Alliance for an Energy Efficient Economy

Energy Efficiency

A COMPELLING VALUE PROPOSITION AND ENABLING RESOURCE FOR SMART CITIES

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Abstract

It is hard to imagine a world without cities. Cities have shown an increasing and massive appetite for energy because of rapid urbanisation trends – in recent years responsible for 60% to 80% of global GHG emissions. The concept of smart cities aims at strategic integration of intelligent technologies (digital, ICT, IoT, cloud computing, advanced analytics based on machine learning and artificial intelligence concepts, etc.) and cutting-edge products and services to restore a city's ability to deliver a better quality life to its residents. All this must be done while regaining its business and economic competitiveness by attracting businesses thereby retaining talent and capital besides drawing visitors and tourists.

This paper is an effort to position energy efficiency as a significant enabler a) to reduce the GHG emissions footprint of cities and b) to act as a glue to integrate traditional, intelligent and digital technologies with the modern fabric of the smart cities. It starts by providing the background and motivation for this paper before describing the enabling policies and guidelines of the Government of India for its flagship Smart City Mission. Subsequently, it has an overarching framework that captures how a traditional city can be transformed into a smart city. It then showcases an "energy efficiency value creation framework" that pulls together the types of habitat, expectations, objectives and the ways the three core stakeholders (the government, the private sector, and the civil society) to give impetus to a city transformation initiative. Identifying the four key constituting elements of a smart city, this paper shares examples of how private sector players have contributed to the shaping of different smart cities globally. Lastly, the paper closes with suggestions on how private sector players could review their internal organisational capabilities to compete successfully in the multi-billion dollar smart cities market.


75%
global primary energy
80%
of wealth creation
~55%
of population

Introduction

From ~3000 BC, when the very first civilisations emerged in the river valleys of Mesopotamia, India, China, and Egypt, cities have been the cradle of innovations and prosperity of mankind. Cities came to occupy the centre stage as they offered "... benefits of dense settlement, reduced transport costs, exchange of ideas, sharing of natural resources, large local markets, and in some cases amenities such as running water and sewage disposal. Possible costs would include a higher rate of crime, higher mortality rates, higher cost of living, higher pollution, traffic and high commuting times. Cities grow when the benefits of proximity between people and firms are higher than the cost."[1] Energy, much like protein in the human body, has been the connecting tissue underlying all these human endeavours.

Modern cities, with dense settlement structures, holding ~55% of the population (and projected to house approximately 68% of the global population by 2050), 80% of wealth creation, guzzling ~75% of global primary energy and - hold your breath - belching out 60% to 80% of the world's total greenhouse gases (GHG), are now facing a moment of reckoning. So far, the economic growth and energy consumption, mostly fossil fuel-powered, conjoined at the hips, have marched together. This model is not sustainable anymore. The marginal benefits offered by our cities are set to be eclipsed by the substantial costs, should the cities fail to decouple growth from energy. The great news is that technologies and strategies now exist to decouple energy and growth. It is now very much possible to stall, and later reverse, the environmental whiplash that the planet in general and cities, in particular, are faced with today while maintaining or accelerating the pace of economic growth. In short, the cities, the living organisms that they are, are now striving to be smart.

The Concept of Smart Cities

Traditionally, the development of cities has been inexorably linked with energy and resource consumption in an unsustainable cycle of use and disposal. Continuing down this path – given the increasing populations and urbanisation and expanding dependency on energy-centric lifestyle – only portends immediate and severe economic and environmental impacts. Smart Cities, as a concept, is a global response to the urgent need for a sustainable urban ecosystem: one with low carbon technologies on the supply side, and efficient infrastructure as well as optimised consumption on the end-user side. Within this context, energy efficiency as the first-fuel (ahead of coal, oil, gas, nuclear) gains vital importance to support sustainable cities and mitigate the challenge of GHG emissions.

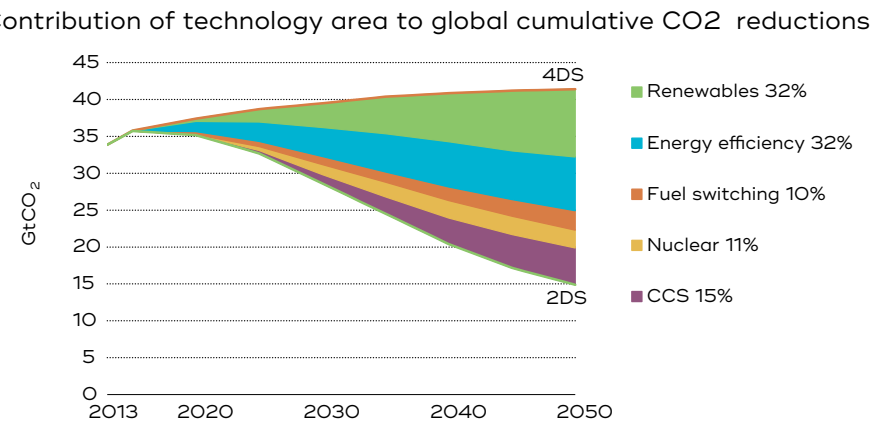
While there is no universally accepted definition of smart cities, they provide their citizens with transparent and responsive governance, better quality of life, intelligent and resilient infrastructure, an ecosystem for sustainable economic prosperity by attracting competitive talent, capital, and businesses, and efficient virtual and physical connectivity, while reducing GHG emissions. Decoupling fossil fuel based energy from a city's economic activities and its growth, and enabling a sustainable lifestyle, is at the very core of a Smart City.

Case for Energy and Resource Efficiency

Cities require an uninterrupted supply of energy to provide the necessary services to its citizens. Research shows that in a city, buildings consume 39% (commercial 21% and residential 18%), industries 33% and transportation 28% of the energy. Per UN-Habitat's data, collectively the city systems emit around 60% of the world's total greenhouse gases; this figure rises to approximately 80% when urban habitants responsible for the indirect emissions are included.[2]

Research also shows that energy efficiency can contribute up to 32% to the global cumulative CO_2 reductions, positioning it as a viable and robust response to the challenge of GHG emissions (Fig 1).[3]

Fig 1: Energy efficiency – a significant contributor to Global Cumulative CO2 reductions

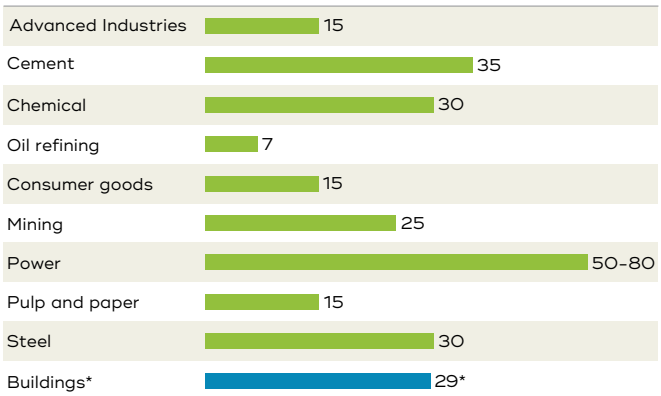


The carbon intensity of the global economy can be cut by two-thirds through a diversified energy technology mix

Source: IEA ETP 2016

Further, a McKinsey study[4] shows that energy is a substantial part (10%-40%) of the operating costs of industries and buildings (Fig 2). Figures for energy as a percentage of building operating costs*, superimposed on McKinsey's chart, have been referenced from Madison Gas and Electric.[5]

Fig 2: Energy cost as percentage of overall operating cost in Industries and Buildings



Source: Madison Gas and Electric

Given that significant utilisation of energy is a vital life-force for buildings, industries and transportation systems in a city, it is amply clear that full weight of energy efficiency technologies, in combination with IoE and ICT, should be brought to bear upon India's Smart Cities projects to maximise potential benefits.

Current Smart Cities Landscape in India

India is one of the fastest urbanising nations in the world today. According to the United Nation's data, India alone is expected to account for 17% of the global growth in urban population between 2018 and 2050, adding 416 million urban dwellers.[6]

This pace of urbanisation requires comprehensive development of physical, institutional, social and economic infrastructure to ensure good quality of life and robust socio-economic health of the city. Within this context, the Government of India launched the Smart Cities Mission in 2015, as urban renewal and retrofit program with the objective to drive economic growth and improve the quality of life of people by enabling local development and harnessing technology as a means to create smart outcomes for citizens.

The government of India had allocated INR 7060 crore (~USD 1.04 billion) for the Smart Cities Mission in its interim budget of 2014-15. More importantly, a government panel has approved the allocation of INR 2.73 lakh crore (~USD 40 billion) over the next ten years for the development of 100 smart cities and 500 cities under National Urban Rejuvenation Mission (NURM).[7]

Since the programme's inception, the Government has released several guidelines and policy drafts to guide the Mission and its implementation. