the Government of India enacted the Energy Conservation Act, 2001 (EC Act). The Act provides for a legal framework, institutional arrangement and a regulatory mechanism at the Central and State level to embark upon energy efficiency drives in the country. Amongst the major provisions of EC Act, are the identification of energy-intensive Designated Consumers with mandatory energy efficiency provisions, Standard and Labeling of Appliances, Energy Conservation Building Codes, Creation of an Institutional setup (BEE) and Establishment of Energy Conservation Fund. The Energy Conservation Act became effective from 1st March, 2002 and Bureau of Energy Efficiency (BEE) was operationalized from 1st March, 2002.

Energy efficiency institutional practices and programs in India are now mainly guided through various voluntary and mandatory provisions of the Energy Conservation Act. The EC Act was amended in 2010 and the main amendments of the Act allowed the Government to issue energy savings certificate to Designated Consumers whose energy consumption is less than the prescribed norms and creation of a trading platform for energy efficiency certificates so that industries who did not comply with the norms could purchase them. Several new initiates such as Super Energy Efficient Program and Smart Grid initiated by the Ministry of Power are expected to not only accelerate energy efficiency but also make the energy sector economically as well as environmentally sustainable.

What is market transformation?

Market transformation refers to the process of increasing incentives or reducing market barriers to support the adoption of cost-effective, energy-efficient and clean energy products in a sustainable manner. Policies can transform markets sustainably by encouraging incentives and addressing barriers to the point at which clean or efficient products become normal practice in appropriate applications.

A market transformation initiative generally includes:

- Market analysis, including identification of the particular barriers that are hindering the development, introduction, purchase and use of the targeted product;
- A clear goal (such as product sales or performance improvements), together with specific milestones that will need to be accomplished to achieve the goal;
- A set of co-ordinated activities that will achieve the desired objectives and systematically address each of the identified barriers;
- Periodic evaluations designed to adjust policies and respond to actual market experiences;
- A plan for transitioning from market intervention activities toward a largely self-sustaining market, i.e. an “exit strategy”.

Market transformation initiatives simultaneously stimulate the development of new products and promote their market introduction by effectively changing consumer-purchasing practices so that targeted products become commonplace. Policies and activities are tailored to address the different stages of a product’s market diffusion. For example, research and development (R&D) and technology procurement efforts are suitable in early stages to stimulate the introduction of new technologies. Rebates and targeted outreach to large purchasers (e.g. bulk purchases) can then strategically increase market penetration until the product achieves “niche” status.

Consumer education, loans/rebates and promotional activities (e.g. labeling) help expand market share. Mandatory performance standards complete the transformation process by removing inefficient products from the market. Cost reductions occur through each stage of the product’s market diffusion, which allows for an even faster deployment trajectory.

Well-designed efforts prompt key market actors — including manufacturers, retailers and installers — to change their behavior, resulting in a much larger impact than approaches that focus strictly on consumers. Such efforts can also lay the groundwork for new minimum product performance standards that “lock in” the improved product. As market share increases, activities will evolve and costs will continue to decline. To continue market transformation, actors will need to fine-tune tactics (e.g. reduce the value of rebates) or shift activities to address the next generation of products. Yet market transformation does not end after product sales reach the targeted level of deployment. Policy makers can extend successful market transformation efforts to related products, using shared promotional and educational activities, rebates and government procurement.

For example, governments and the private sector could work together to "pull" super-efficient appliances into the market by co-operating on measures such as manufacturer incentives and support for R&D. At the same time, countries could "push" the most inefficient appliances out of the market by co-operating on measures such as global standards.

In India, market transformation in the end-use equipment and appliances is still in its nascent stage but is likely to accelerate with the introduction of mandatory standards and labeling for larger number of products as well as the introduction of the SEEP (Super-energy efficient program) in electric appliances. The case study in Annexure 1 on high efficiency electric motors globally and in two continents (a) North America and (b) Australia & New Zealand captures the key features of market transformation and lessons learnt globally.

Policies and Regulations Framework

With the introduction of the Energy Conservation Act, 2001 and the Electricity Act 2003, the Government of India started efforts in market transformation in energy efficiency. Subsequently, the National Mission for Enhanced Energy Efficiency announced in 2008 provided the framework for initiatives to overcome the challenges that limit energy efficiency investments in India. Over the past few years, initiatives have been introduced to promote:

- adoption of energy efficient consumer appliances through energy labelling;
- design of energy-efficient commercial buildings based on an Energy Conservation Building Code;
- energy conservation in buildings and municipalities through performance contracting by ESCOs;
- market transformation towards energy efficient appliances (such as CFLs) through demand side management programmes;
- enhanced focus on energy efficiency investments in industry due to energy data reporting and bench marking practices. The smart grid initiative is also an evolving concept in India which is targeted for demand side management and integration of renewable resources.

However, there continues to be energy efficiency opportunities that remain unexploited because challenges such as higher first costs, coupled with inadequate information on energy performance of appliances and equipment; financial, technical and transactions risks associated with the adoption of new energy efficient technologies; and split incentives, especially in the buildings sector. The unlocking of this potential is essential to meet national goals of access to energy for all, reduced vulnerability to shocks in energy imports and better urban air quality. Additionally, as a co-benefit, these actions also further mitigate greenhouse gas emissions.

Most of these programs are currently in their initial phases and have shown some very good results. These programs have also provided very useful insights based on the challenges faced during implementation. The challenges are not only institutional but also on availability of adequately skilled manpower in the clean energy domain. The sheer geographic spread and massive regional markets in the country with variations in the agro-climate conditions and demographics require a diverse set of solutions to the introduction of clean energy policies and technologies. The experiences during the last decade has identified several areas where a lot of work needs to be done for example lack of infrastructure in testing of super-energy efficient appliances, the nationally accredited labs; the lack adequately trained manpower for monitoring and verification of the standards of the appliances.

Many major economies can point to successful examples of domestic market transformation for clean energy products, resulting in a dramatic improvement in energy efficiency and cost reductions that allow technologies to enter a growing number of markets. Yet there remains potential for greater, global market transformation within the end-use energy efficiency, renewable energy and transport sectors in all countries. Achieving this potential will require application of good practices at the national level, as well as a step change in international co-operation to increase incentives, remove trade barriers, co-ordinate domestic policies, and harmonize technical codes and standards.

Institutional Framework

The Petroleum Conservation Research Association (PCRA) was set up in 1978 by the Ministry of Petroleum and Natural Gas. The BEE was setup in 2002 by the Ministry of Power to develop policies and strategies on self-regulation and market principles within the overall framework of Energy Conservation Act to reduce the energy intensity of the Indian economy. It was suggested in the Integrated Energy Policy, 2006 to merge PCRA with Bureau of Energy Efficiency (BEE) that is seen as an autonomous statutory body under the Energy Conservation Act.

2. Energy Efficiency Programs

The PAT Scheme

The National Mission for Enhanced Energy Efficiency (NMEEE) is one of the eight missions under the National Action Plan on Climate Change (NAPCC). The scheme was launched in 2011 and Bureau of Energy Efficiency (BEE) has been entrusted with the task of preparing the implementation of NMEEE and to upscale the efforts to create and sustain market for energy efficiency to unlock investment of around Rs. 74,000 Crores. The Mission, by 2014-15, is expected to achieve about 23 million tons oil-equivalent (mtoe) of fuel savings in coal, gas, and petroleum products, along with an expected avoided capacity addition of over 19,000 MW. The carbon dioxide emission reduction is estimated to be 98.55 million tons annually. One of the initiatives under NMEEE is the Perform, Achieve and Trade (PAT) scheme, which is a market, based mechanism to enhance cost effectiveness of improvements in energy efficiency in energy-intensive large industries and facilities, through certification of energy savings that could be traded.

India's PAT Scheme is one the most ambitious energy efficiency improvement project that has ever been implemented in the history of this country. The scope and scale of this program is so comprehensive that it promises to better any other similar programs implemented anywhere globally. The PAT scheme in its first phase of implementation, called PAT Cycle 1 (2012-2015), covers 478 Designated Consumers (DC) in eight industries, namely, Thermal Power Plants, Fertilizer, Cement, Pulp and Paper, Textiles, Chlor-Alkali, Iron & Steel and Aluminum. During the PAT Cycle 1, the total energy saving targets is 6.686 mtoe (million tons of oil equivalent) out of which more than 80% lies in three industries, viz. Thermal Power Plants, Iron and Steel, and Cement with targets of 3.211 mtoe, 1.486 mtoe and 0.816 mtoe respectively.

The PAT scheme, at this initial phase of implementation, has purposefully reached out to the energy intensive sector that is more organized than few other energy intensive sectors while also avoiding some of the more complex energy sectors like refinery and petrochemicals for implementation. This approach has facilitated BEE to focus on development of robust energy management system across the organized sectors by capacity building of manufacturing units, energy auditors (accredited as well as certified), and implementation agencies / state designated agencies (SDA) / nodal agencies.

The PAT scheme's target setting is result of painstaking efforts that ensured the mechanism designed is transparent, flexible and easily applicable to all the industries that are covered by the scheme. The PAT scheme essentially relies on the historical data for energy consumption of the plants vis-à-vis the production of the finished products to provide the Specific Energy Consumption (SEC). This historical data though forms the most integral part for establishing the targets, the challenge was to design a model that would capture all the variables that affect the energy consumption and would almost accurately foretell the SEC capturing the effects of vintage, technology, raw material and other parameters. During the sectorial studies undertaken by BEE, a large bandwidth of SEC was observed, which inferred that not only there is significant potential for improving the SEC but also the effect of variables affecting SEC is predominant. Thus due to absence of homogeneity that is essential to define a single norm/ target for all the Designated Consumers (DCs) in a sector, a "unit specific" target approach was instigated. In the "Unit Specific" target setting, every DC was given a target to reduce its SEC by a certain amount based on its current or baseline SEC in the SEC bandwidth of that sector. Below is the synopsis of the PAT target methodology for thermal power plant sector:

Difference between Plant Heat Rate from Design Heat Rate	Reduction Target
Less than 5%	10%
Between 5% and 10 %	17%
Between 10% and 20%	21%
Above 20 %	24%

The challenge underlying the above task of setting targets and deciding baselines was data collection and scrutiny of the data available; add to this, the fact that not all the DCs had completed the mandatory energy audit. To resolve this issue, BEE adopted two parallel methods, one that was applied for units which had the audit completed and the other for units that had not undergone audits. For the plants which were audited, and had the energy saving measures were identified with implementation plan, the baseline was set based on data made available to BEE (through form 2 and form 3 as per rule 2008). For the plants audits where audits were not conducted, the baseline and targets were formulated taking into consideration, the average rate of reduction in SEC across all DC sectors. Since incentives for energy efficiency is the theme of PAT scheme, the target SEC was intentionally kept a few percentages above the average rate of SEC reduction.

A technical committee reviewed the data made available by the plants and calculated the net energy input by the plant with due consideration to the factors like type of energy, quantum of energy exported / imported, etc. The effects on energy consumption due to capacity utilization, raw material availability, natural disasters, etc. were accounted, if any, during the three years for which the data was available.

The baselines and target SEC were notified to all the DCs and are also published by BEE in the PAT booklet along with the PAT rules. In the next stage, within three months of declaration of PAT scheme(i.e. by 30th June'12), it was expected that the DCs would submit to the SDA an action plan complying to the set targets and SEC along with estimated expenditure and implementation plan. The PAT rules clearly define the Measurement and Verification (M&V) standard, where in, it is essential for plants to maintain quarterly and annual records of information related to energy usage and production.

Within three months of the end of target year, it is mandatory for the DC to submit Performance Assessment Document (PAD) verified by an accredited auditor to SDA and BEE. Based on the SEC achieved in comparison to the target, energy certificates (E-Certs) will be issued to the DC or the DC will have to purchase E-Certs.

Key Challenges to PAT Scheme

Benchmarking

As discussed earlier, the present PAT phase has relied to large extent on the historical data for setting the benchmarks for efficiency improvement. A similar approach has been also adopted by many energy and environment improvement schemes worldwide, for e.g. the Climate Change Agreement in U.K. The reasoning for the this kind of approach most often than not revolves around the fact that benchmarking on historical data accounts for the site specific conditions and thereby easy adaptation / acceptance of the benchmarks by the industry. However with the fast improving technologies in manufacturing and production, it is evident that generally newer plants are more efficient. So, factoring for the best available technology (energy efficiency wise) in the benchmarking is essential. This approach would lead to real market transformation and a sustainable reduction in energy consumption. With modern day statistical tools accompanied by reliable data and process expertise the redefined benchmarking can be made available for existing 8 sectors as well as for any new sector added to the PAT scheme.

Clarity and confidence building

The PAT scheme presently is in an infancy stage and like any other scheme will face teething issues. During this phase, more than ever before, it is the responsibility of the implementation agency to continue engagement in dialogue. It is necessary to build up confidence of the stakeholders and if required hand hold the institutions through the initial year of this phase. The involvement and help of BEE to ensure timely submission of correct data by the DCs is immensely important. Though the industry is aware of the benefits of energy efficient system and its impact on product cost, the unique tradability of energy efficiency, offered by PAT has to be communicated and delved upon, perhaps more substantially than done now.

Failures/ Success of similar schemes

PAT scheme is first of kind ever implemented in India and cross references to similar carbon trading schemes may impact adversely. Some of the organizations which had invested in carbon trading may respond cautiously if the carbon market continues to fall.

Way forward for PAT scheme

Inclusion of more sectors

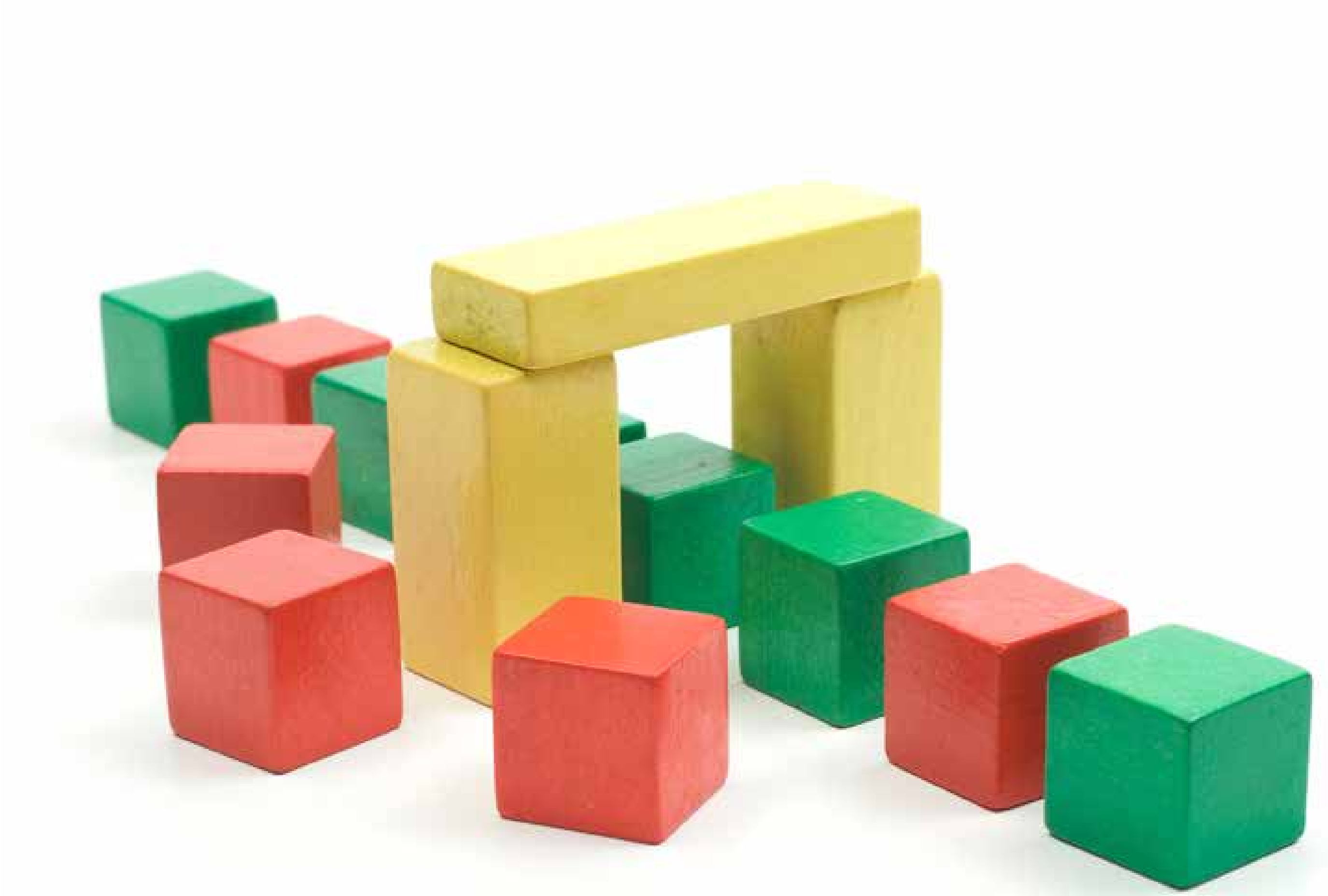
The implementation of Phase 1 of PAT scheme has laid a strong foundation and the same can now be extended to other energy intensive sectors like sugar industry, commercial buildings, chemicals, petro-chemicals, ports, power transmission/ distribution, automobile manufacture, etc. can definitely be included with due attention to the sector specific energy dynamics and energy portfolio. For sectors like petrochemical industry or refineries, to decide the SEC targets, rigorous statistical modeling exercises is required and a greater involvement of BEE and SDAs to facilitate data collection is envisaged.

Lowering the threshold energy consumption

To facilitate inclusion of more number of industries in the selected eight sectors, the threshold limit can be reduced. For example, in the thermal power plants the current threshold limit to be a designated consumer is 30,000 toe which can be reduced to 20,000 toe in the next phase of PAT scheme.

Stiffer Targets

To improve the overall energy efficiency, in the next phase of PAT, the DCs can be given a stiffer than present target; however industry participation and dialogue is extremely importance to define mutually agreeable and realistic targets.



Standards and Labeling (S&L) Program

Standards and Labeling (S&L) program has been identified as one of the key activities for energy efficiency improvements. A key objective of this scheme is to provide the consumer an informed choice about the energy saving and thereby the cost saving potential of the relevant marketed product. The scheme was launched in May 2006 and is currently invoked for 12 equipment /appliances, of which only 4 have been notified under mandatory labeling in January, 2010. The other appliances are presently under voluntary labeling phase. The energy efficiency labeling programs under BEE are intended to reduce the energy consumption of appliance without diminishing the services it provides to consumers. The STAR rating ranges from 1 to 5 in the increasing order of energy efficiency. This program is likely to leads to huge energy savings, reduces capital investment in energy supply infrastructure, enhances the product quality and strengthens the competition, build position for domestic industries to compete in such markets where norms for energy efficiency are mandatory, removes indirect barriers to trade, reduces carbon emission and helps meet climate change goals.

Energy performance improvements in consumer products are an essential element in any Government's portfolio of energy-efficiency and climate change mitigation programs. Energy-efficiency labels and standards for appliances, equipment, and lighting products deserve to be among the first policy tools considered by a country's energy policy makers. Appliance and equipment standards help states meet energy policy objectives while lowering energy bills for consumers. However it is important for local governments and consumers to understand the two main costs associated with appliances and equipment – the initial purchase price and the lifetime energy costs to operate the equipment.

An important feature of Energy Conservation Act, the S&L program in India was initiated in 2006 by BEE through a voluntary comparative labeling scheme for refrigerators and air conditioners. BEE initiated the S&L program in India through a voluntary comparative labeling scheme for refrigerators and air conditioners. BEE's overall strategy is to begin labeling on a voluntary basis and then, as market receptivity increases, transition to a mandatory approach. Labeling is now mandatory for four appliances, including frost-free refrigerators, room air conditioners, distribution transformers, and tubular fluorescent lights. Star labeling is currently voluntary for ten additional products and an endorsement label was later introduced for notebook computers.

In parallel with BEE's efforts to raise appliance energy efficiency levels, there have been initiatives by central and state electricity regulatory commissions which regulate electric utilities in their respective jurisdictions. This has led to some utility-administered programs, mostly for subsidized sale of CFLs, T-5 tube-lights, ACs and fans, where the utility recovers the cost of the programs through the annual revenue requirements which form the basis of consumer tariffs. However, even these utility programs in India are small and should be classified as pilot programs. Further, some of the early programs of CFLs have had high failure rate of lamps and many programs lack proper monitoring and evaluation. In short, the development of utility-administered DSM programs and the shift to efficient appliances in India has been sluggish. Some of the reasons for the slow development are: (1) lack of expertise in DSM in utilities and regulatory commissions; (2) diversion of utility attention by other issues such as electricity shortages and high distribution losses; (3) reluctance of utilities to propose and design programs on their own.

In the year 2009–10 alone, India's S&L program has resulted in electricity savings of 4,350 million kWh, equivalent to avoided capacity generation of 2,179 MW. While the results of India's S&L program have been impressive to date, there are still barriers which need to be addressed before the market can be transformed towards becoming more receptive to energy efficient consumer appliances. Well-designed energy-efficiency standards transform markets by removing inefficient products, with the intent of increasing the overall economic welfare of most consumers without seriously limiting their choice of products. Energy labels empower consumers to make informed choices about the products they buy and to manage their energy bills.

With the Super-Efficient Equipment Program being implemented and more appliances being planned to be introduced in the next phase of S&L program, it is imperative that a detailed analysis of the operating S&L scheme in terms of Standard Setting, Compliance Checking/Verification and Awareness be undertaken. The outcome of this analysis should be used to address the challenges faced and reframe the policies. The Directorate General of Supplies and Disposals, Government of India, is already promoting the procurement of energy efficient appliances in government purchases as a demonstrative example for utilities to follow. All appliances/equipment purchased by Central and State Government should mandatorily be of either Star Labeled appliances or higher energy efficiency level. There is a need to bring about harmonized S&L standards & test procedures and also to enforce a regulatory framework that incorporates punitive actions for non-compliance. There is need to build capacity at State level to ensure compliance. This needs to be developed if program is to be executed at national level.

Another important feature is the laboratory capacity development to support monitoring, verification and enforcement of standards and labels for consumer electronics in India. In order to encourage investments in establishing lab facilities it should become a feasible business proposition. Grant of tax breaks to testing labs and other subsidies would act as incentives to encourage investments in lab facilities. At the same time it is important that the staff should be adequately trained and mechanisms should be established to ensure "independence, reliability and repeatability" of the labs.

One more important aspect is raising awareness among consumers and involving them during S&L program implementation, since they are the ultimate beneficiaries of such programs. Agency problems often arise in rental markets, since landlords may not purchase energy-efficient appliances or make buildings energy efficient if they do not bear operating costs. There could be a possibility of providing incentives to retailers and buyers for creating awareness and improving the penetration levels of 5 star rated appliances. There is also a need for research study on factors affecting the rate of diffusion of energy-efficient technologies. Such studies would provide useful information about the impact of changes in energy prices, changes in capital costs, energy efficiency standards, or technology adoption subsidies. These studies can also provide answers to: Have reforms increased overall energy efficiency? Has labeling promoted the purchase of more efficient appliances, holding other factors constant? Their answers should help policymakers understand consumers' and firms' behavior in the adoption of energy-efficient technologies and thus assist in framing the government policy in this area.

Super-Efficient Equipment Program (SEEP)

Another program under this initiative is the development of Super-Efficient Equipment Program (SEEP). This program is proposed to develop superefficient appliances with an aim to reduce consumption and enable demand side management. The goal is not only to reduce cost of energy efficient equipment but also to stimulate and accelerated market transformation and also to encourage domestic manufacturing to sustain the market. This program is expected to be launched in 2013.

The Super-Efficient Equipment Program (SEEP) is implemented by the Bureau of Energy Efficiency (BEE). The SEEP program has two major objectives clearly cut out, firstly to act as a catalyst to accelerate the shift to energy efficient appliances without affecting the products affordability and secondly to facilitate capacity building of domestic manufacturers for production of the super- efficient appliances. The Standard and Labeling (S&L) Program launched by BEE, laid the foundation for the SEEP initiative. The success and wide spread acceptability of S&L program has demonstrated the sustainability of the demand for efficient products in India which acted as an impetus to SEEP.

Globally, the energy efficient appliances are looked upon as the primary sources for reducing the energy consumption and thereby the energy cost. The S&L program though tries to orient consumers towards energy efficient 5 star appliances; there still remains a wide gap between the energy efficiency of a 5 star appliances and the best in class efficient technology product. It is very obvious to understand that the cutting edge technology that drives the super-efficient technology is more often than not, expensive, due to various reasons that can be as varied as patent related to manufacturing technology requirements. Whatever the reasons for expensiveness of these appliances and equipment, transforming the cost sensitive Indian market to rapidly adopt them based on efficiency alone might not be possible.

However the fact difficult to ignore is that by adopting super-efficient versions of room air conditioners, refrigerators, television sets, and ceiling fans has a potential of saving 60 million units of electricity in 2020 and avoiding a peak capacity addition of 20,000 MW

(Chunekar et al., 2011). In a power deficit country like India which relies heavily on imports of fuel for power generation (including coal), the benefits of reducing the electricity demand by inherently efficient equipment is multifold and multilateral. The urgency to design and implement a program like SEEP was driven not only by the energy saving potential that lies with adopting super-efficient appliances but also the unprecedented growth rate of the demand for appliances. It is reported that the total stock of domestic appliances by year 2020 will have 70% appliance that will have been purchased after year 2010. With a significant shelf life of appliances, to avoid buildup of non-energy efficient stock, it is essential to make available energy efficient appliance at the earliest.

With above view point, the SEEP initiative is being rolled out by BEE and the first product to be benefited by the program is the Ceiling fan. Though ceiling fan is currently covered by the S&L program, benefits of extending the SEEP approach to ceiling fan have many distinct advantages. There is perhaps no other domestic appliance, other than probably incandescent bulb / tube light, that has its presence is almost every electrified home, but even then, it is the most neglected appliance when it comes to subject of energy efficiency. The annual sales of ceiling fan are between 25-30 million and the market is growing at approximately 10% year on year. With such a considerable size coupled to a rapid and consistent growth, ceiling fan is an ideal choice to benefit from market transformation initiative.

Though the conventional S&L program and SEEP have the same objective of creating market transformation, the latter of two is more aggressive initiative. The S&L program is till now a voluntary program for ceiling fans and has not tasted much market success. The 5 star rating, the best efficiency rating under S&L program, specifies a service factor of greater than 4, which means that for an air delivery of 210 cubic meters per minute (cmm) the fan essentially consumes less than 50 W. Not many manufacturers have made these fans available in market, partly due to low demand attributed to higher cost and partly technology migration aspects.

The SEEP program is radically different that S&L program in more than one aspect. The major difference obviously the efficiency level targeted, but that is not all the difference. The SEEP fan specifications tentatively, though not officially available, will have service factor of 6 and thereabout. This means that for the same air delivery of 210 cmm, a SEEP fan will consume less than 40 W. The service factor of 6 may not be available to achieve by traditional fan technology and either energy efficient motors or brushless direct current (BLDC) motors seem to be the options. The technology adaptation will require capital investment from manufacturers who under normal environment will pass on the incremental costs to consumers. With consumers lack of interest observed so far in the star rated fans, it is highly unlikely the SEEP fans will catch on with masses. To break this jinx, SEEP would provide incentives to manufacturers to write off the incremental cost and thereby ensuring that the SEEP fans are available in market to consumers at almost the same price as any other normal fan. It is envisaged that the manufacturers will gradually build up the capacities to manufacture the fans domestically and strengthen the value chain. With the launch of SEEP fans at affordable price, the consumers would rapidly adopt to efficient fans thereby transforming market to efficient appliances only market. With a highly competitive Indian market, it is quite likely that all the manufacturers will catch up with the technology soon.

The SEEP initiative for fans is already in final design phase with BEE completing the consultations with major fan manufacturers, technology experts and policy institutions. The finalization of specification, incentive structure and Measurement and Verification (M&V) strategy is underway. With the present status of the program it can be expected that the SEEP fans are available to people very soon.

The success of SEEP fans will create a strong foundation for launching of other super efficiency appliances like air conditioners, refrigerators and televisions sets. The incentive based SEEP initiative creates a win-win situation for all. The consumer saves on energy cost, the manufacturer gains from the newly created market avenue and the government benefits by cutting of fuel import bill, but on a larger canvas the society benefits from contributions to sustainable future.

Energy Conservation Building Codes

The resurgent India is witnessing an unprecedented growth in the commercial building and floor space. The total building space which was around 21 billion sq. ft. in 2005 is estimated to undergo a fivefold increase to 104 billion sq. ft. by 2030. Following the global clues of approximately 50% of population residing in urban cities, and with an estimated population of 2030, the current building space is sufficient for only 30% population. This means that in the coming 20 years approximately, 70% building space will be added; this is a steep growth and perhaps unforeseen even in the most developed countries.

The Indian building market is a complex environment with a large numbers of players including the government agencies, agents, buyers and sellers. The trade agreements and benefits of each player are different and probably are not motivators for improving energy efficiency. The central or local authority guidelines for building construction result in decision by builders to compromise between cost and energy efficiency. Similarly, a builder might be least interested in incorporating energy efficiency as it is likely that the target buyers for him are not energy conscious. Similarly, a buyer may not be buying the property for himself but with an objective of either to resell (capital returns) or rent (Investment). In the prior case, buyer is not at all bothered about energy consumption as he is definitely not going to pay for energy while in latter case, most often than not the tenant pays for the electricity, so in this case too buyer may not invest more for incorporating energy efficiency in the design of the building. This has led to a total failure of building energy efficiency across the sector.

Presently the building sector consumes approximately 30% of the electrical energy and is annually rising at 8%. With little or no attention to energy conservation measures that can be taken at design stage, inefficiency is profuse in majority of the buildings. With the present trend of energy consumption and energy efficiency levels, for a developing country like India which relies substantially on imports of fuels, the projected growth will indeed by unaffordable if not unachievable.
In 2007, Bureau of Energy Efficiency (BEE) introduced voluntary energy conservation guidelines for building sector, The Energy Conservation Building Code (ECBC). The ECBC was developed by the International Institute for Energy Conservation (IIEC) under a contract from the United States Agency for International Development (USAID) as a part of the Energy Conservation and Commercialization (ECO) Project providing support to the (BEE) Action Plan. Though the code has remained voluntary so far, steps are being initiated to identify, understand and address the issues acting as barriers to widespread acceptance and mandatory implementation of the code.

The ECBC lays down guidelines for following five components,

- The building envelope, that includes walls, windows, doors, roofs, etc.
- Lighting, indoor as well as outdoor, this means use of natural sunlight as well as use of energy efficient electrical lighting
- Heating, Ventilation, Air Conditioning (HVAC) System that includes mechanical ventilation and air conditioning
- Hot water System, mandates use of Solar water Heating
- Electrical System that means measures of reducing the losses in electricity transmission and distribution

ECBC is currently voluntary, but it is proposed that it will be made mandatory for all new building that have a connected load of 100 kW or higher or a contract demand of 120 kVA or higher. The code is also applicable to all buildings with an air conditioned floor area of 1,000 m2 or more. It is expected that by nationwide implementation of the code, annually 1.7 billion kWh of electrical units would be saved.

Apart from the ECBC, National Building Code (NBC), LEED rating and GRIHA rating codes are prevalent. The NBC code is a comprehensive guideline for building but is not mandatory and is more of a model for construction in India. Also the NBC focuses more on design aspects that avoid failure of building in case of natural calamity like earthquake. Similar to the Leadership in Energy and Environmental Design (LEED) USA, LEED – India too provides guidelines for sustainability in five sections, namely, (1) sustainable site development, (2) water savings, (3) energy efficiency, (4) materials selection and (5) indoor environmental quality. The Green Rating for Integrated Habitat Assessment (GRIHA) developed by The Energy and Resource Institute (TERI) moves a step ahead to LEED to address India specific scenario where majority of the buildings are not air conditioned.

Challenges to ECBC

- State wise Adoption:The ECBC code lays emphasis of involvement of state in regulatory and implementation exercise. This requires significant capacity building of the institutions that support energy efficiency at state level, Like the State Designated Agencies (SDAs), Urban Development Department (UDD), Public Works Department (PWD), Urban Local Bodies (ULBs).
- Implementation:The ECBC implementation requires that the building architects, contractors and engineers are well conversant with the code requirements and they have all the necessary measuring instruments to check and verify the energy consumption. The integration of the energy efficiency aspects with the engineering and aesthetics specification is a major challenge and a trade-off may be tried to be maintained. The new workforce of architects and engineers needs to be conversant with the ECBC, perhaps a compulsory course in the academic curriculum is need of hour.
- Testing, Monitoring and Verification: A robust testing facility has to be in place which is well equipped to test all the appliances and evaluate performance of indigenously available building materials, insulation, glazing, window frames, HVAC equipment, lighting systems, etc. Also the monitoring and verification of the savings needs to be strengthened by engaging in a dialogue with all the stake holders.

R-APDRP Programme

The Restructured- Accelerated Power Development and Reforms Programme (RAPDRP), the government's renewed attempt to revive power sector reforms, was launched in the X Five Year Plan.

The focus of the programme is on actual, demonstrable performance in terms of sustained loss reduction. The establishment of reliable and automated systems for sustained collection of accurate base line data, and the adoption of information technology in the areas of energy accounting are the necessary preconditions before sanctioning any regular distribution strengthening project. This will enable objective evaluation of the performance of utilities before and after implementation of the program, and will enforce internal accountability leading to pressure to perform pointers. R-APDRP covers the overall performance of the states as against a particular area. The loan provided under this scheme will be converted to a grant only if it has performed well. Incentive will also be provided to utility staffs in towns where AT&C losses are below 15 per cent. The distribution companies will be required to implement an incentive program for utility employees and a maximum amount of 2 per cent of the grant for the second part of the project is allocated for this purpose.

R-APDRP proposes to cover urban areas - towns and cities with population of more than 30,000 (10,000 in case of special category states). In addition, in certain high-load density rural areas with significant loads, work for separation of agricultural feeders from domestic and industrial ones, and of high voltage distribution system (11kV) will also be taken up. Further, towns / areas for which projects have been sanctioned in X Plan R-APDRP shall be considered for the XI Plan only after either completion or short closure of the earlier sanctioned projects.

R-APDRP is an AT&C loss reduction programme on sustainable basis through systematic measures. The project has two parts

- Part A –IT enabled platform with different levels of communication for major components of the distribution network for energy accounting and consumer service centres.
- Part B – Strengthening and upgradation of the distribution network for increasing the reliability, automation and control

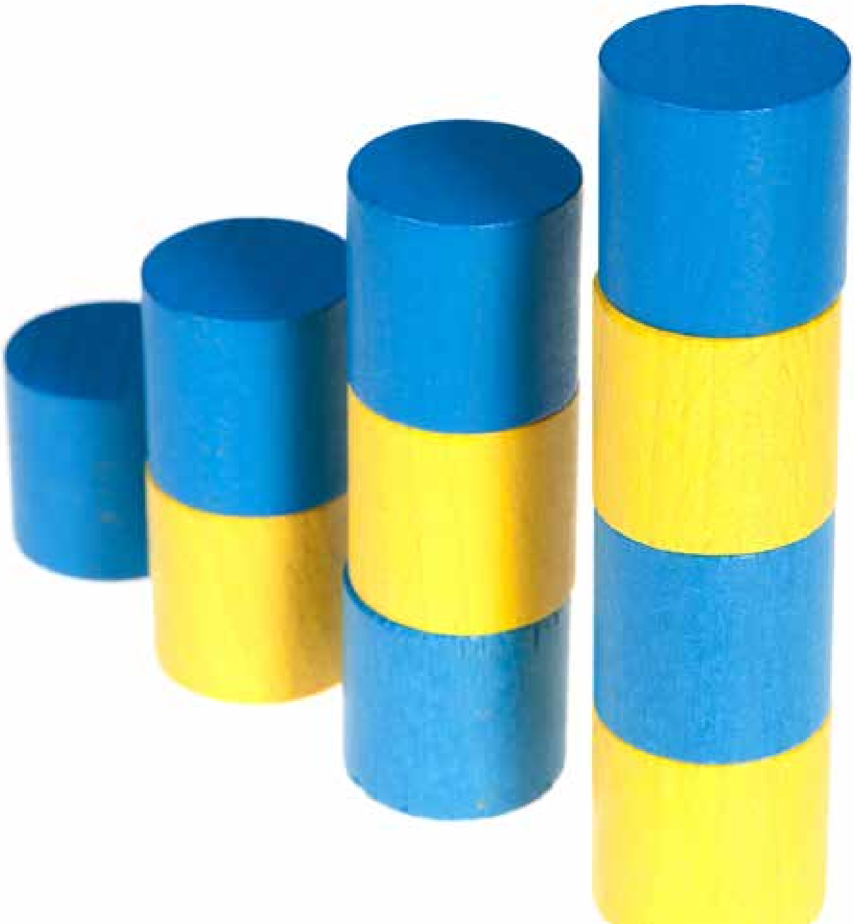
Smart Grid Initiatives

Smart Grid is the modernization of the electricity delivery system so that it monitors, protects and automatically optimizes the operation of its interconnected elements – from the central and distributed generator through the high-voltage network and distribution system, to industrial users and building automation systems, to energy storage installations and to end-use consumers and their thermostats, electric vehicles, appliances and other household devices. Smart grid is the integration of information and communications system into electric transmission and distribution networks. The Smart Grid in large power system is a combination of Energy, IT and Telecommunication Technologies.

The Energy Independence and Security Act of 2007 (EISA) of the US, which directed the National Institute of Standards and Technology (NIST) to coordinate development of this framework and roadmap has indicated the following distinguishing characteristics of the Smart Grid:

- Increased use of digital information and controls technology to improve reliability, security, and efficiency of the electric grid;
- Dynamic optimization of grid operations and resources, with full cyber security;
- Deployment and integration of distributed resources and generation, including renewable resources;
- Development and incorporation of demand response demand-side resources, and energy-efficiency resources;
- Deployment of ''smart'' technologies for metering, communications concerning grid operations and status, and distribution automation;
- Integration of ''smart'' appliances and consumer devices;
- Deployment and integration of advanced electricity storage and peak-shaving technologies, including plug-in electric and hybrid electric vehicles, and thermal-storage air conditioning;
- Provision to consumers of timely information and control options;
- Development of standards for communication and interoperability of appliances and equipment connected to the electric grid, including the infrastructure serving the grid; and
- Identification and lowering of unreasonable or unnecessary barriers to adoption of Smart Grid technologies, practices, and services.

The smart grid delivers electricity to consumers using two-way digital technology to enable the more efficient management of consumers' end uses of electricity as well as the more efficient use of the grid to identify and correct supply demand-imbalances instantaneously and detect faults in a "self-healing" process that improves service quality, enhances reliability, and reduces costs. The emerging vision of the smart grid encompasses a broad set of applications, including software, hardware, and technologies that enable utilities to integrate, interface with, and intelligently control innovations. Some of the enabling technologies & business practice that make smart grid deployments possible include are: Smart Meters, Meter Data Management, Field area networks, integrated communications systems, IT and back office computing, Data Security, Electricity Storage devices, Demand Response, Distributed generation and Renewable energy.



Key Smart Grid Initiatives in India

India has formed Indian Smart Grid Forum (ISGF) & Task Force to study and finalize the smart grid road map. The India Smart Grid Task Force (ISGTF) is an inter-ministerial group and will serve as government focal point for activities related to SMART GRID. Shri Sam Pitroda (Advisor to the PM on Public Information Infrastructure and Innovation) is the Chairman of this task force.

The main functions of ISGTF pertaining to Smart Grid are:

- To ensure awareness coordination and integration of diverse activities related to Smart Grid Technologies.
- Practices & services for research & development of SMART GRID.
- Coordination and integrate other relevant inter-governmental activities.
- Collaborate on interoperability framework.
- Review & validate recommendations from India Smart Grid Forum etc.

Five Working groups have been constituted to take-up the different task related to SMART GRID activities i.e.

- WG1 – Trials/Pilot on new technologies.
- WG2 – Loss reduction and theft, data gathering and analysis.
- WG3 – Power to rural areas and reliability & quality of power to urban areas.
- WG4 – Distributed Generation & renewable.
- WG5 – Physical cyber security, Standards and Spectrum.

Currently there are 14 smart grid pilot projects that are being tried out in various states across the country with the objective of testing various technological concepts such as advanced metering infrastructure for residential and industrial consumers, outage and peak load management, power quality management, micro grid and distributed generation.

The India Smart Grid Forum is a non-profit voluntary consortium of public and private stakeholders with the prime objective of accelerating development of Smart Grid technologies in the Indian Power Sector. Governance of the Forum would be overseen by a Board of Governors / Directors. Two of the representatives are from Ministry of Power and Power Finance Corporation .The goal of the Forum would be to help the Indian power sector to deploy Smart Grid technologies in an efficient, cost-effective, innovative and scalable manner by bringing together all the key stakeholders and enabling technologies. The ISGF is expected to coordinate and cooperate with relevant global and Indian bodies to leverage global experience and standards where ever available or helpful, and to highlight any gaps in the same from an Indian perspective.

Key Drivers for Smart Grid Initiatives

Aggregated Technical & Commercial (AT &C) Loss reduction

In response growing concern about AT &C loss across all power distribution utilities India, Smart Grid Technology will contribute to reduce the losses to achieve the target goal of AT&C loss around 15% across all utilities against presently 30 to 35%. It will do by collecting data through AMI (Automated Metering Infrastructure), cleansing and analyzing the data through MDM, developing energy audit mechanism to identify the loss prone areas, and finally reduce the losses by applying effective energy conservation measures.

Consumer Price Signals

Smart Grid aims to create an understanding among consumers that pricing of electricity varies significantly during the day. Facilitating consumer readily accesses it and which will influence their behavior, encourage initializing the wiser use of energy.

Integration of Renewable Energy Sources

The two most common form of commercial renewable energy available in India are Wind and Solar. Both are intermittent and tend to be geographically dispersed than conventional generation. In this case smart grid will help the utility to deal with this nonconventional energy sources, especially when these resources are becoming prevalent in India.

Key Focus Areas for Smart Grid Initiatives in India

Following are the important areas where needs technological development as a part of smart grid initiative in India:

Advanced Metering Infrastructure

The Indian Power Distribution utilities had a wide array of meter reading practice but virtually no AMI capable systems the following meter reading capabilities were identified:

- Most meter reading systems are manual or handheld based

- Advanced Metering Infrastructure provides utility companies the opportunity to enhance customer service and improve operational efficiency. The opportunity brings with it a set of inherent security risks that need to be mitigated for ensuring the success of an Advanced Metering Infrastructure. The driving forces for an Advanced Metering Infrastructure (AMI) program for utilities as follows:
  - Empower utilities to get information in real time of consumption patterns and use this data to plan for demand thereby increasing efficiency
  - Automate the aggregation of meter data
  - Remote management of meters to detect outages and prevent theft
  - Provide consumers time-based pricing options and therefore effectively manage demand

Meter Data Management

Meter Data Management (MDM) is a relatively new concept to Indian power utilities. The approach for the MDM system is to implement a multi-location instance that would allow individual utility to take advantage of the system by allowing view a subset of the collected data from all of the Locations after integration with AMI system.

Geographical Information System (GIS)

GIS application not yet fully implemented in power utility sector in India. GIS widely recognized for its strong role in managing the transmission and distribution network GIS will likewise play a strong role in the smart grid for the utilities. GIS already provides most comprehensive inventory of the electrical distribution network components and their spatial locations. GIS can provide a spatial context to the analytics and metrics of Smart Grid. With GIS utilities can track the metrics over time and provide a convenient means of visualizing trends.

Enterprise Asset Management

The Enterprise Asset Management (EAM) system forms an integral part of the management process in a utility businesses and hence there is significant role of EAM system to cope the Indian utility businesses in competitive market, and is one of the most critical areas. It deals with the management of total life cycle of asset in a utility businesses related to investment planning, construction, operation, maintenance and disposal of asset. The results are then used for asset performance analysis to help further decision in investment, operation & maintenance. At various levels, management information reports need to be extracted to communicate the required information across various levels of management. The core processes of enterprise asset management involve a huge amount of paper work and manual labour, which makes it tedious, time-consuming and prone to human errors. Moreover, the time taken at each stage as well as the transparency of the relevant information has a direct bearing on the economics and efficient operation of a utility business. Both system performance and information transparency can be enhanced by designing & developing a software system for a complete IT solution for the managing the core business processes of asset management of Indian power utility businesses.

Distribution Automation

The distribution networks in the Indian power sector has grown quite rapidly over the last decade not only in terms of size but also in complexity leading to increased work load and inefficiencies. Continuing with conventional manual systems is no longer an option as it will increase its operation and maintenance costs also result in consumer dissatisfaction due to poor quality of service rendered and increased Aggregated Technical & Commercial (AT&C) Losses. Enactment of the electricity Act 2003, has mandated large the power distribution utilities to plan a clear road map towards achieving Distribution Automation. An integrated Distribution Automation system enables Indian power utilities to have real time control over the costly energy sold.

Customer Relationship Management (CRM)

Customer management, particularly regarding increased availability and reduced commercial losses, is key driver for the smart grid. Integrating customer relations management (CRM) and advanced metering infrastructure (AMI) data will be a key enabler here, as it will help derive the benefits of optimized capacity utilization and system performance. Up-to-date load data at each feeder section are required along with customer load profiles in order to develop auto fault detection, location isolation, and service restoration. In addition such data will help evolve fault isolation and service restoration switching sequences for premium customers. This integration will also enable utilities to set up quick response teams that will improve demand response (DR) and lead to the integration of AMI/DR in systems planning and engineering. Coincident load data for optimized load balancing and the potential for using AMI for end voltage monitoring will help complete the load profile data for estimating and minimizing technical losses. An important aspect of CRM is customer awareness (education) and participation. Customers will be important stakeholders in the smart grid and they will need to be more aware of the risks involved.

Automated Call Centre

At present, the complaint handling process in India is weak, resulting in decreased customer satisfaction. The automated call centers will allow utilities to integrate customer information, address customer queries and complaints, and provide basic information about office locations, billing information, bill payment centers, modes, connection status, service levels, planned outages, and information on efficiency programs, among others. These initiatives will help utilities measure and drive customer satisfaction, and make customers more aware of opportunities for energy efficiency. They will also help utilities track consumption patterns and payments. In addition, the databases maintained by the centers would enable quick-start smart grid implementations, through targeted programs for home area networks and smart appliances projects to increase availability and reduce commercial losses.

Utility portals

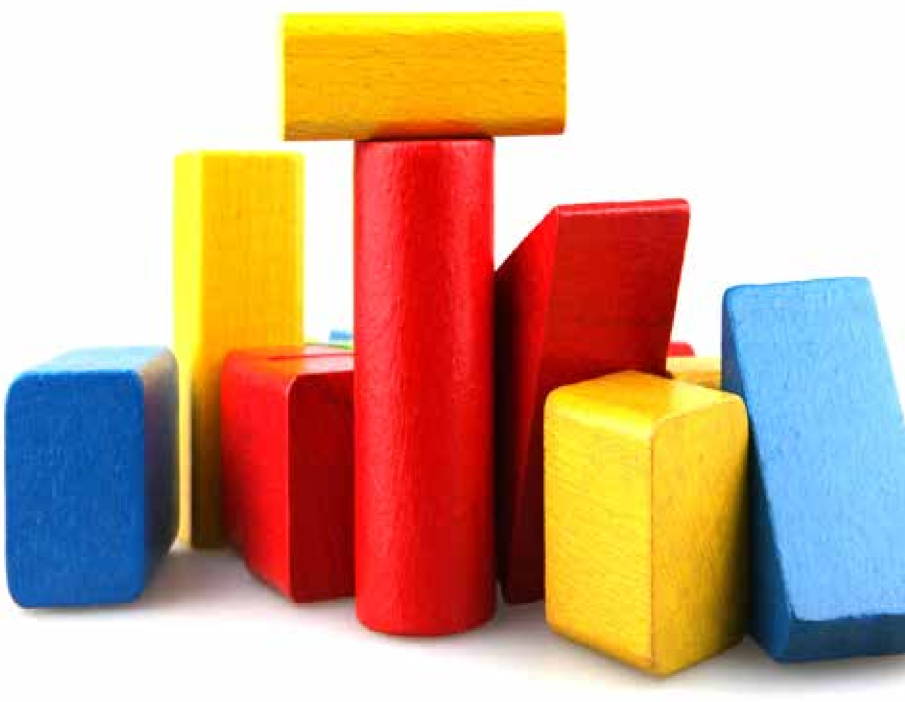
Utility portals (interactive websites that are linked to the call center databases and help customers log directly into websites. Their objectives are similar to those of the automated call centers and give customers another medium for interacting with the utility.

Renewable energy

Wind generation, small hydro, micro hydro, solar and similar supply-side technologies need to be integrated into the power system network. Smart control devices are needed to connect these renewable energy sources to the power grid, and exchange information and commands with the energy dispatch center.

Demand Response

Smart grid applications allow electricity producers and customers to communicate with one another and make decisions about how and when to produce and consume. Emerging technology will allow customers to shift from an event-based demand response where the utility requests the shedding of load, towards a more 24x7 based demand response where the customer sees incentives for controlling load at all times. Smart grid applications increase the opportunities for demand response by providing real-time data to utilities and consumers, but economic incentives remain the driving force behind this practice. The foundation for this would again be having accurate customer profiles with load, consumption pattern and asset data so as to be able to evolve customer segmentation and develop business cases for supporting each of those categories with different plans and incentives.



3. Financing Models for Energy Efficiency under NMEEE

The National Mission on Enhanced Energy Efficiency (NMEEE), as a key component of National Action Plan on Climate Change (NAPCC), reflects GoI's increased and renewed emphasis on achieving energy efficiency in the Indian economy. In its implementation plan, the Mission seeks to upscale the efforts to create market for energy efficiency, estimated to be about Rs. 74,000Cr. Under this ambitious initiative, one of the key components of NMEEE consists of "Creating and Promoting the energy efficiency financing platform, setting up Partial Risk Guarantee Fund for Energy Efficiency and Venture Capital Fund for Energy Efficiency, and developing innovative financial derivatives of performance contracts and fiscal and tax incentives for investment in this sector."

Currently the Partial Risk Guarantee Fund and Venture Capital Fund for Energy Efficiency are available only limited to Government Buildings and Municipalities in the first phase. The Ministry of Power has recommended that the Government of India must promote a corpus of funds from its budget for setting up the VCFEE as well as the PRGF. This fund is to be managed by the institutional framework of EESL that is also been recommended herein. International experiences surveyed by the Ministry indicated government leadership in promoting such funds to promote markets for energy efficiency. These funds have been used for both risk capital as well as for guarantees.

Partial Risk Guarantee Fund for Energy Efficiency (PRGFEE)

The Partial Risk Guarantee Fund for Energy Efficiency (PRGFEE) is a risk sharing mechanism to provide commercial banks with a partial coverage of risk involved in extending loans for energy efficiency projects. The Guarantee provided by the fund will directly support financing of energy efficiency projects by:

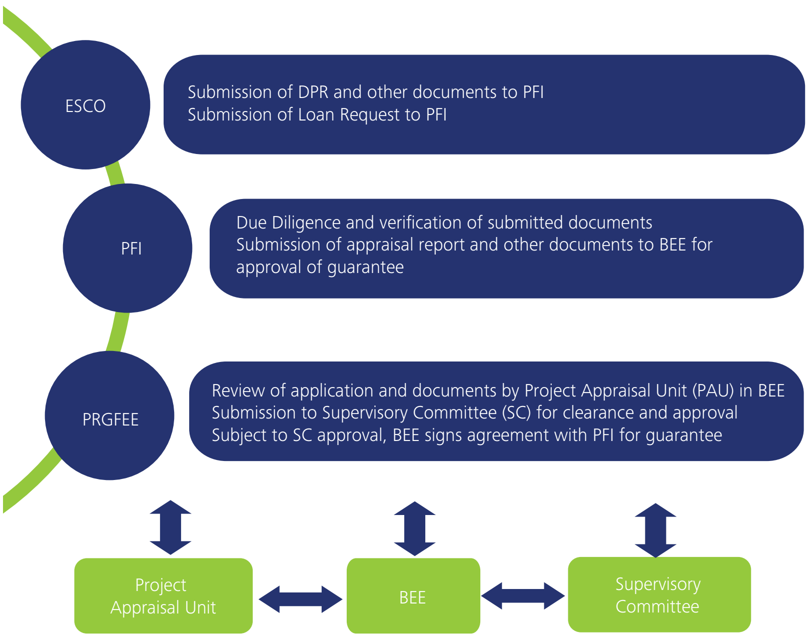
- Addressing credit risk and barriers to structuring the transactions involved in financing energy efficiency projects and
- Engaging commercial financial institutions and building their capacity to finance energy efficiency projects on a commercially sustainable basis

PRGFEE guarantees a maximum 50% of the loan (only principal). The Guarantee will not exceed Rs.3 Crore per project or 50% of loan amount, whichever is less. In case of default, the fund will:

- Cover the first loss subject to maximum of 10% of the total guaranteed amount
- Cover the remaining default (outstanding principal) amount on pari-passu basis up to the maximum guaranteed amount.

Institutional framework for PRGFEE

- In case of PRGFEE the fund shall be managed by BEE and a Project Appraisal Unit (PAU) shall carry out the due diligence for the documents duly submitted by the Participating Financial Institution (PFI). The PAU shall deliver its submissions to the Supervisory Committee (SC) for final clearance and approval. Subject to the SC approval, the BEE shall sign the agreement with the PFI which in turn shall provide the loan to the ESCO.
- The following figure provides a snapshot on the Guarantee Mechanism of PRGFEE.



Venture Capital Fund for Energy Efficiency (VCFEE)

The Venture Capital Fund for Energy Efficiency (VCFEE) is expected to meet the requirement of equity investments through venture capital in the energy efficiency projects. This will ease a significant barrier from the viewpoint of risk capital availability to the Energy Service Companies (ESCOs). In addition the VCFEE shall try to address the following:

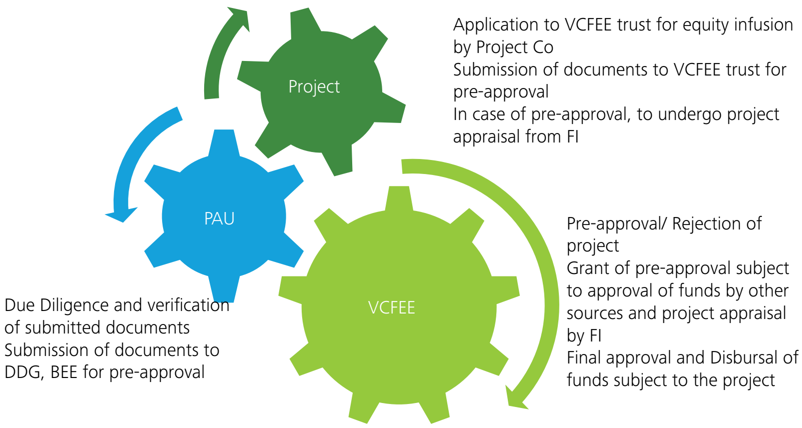
- lack of established Venture Capital firms specializing in energy efficiency projects in India;
- poor success rate of R&D by research institutions in spinning out effective technologies;
- unfamiliar risk profiles of energy users and energy service providers such as ESCOs;
- business environment barriers discourage entrepreneurship; and
- general deficiency in awareness in and expertise for energy efficiency projects among financial institutions.

Institutional framework for VCFEE

Generally, venture capital funds are raised from a wide range of sources with high risk appetite, and are used to finance new technology development. Their focus is on early-stage company development and funds are provided in exchange for equity in the company. The investment horizon ranges from 4 to 7 years. There is a high risk of failure, so venture capital funds seek internal rates of return (IRR) of 50% to 500%. This aspect has to be kept in mind while deciding the risks and other aspects that may have been considered by BEE and the Ministry of Power.

- In the case of VCFEE, the fund shall be managed by an independent VCFEE Trust which shall be a legal entity defined by a Trust Deed.
- The governance structure of VCFEE envisages the project company to submit an application to the VCFEE Trust along with other project appraisal documents for pre-approval of fund disbursement/ equity infusion.
- The Project Appraisal Unit (PAU) which is the Fund Manager for VCFEE shall carry out the due diligence of the documents and submit its report to the DDG, BEE for pre-approval
- VCFEE Trust shall accord pre-approval based on its guidelines and subject to funding by other sources in the project
- The project company shall submit the project appraisal letter to the VCFEE for disbursal and final approval of equity.

The following figure provides a snapshot on the Fund Disbursal Mechanism for VCFEE.



4. Market Transformation in the Transport Sector

In pursuance of the decision by PMO regarding the introduction of Fuel Economy Labels & Standards for Passenger Cars in India, extensive consultations were carried out by the Ministry of Power (MoP), Ministry of Road Transport & Highways (MoRTH), Department of Heavy Industries (DoHI), Bureau Of Energy Efficiency (BEE) and Society of Indian Automobile Manufacturers (SIAM). Based on these consultations, a consultation paper was prepared (in November 2011) outlining the Passenger Car Fuel Economy Labeling & Standards Framework. Various stakeholders provided their inputs in designing the Standards and labeling program, which were used to specify standards and arrive at the Star program in early 2012.

During the last decade the fuel consumption by Indian car fleet tripled, 0.698 million cars sold in 1999-2000 to 1.88 million cars sold in 2009-10. The average of weight cars sold during the last decade also increased, with 987 kg in 2006 to 1037 kg in 2009 (source: Society of Indian Automobile Manufacturers, SIAM). It is anticipated that if the present trend continues, the annual car sales in 2020 would increase to over 5.5 million per year. The annual petroleum fuel requirement would exceed 25 million ton of oil equivalent. Keeping in mind the pollution hazards due to vehicular emissions, and the increasing import dependency of fossil fuels the Government of India decided to send strong signals to the car manufacturers and users to improve fuel efficiency in the new cars.

The approach adopted by the Government of India is two pronged (a) regulatory signals to manufacturers to continuously reduce the average fuel consumption of cars sold in the Indian market over the next 10 years and (b) to introduce labeling for all new cars that are sold in the Indian market. It is expected that the labeling program will be introduced from April 2013. This strategy is expected to provide a market pull for high efficiency cars and a supply push to enable large scale transformation in the automobile market.

Under this car labeling programme, the car manufacturers will have to continuously reduce the average fuel consumption of cars sold by them over the next 10 years. BEE hopes to achieve the reduction in fuel consumption per 100 km from the present 6 litres to 5.1 litres by 2016 and up to 4.4 litres per 100 km by 2021.

It was found that only 9 to 16 per cent cars are fuel efficient in India. With increasing average weight of the cars, their fuel efficiency is being affected. A consultation paper also revealed that of the total 330 car models in India, only 32 fell within Five-Star category, while 52 fell in Four-Star category. As per the BEE's assumption, cars in Five-Star category are those which roughly consume up to seven litres of fuel for 100 km. Those consuming between seven and nine litres fall in four-star category whereas those between nine and 11 litres per 100 km belong to the three-star category. Cars consuming 12 litres of fuel for 100 km and beyond are in the One-Star category. Primary findings of BEE reveals that 105 car models fall in Three-Star category, 69 car models belong to Two-Star category and 72 Car Models belong to One-Star category.

The study also revealed that the sale of 1-star and 5-star models contributes the lowest between 62 and 72 vehicles per 1,000 vehicles and the sale of Four-Star car models contributes the highest at 625 in 1,000 vehicles. Two-Star and Three-Star rated car models are selling at 535 to 585 cars among 1,000 vehicles each.

Transformation at the Manufacturers End

The standards specify fuel consumption norms that manufacturers have to meet. Compliance with this standard would require manufacturer to invest in new technology and production lines. Manufacturers would therefore require investing in new technologies and up-grade their production lines to meet the new standards. The standards are therefore being specified for the sales that occur in the fiscal year 2015-16 and 2020-21. It is expected that the standards in 2015-16 can be met through fine tuning and optimization of current designs; whereas the 2020-21 standards would require complete re-designing and retooling. These time frames reflect the technological change cycles inherent in the automobile industry, and therefore, it is expected, that with management focus and prioritize investments.

Corporate Average Fuel Consumption (CAFC)

Since manufacturers make several models to meet their consumers' requirements and hence have different fuel efficiencies it was decided that a maximum energy consumption standard is specified so that no model consumes more than the maximum consumption standard. This specified as Corporate Average Fuel Consumption (CAFC). Each of the manufacturers needs to ensure that they meet their CAFC of all cars sold by them, except those exempted under CMVR (Central Motor Vehicles Rules, 1989 and its amendments). The 2020-21 CAFC standards reflects fuel efficiency achievements that can be obtained with complete re-designing and re-tooling, along with higher nationwide availability of higher quality Euro V or higher grade fuel.

