**Day 3: Plenary session 1: Role of technology innovation and business models in enabling EE as a resource.**

While it is an accepted fact that the private sector needs to complement public policy initiatives to realise the full potential of energy efficiency, it is often not clear how public-private partnerships can benefit from technology development and innovations taking place in companies. Business leaders of leading Indian and international companies shared ideas and perspectives on how this can be done.

The chairman Dr Ajay Mathur said that technology today allowed the bar to be raised for entries into EE the market, with the challenge lying in how to bring this about very quickly, dovetailing with policy, 'nudging' in the right direction to 'push' the market, and 'pull' demand.

Mr Ravi Purushothaman, Danfoss Industries, India, spoke of looking at the economic model associated with EE and three components, energy, technology and business models. While technology was widely available, it was not harnessed optimally, and price was a challenge. With respect to energy, there was little grasp on hybridization (seamless supply, storage, etc.), and the question was how to build new business models.

In Mr Ajay Durrani's (of Covestro India) experience, considering the entire value chain would make the best business sense; if sustainability was taken into account in the entire organization, a host of opportunities would emerge. New materials would offer a significant method to become efficient.

Mr Venkat Garimella, Schneider Electric, India, suggested that mega trends such as digitization (such as connectivity and IoT), urbanization would create an impact being large consumers of energy. He was of the opinion that energy was being managed unsustainably. Schneider Electric viewed demand as manageable by digital means; EE potential remained untapped in industry (58%), infrastructure (79%) and buildings (82%).

Ms Jennifer Layke, World Resources Institute, USA, said that her organization viewed EE in terms of the phrase, count it - change it - scale it and that the private sector had a significant role to play in the broad playing field that government-led policy drew up. The value proposition for customers needed to be put forward clearly and the equation around risk and reward changed, with help from stakeholders working with government. Projects must measure, collect data and track progress.

Mr Dhiraj Wadhwa, United Technologies Corporation, India, observed that EE is not the first thing that practitioners think of in the morning. Private sector operators must push the market, because the potential for EE was not getting tapped.

In the Q and A session that followed, as well as the discussion, some points made were:

* Policy can create the 'push' and 'pull' needed.
* Consumers don't see EE as tangible so attempts to advance EE should show benefits to quality of life, apart from monetary savings.
* ESCO and service model structure seemed to be universally workable.
* Tools such as EDGE were extremely valuable and helped to educate people, also; overall, a broader and bigger EE community was needed.
* Active energy management could be aided by artificial intelligence, machine-learning and algorithms which 'man' EE systems for better control.
* Standards for Indian conditions needed, with outdated ones weeded out.
* In India situation was complicated with large state-to-state variations.
* In residential spaces, four sets of people were involved: real estate developer, owner, operator and tenant.
* EESL was able to aggregate the market but this was a costly proposition – something like chilling could be looked upon as a service.
* Electricity provider and customer should be rewarded for adapting EE.
* Focus should be on barrier-busting and determining why people behave the way they do – what are the rewards?
* Look for the right designs.
* Stress not so much new technology as good combinations of technology.

**Plenary session 2: Global R&D experiences leading to technological innovations and visionary policies**

The session focused on how public-funded R&D efforts around the world had, a) led to technology development that had made a significant contribution to pushing the energy efficiency envelope; b) helped policy formulation and implementation organizations come up with visionary policies leading to low-carbon and sustainable development (for example, building and habitat energy efficiency, sustainable and smart space cooling, etc.)

Chair: Dr Rajiv Sharma, Secretary, Science and Engineering Research Board, DST, Government of India

Dr Daniel Shah, Research Council, UK, presented areas and ways by which the UK and Indian governments were collaborating towards research programmes. Important research themes included clean growth and artificial intelligence.

Prof Ashok Lall, Sustainable Architect, India, spoke of the urbanization that was overtaking the country and the need for research findings to feed into policy particularly in the context of low-carbon sustainable development. He said that research on its own would not solve problems but when combined with a push from government, could make a difference. Research, in the current Indian context, should look at resource-use efficiency, low carbon growth and affordability; the government should seek/push for research in certain areas which were, at present, blind spots (energy and water-efficient evaporative cooling; hybrid cooling systems; and mechanically-assisted ventilation). A combination of resource-efficient, compact, low-rise rooftop solar PV, low-carbon city transport would produce affordable urban systems.

Prof Rangan Bannerjee, IIT Bombay, India, pointed out that all policies were about low-hanging fruit and dissemination; creating a roadmap, baselines and targets would help researchers deliver in conjunction with industry and academia. A highly successful method was holding competitions which could attract students producing ideas for path-breaking changes in design and fabrication for the Indian context. He also stressed the need for research on materials and sensors for use in India.

Dr Amol Phadke, Lawrence Berkeley National Laboratories, USA, was of the opinion that the time required to move an innovation from the laboratory to the field had to be cut down drastically. He suggested that energy modelling inform the research community, that research be made more strategic, by, for example, asking utilities to sponsor programmes related to EE, so that accountability could go up. Policy should accelerate innovation and not just deployment, and should set strict, stringent standards to avoid picking only the low-hanging fruit, so as to bring about change quickly.

Prof Rajan Rawal, CEPT, India, suggested that stakeholders should be helped to adopt policy and that R and D should feed into it. Changes in academic curriculum are necessary with a focus on what outcomes of research can change practice.

The Q and A session threw up the following points:

* Turning R&D into policy was a hard task because a large variety of operating conditions had to be accommodated.
* Substitution of materials such a concrete currently in use in buildings, would make a difference to energy efficiency of the building, particularly in the materials used for walling.
* The DST was beginning to focus now on networked research and consortium formation so that groups with similar interests could work together.

**Executive discussion: Putting the spotlight on Indian states (led and organized by BEE and Designated State Agencies, with The World Bank, ACEEE and AEEE).**

Chair: Mr Milind Deore, Director, Bureau of Energy Efficiency, introduced the session saying that the Indian states needed help with accelerating the progress towards EE, especially in view of the development of the State Energy Efficiency Index framework.

He also spoke of the State Energy Efficiency Index, pointing out that a large amount of energy was wasted in inefficiencies, and also explained the structure of the organizations involved in EE from policy/concept to implementation.

Mr Harendra Kumar, NITI Aayog, India, described his organization's role in helping the BEE develop policy. He underlined the need for developing best-practices since coal was the mainstay of India's energy supply and was associated with worrying emissions. He said that EE had greater value than energy generated, so pushing EE in Indian states was a necessity. He proposed allocations to states based on EE performance, pointing out that this could be problematic because of the large variation in economic activity between states, some being dominated by industry while others were primarily agrarian, but some common denominator could be arrived at.

Mr Steve Nader, American Council for an Energy-efficient Economy, USA, detailed the principles of the ACEEE Scorecard developed for American states and the rankings it brought out. The ranking was divided into policy categories such as transport, utilities, industry, etc., and improvement rankings were also published. Requests for data were sent to state energy offices and state public utilities after which rankings were computed. The ACEEE was now working on new appliance efficiency standards.

Mr Mijo Vodovic of the MacArthur Foundation spoke of the example of multi-family housing in the US and how his Foundation had been trying to incorporate EE into it. He pointed out the need for objective non-partisan data and called for evidence-based comparisons. The benefits of EE were seen in higher productivity, greater economy and the creation of equity. He was of the opinion that constituencies with limited access to capital should be allowed a different pace of adoption.

Mr Chandrasekhara Reddy, CEO, State Energy Conservation Mission, Andhra Pradesh Government, described the many initiatives that the AP government had taken towards EE. Although they had been constrained by tight budgets, the scheme, UJALA, to provide domestic consumers in Vijayawada with low-cost LEDs was a success mainly because of support from senior government and political leaders, as well as the public (low cost). The government has run a pilot project on water pumps and EE ceiling fans and has entered into an agreement with Gram Panchayats for street lighting by 2019.

Dr Satish Kumar, AEEE, mentioned that work on the State EE Index had begun 9-10 months back (beginning of 2017) with guidance from BEE, Niti Aayog, and wanted to bring objectivity into the index, with plans for a strategic energy conservation action plan as data and feedback became available. This would also make it possible to set targets for energy-saving for states and requested comments from State Designated Agencies in the audience.

A representative from West Bengal pointed out the availability of ECBC master trainers as being a constraint, particularly because the subject required multi-disciplinary expertise. He requested a training/certification programme fulfilling minimum criteria so that implementers of the code would become available.

In response he was told that the BEE was working on this and would shortly be announcing an examination and associated course material, so within a year or so, the first qualified implementers who could go through the checklists would be ready, and until then accredited energy auditors could help.

A representative from the Gujarat Energy Development Agency pointed out the tendency for renewable energy concerns to be prioritised over EE considerations since EE is not all that easy to understand and lacks support from senior bureaucrats and political leaders. Working directly under the Centre would help. In response, it was suggested that the Niti Aayog could recommend standalone SDAs which would help, such as those in Kerala and AP.

Other points that emerged in response to questions were:

* Responsibility for ECBC 2017 will rest with states – with the federal-state structure, implementation cannot be forced but technical support and amending of codes can be provided.
* National standards are both very important so that there is agreement on variables. States can then introduce variations, if necessary. Some bodies (municipalities) are better at collecting data and that must be reliable and consistent.
* Policy and outcomes should be given weight because outcomes can show other states that -favourable policies make a difference.
* Intent is not to discourage state governments: in initial discussions with Niti Aayog and BEE, the rigour of the first round of indexing was debated because aspiration should be the goal and stringency of standard should rise with time.
* Stability of economic policy with respect to EE should be considered carefully. In the case of RE tariffs for example, this has been a problem.
* Difficulty in getting staff for SDAs is something the BEE would have to take note of.
* More data will help bring about more savings.