Implementation

The mandatory CAFC standards and labels for 2015-16 and 2020-21 would be notified by the Ministry of Power under the Energy Conservation Act and the notification would be provided for their implementation by the Ministry of Road Transport and Highways. The Ministry of Road transport and highways would issue a TAP document under the Motor Vehicles Act, which would provide the technical regulations for the implementation of the standards. The fuel consumption would also be measured for each model during the tests which are carried out to ensure conformity of production with the type approval on a regular basis. The manufacturers would provide annual sales data to the Ministry of Road Transport and Highways, which would compute the average kerb-weight of the car sales during the year for each manufacturer, and the corresponding CAFC. The computed CAFC would be checked for compliance against the 2015-16 and 2020-21 standards at the end of those target years. Failure to comply would lead to penalties under the Energy Conservation Act. The notification of this program will be done by BEE and the implementation will be done by the Ministry of Road Transport & Highways.

5. Discussion Points

This write-up primarily captures the key energy efficiency initiatives and their status in India, particularly driven by the Ministry of Power. The last decade saw several new initiatives being introduced, as well as provided new insights which provided valuable feedback for course correction. Energy efficiency challenges are not merely restricted to technology but also to markets, behavioural aspects as well as innovations in financial, regulatory and policy. Globally, several new initiatives have also been introduced driving market integration and transformation. The following are some key questions which need to be addressed to bring about a more rapid market transformation in Energy Efficiency:

PAT

- The first phase of PAT is already under implementation and the key lessons from the first phase should be incorporated while designing the phase II. The next phase would also involve more complemx sectors like Refinery and Petrochemicals. What have been the key learnings and implementaiton issues and what should be done to overcome them during the Phase II?
- Has BEE developed sufficient institutional capability to monitor and evaluate the phase I implementation by Designated Consumers (DCs)? What has been compliance record of DCs?
- There has been a general concern of DCs on the fate of PAT as a result of fall in carbon trading prices and the alternate market mechanisms being develpoed for the clean energy (like RECs). What has been the response of BEE to address some of these concerns?
- BEE has adopted an "average of last three years" as benchmark and target setting methodology for few sectors. Are there any concerns raised by DCs and still pending to be resolved by BEE?
- In PAT phase-I the concept of setting baselines did not consider the normalization factor which was meant to account for the vintage, raw materials etc. to account for the variation in specific energy consumption, how can one be sure that the baseline that has been set is acceptable? In many cases the designated consumers have a variation in the third decimals.

Standard & Labelling

- What obstacles prevent expansion of mandatory labeling to hereto voluntary labeled appliances?
- What measures are required to be taken to narrow the gap between the best achievable technologies and present 5 star technologies for various appliances?
- What are lessons learnt till date that will help in future S&L or other energy efficiency initiatives?
- "Increase the number of appliance under S&L scheme or implement stricter norms for currently selected appliances" Which approach is beneficial?
- How can BEE be equipped to enforce compliance of the S&L norms? Grey markets in most electrical appliances are quite pre-dominant in many cities, how can one tackle this enormous problem?

Super Energy Efficient Program (SEEP)

- How does an incentive based market transformation scheme like SEEP be relevant and necessary when already the S&L scheme is yet to gain momentum?
- Will SEEP accelerate the market transformation of energy efficiency appliances and equipment towards super energy efficient programs?
- What kind of institutional arrangement will be required to have global cooperation in R&D so that costs of developing super energy efficient technologies become affordable and accessible to countries at affordable prices?
- Implementing SEEP programs require new skill sets on a much larger scale if most appliances and equipment are to be brought under its ambit. For example sophisticated testing facilities, integrating the national standards with global standards and other relevant bodies etc. How can this be formalized?

ECBC

- Presently we have National Building Code (NBC), LEED, GRIHA, and ECBC prevalent simultaneously and perhaps competing with each other. How this has impacted implementation of ECBC? Is there a possibility to converge various building codes into a common code?
- What additional capacity building measures are identified for state agencies as well as builders and architectures?
- Before expanding the scope of ECBC, how does the government plan to remove the obstacles that have prevented mass acceptability?
- What capacity building programs of various stakeholders like builders, architects, financiers etc. are now being addressed to meet the rapid growth rates in the residential and commercial sectors?
- Integrating renewable energy technologies in buildings, the concept of green buildings, etc. require a multi-disciplinary approach while considering local

agro-climatic conditions how are these concepts introduced to the students or new practitioner?

Smart Grid

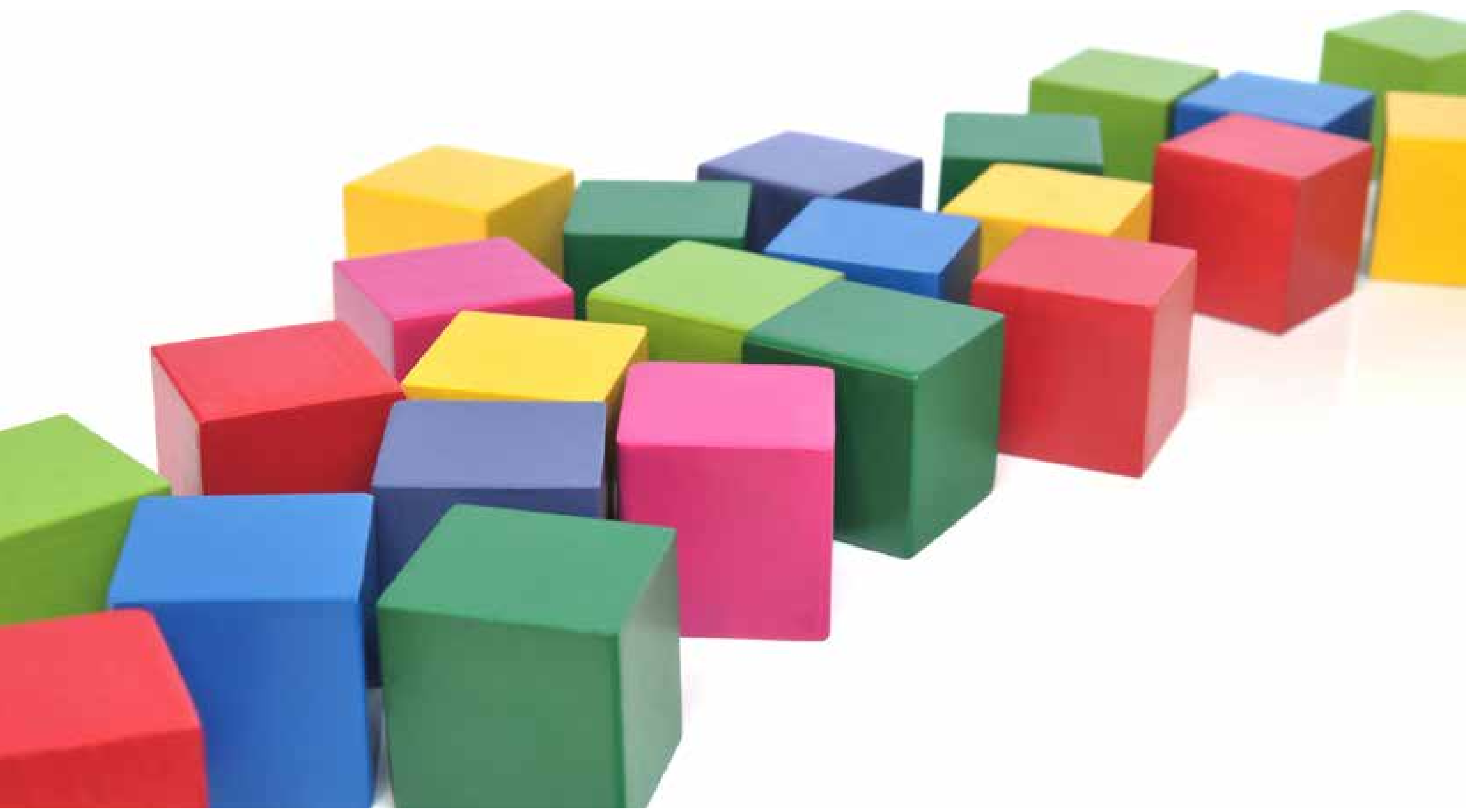
- Introduction of smart-grids may be the panacea but are the DISCOMs adequately equipped to address the challenges of implementing them?
- It has been identified that agricultural loads and substandard equipment used in rural areas are responsible for high losses. What role can the DISCOMs play in ensuring that the relevant standards are met and also introduce distributed generation in remote areas?

Financing initiatives

- One of the major challenges is financing of EE measures, most companies would not like to finance them as they perceive the benefits insignificant even if the payback is 3 years or less. What innovative financing mechanisms can make it happen?
- Although the concept of ESCOs has been around for a few decades it has still not taken off in India. How can this be made very lucrative business especially when there is immense energy savings potential?
- How do can the capacities of financial institutions/ commercial banks be enhanced to evaluate EE projects?
- Are monitoring and verification of energy saved is the key issue in most EE projects?
- How can Venture capital play a more proactive role in financing EE projects?

Institutional Issues

- There seem to be a lack of an integrated approach to provide rationale and cost-effective energy solutions across the economy. What steps needs to be taken to evolve an integrated mechanism for energy efficiency programs across different sectors?
- Is there a need to enhance the role of the power sector regulators to facilitate the implementation of the Energy Conservation Act?
- Is BEE structured and staffed to address the goals mandated upon it?



6. Annexure: Case study on market transformation for energy efficiency[1]

Case study: electric motors

Electric motors convert electricity to mechanical energy to undertake innumerable types of work. Motor driven systems are widely reported as using more than 40% of all global electrical energy. The savings potential for standards on motors alone are significant, but a far greater amount (as much as 20% to 30%) of electricity could be saved through global specifications for driven device standards as well as motor system optimization.

Market transformation efforts for motors began in Canada in 1988 and spread gradually to other countries over the next two decades. These original efforts included testing, databases of product efficiency, high-efficiency specifications, educating motor purchasers and financial incentives, which effectively established many of these policies tools within end-use equipment programs.

Minimum efficiency performance standards began in Canada and the United States in 1995 and 1997 respectively and have been adopted in quite a few major countries subsequently (especially in recent years). While there was extensive national consideration of overseas developments in many countries, international co-ordination was mostly informal and occurred without widespread high-level political endorsement. As a result, it probably took longer for the higher standards to spread from one country to another (for example, European standards did not become effective until 2009).

In 2008, the International Electrotechnical Commission adopted an efficiency specification that unifies the many national standard schemes. Under this scheme, new technology developments like a new super-efficient class of motor, IE4 level will be settled providing a sound foundation for future international efforts and national regulation. With accelerating engagement by developing and developed countries, this product type is a prime candidate for enhanced global co-operation.

Individual countries informally following the lead of Canada and the United States gradually improved the efficiency of motors being sold on their markets. Yet since this co-operation was informal, it probably took longer for the higher efficiency products to spread from one country to another. The International Electrotechnical Commission (IEC) decision to develop a new specification unifying the many regional standards now provides a common foundation for future international and national efforts. Such a foundation will make it easier for countries to adopt new internationally aligned standards as they are adopting an international specification, and to benefit from the achievements of the pioneering nations. This international specification includes several performance tiers, so individual nations can choose the level that best meets their needs and capabilities while remaining within the global scheme.

The opportunity

Electric motors account for nearly half of worldwide electricity use, including about 70% of electricity used in the industrial sector (Nadel et al., 2002). Efficient motors can convert more than 95% of the energy in the electricity into useful work. Motor efficiency can be dependent on output and size – it is easier for larger motors to achieve higher efficiencies.

Higher efficiencies however are also achieved with motor design including higher quality steel cores, improved quality and quantities of windings, superior bearings, better fans, and related technological improvements. However, improving motor efficiency costs money for better quality materials and for improved design and production processes. More efficient motors tend to be somewhat larger than less efficient motors with the same output and have higher speed.

With increase in energy prices, manufacturers responded by developing higher efficiency motors. Today, in most international markets, there are commonly three efficiency classes for motors – standard efficiency, high-efficiency and premium efficiency. In developing countries, older motor designs with sub-standard efficiency are still often available. In 2008, the International Electrotechnical Commission (IEC) finalized a standard defining these three classes with less efficient motors left outside the rating scheme. The classes are labeled IE1 (standard), IE2 (high) and IE3 (premium), with minimum efficiency levels specified for each motor output level.

Overall, energy savings from using more efficient motors can range from about 1-12%, depending on motor output and efficiency class. While the percentages do not appear especially high, the energy savings can be enormous since motors often run for 4 000 hours per year or more. The IEA estimates that there are about

1 Adapted from "Transforming Global Markets for Clean Energy Products" – © OECD/IEA 2010

193 million motors with an output of 0.75 kW or more in use in the European Union plus eleven other major economies (United States, China, India, Brazil, etc.) (Waide, 2010).

Market transformation efforts

Given the large energy savings available from efficient motors, market transformation efforts for this product type were one of the first efforts of many nations. They began in the United States and Canada in the 1980s and have spread to Australia, Europe, and China and continue to this day in these and other countries.

North America: The first Canadian effort consisted of four components: 1) educational efforts to provide customers and dealers with information on high efficiency motors – their economics and availability; 2) customer incentives to pay part of the incremental cost of high efficiency motors; 3) vendor incentives to encourage vendors to routinely stock and promote high efficiency motors; and 4) support for efforts to enact national minimum efficiency standards. As a result of the first three components, high efficiency motors had gained a 70% share of the new motor market in 1993, up from approximately 5 percent in 1987. In 1992/93, the utility reduced the incentives by just over 10% but market penetration held since by then dealers routinely stocked (and many customers routinely requested) high efficiency motors. Provincial efficiency standards were subsequently introduced and B.C. Hydro phased out their promotional activities (Nadel, 1996). Following this model, similar efforts in Ontario, Canada and several US states achieved similar market transformation impacts.

An important underpinning of these efforts was the adoption of a test procedure, CSA 390/IEEE 112 Method B that included all motor inefficiencies and therefore allowed a fair comparison of motors. The market transformation efforts used this foundation to begin widespread testing of motors for efficiency, comparison of test laboratories to improve replicability of test results across laboratories, and compilation of several databases listing motors from multiple manufacturers, including their efficiency. The testing allowed motors to be compared to one another. The databases were useful for setting specification levels for high efficiency motors, for establishing incentive levels, for manufacturers to know how their products compared to specification levels and their competitors, and for motor purchasers to be able to compare products.

In the United States, as market share for high-efficiency motors rose, several states considered adopting minimum efficiency standards. Ultimately motor manufacturers and energy efficiency supporters negotiated a consensus agreement that called for US-wide minimum efficiency standards to take effect in 1997, with the standards based on a high-efficiency motor specification developed by the National Electrical Manufacturers Association (NEMA). The US Congress enacted this standard in 1992, and it covers approximately 65% of sales of 1-200 horsepower (.76-149 kW) motors (certain specialized motors are excluded), (Nadel et al., 2002). Shortly thereafter, the Canadian government adopted essentially the same standard, effective 1995. And following the signing of the North American Free Trade Agreement in 1994, Mexico adopted the same standard, effective in 2003.

Following the effective date of their high-efficiency standard in 1997, multiple US utilities and states developed a new “Premium Efficiency” specification, based on the best products on the US market, and began to promote this specification through education efforts as well as incentives. Market share for premium motors rose to approximately 20%. At this point, motor manufacturers approached efficiency supporters about increasing the US minimum to premium efficiency levels. Agreement was reached and the US Congress passed the new standard in 2007, effective late 2010. This agreement and law also included provisions to require high (but not premium) efficiency levels for 200-500 horsepower motors (149-373 kW) and for some of the specialized motors excluded from the original US standard (Elliott, 2007). Canada is in the process of adopting the same standard effective 2011 (NRCan, 2010). Mexico has also begun to revise their standards.

Australia and New Zealand

Australia started developing motor standards in the late 1990s. This was a joint federal/state effort under the leadership of the Australian Greenhouse Office. Originally work focused on developing standards that would eliminate 40% of products with the lowest efficiency from the market. However, the European voluntary Eff2 values were published around the same time and because the Eff2 value was very similar to the draft Australian 40th percentile values, Australia decided to use Eff2 for their mandatory standard and Eff1 for their voluntary "high efficiency" standard. This decision to modify the original performance proposal was made on the grounds of facilitating trade and international alignment (Marker, 2003). New Zealand began considering standards as far back as in 1994, but later concluded an agreement with Australia to generally co-ordinate on standards activities. All standards committees now have both Australian and New Zealand Government appointees, and the two countries fully co-ordinate standards including the same test methods, standard levels, and mutual recognition of test results. The first electric motor Australian and New Zealand standards took effect in 2001 (Cogan, 1997 and 2003).

In 2002, Australian and New Zealand government officials decided that further improvements could be made, as the 2001 levels were substantially behind those of the United States and Canada, and began the process of developing a new standard. Both countries had adopted a policy of matching the best standard in effect elsewhere in the world, subject to the maintenance of competition in local markets, a positive cost benefit exercise and the production of a satisfactory regulatory impact statement (covering the economics of the new standards and the ability of manufacturers to meet the standard – Marker, 2003). The new standard was finalized in 2005 and took effect in 2006. It mandated standards based on the 2001 high efficiency values and included a new set of high-efficiency values, somewhat similar to the US premium efficiency levels (AS/NZS 1359.5.2005).

Accomplishments

As discussed in the section above, enormous progress on motor efficiency has been made. Minimum efficiency standards for motors are in effect for many countries. Canada and the United States have worked together and now have standards equivalent to the IE3 level. Several countries are at IE2 including Australia, New Zealand, Mexico, the European Union, Brazil, South Korea, and, as of late 2010, China. The IEC is now developing a new IE4 specification, for even higher levels of efficiency.

Lessons learned

There are several key lessons learned from efforts to promote improved efficiency motors over the past two plus decades:

- Fair, complete, and comparable test procedures are needed to measure efficiency and permit product comparisons.
- Market share of improved efficiency products can be increased through education efforts, and the development of databases that permit product comparison, financial incentives to purchasers, and technical assistance efforts to help manufacturers develop higher efficiency products.
- Minimum efficiency standards are a critical step to fully transform markets, locking out inefficient products returning to the market.
- Once a market is transformed to one efficiency level (e.g. "high efficiency"), efforts can proceed to the next efficiency level (e.g. "premium efficiency").
- Countries can learn from each other, especially from the examples of Canada and the United States.
- International co-ordination cannot be made more effective if most activity remains centered on national bodies reflecting on overseas developments.
- Much greater levels of co-ordination could have been implemented through international bodies like the IEC, which would have saved resources within all stakeholder groups.
- The leadership ultimately shown by the IEC to task its motors committee with establishing global specifications for all motor efficiencies should make future international collaboration efforts easier.

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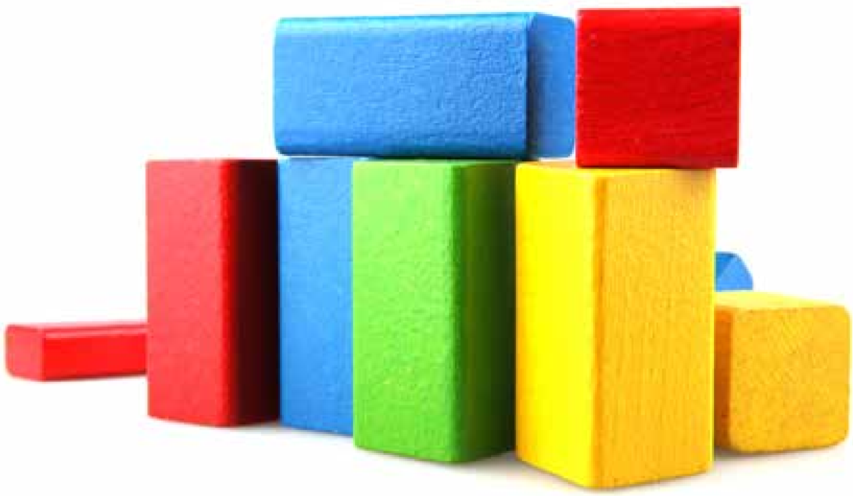

Contacts

Vedamoorthy Namasivayam
Senior Director I Consulting
Deloitte Touche Tohmatsu India Pvt. Ltd.
Deloitte Centre, Anchorage II, #100/2, Richmond Road,
Bangalore, Karnataka - 560 025, India
Email: vnamasivayam@deloitte.com

Shubhranshu Patnaik
Senior Director | Consulting - Energy and Resources
Deloitte Touche Tohmatsu India Private Limited
7th Floor; Building 10, Tower B, DLF Cyber City
Complex, DLF City Phase - II, Gurgaon - 122002,
Haryana, India
Email: spatnaik@deloitte.com

Debasish Mishra
Senior Director | Consulting
Deloitte Touche Tohmatsu India Pvt. Ltd.
30th Floor, Tower 3, Indiabulls Financial Center
Senapati Bapat Marg, Elphinstone Road (West)
Mumbai- 400 013
Email: debmishra@deloitte.com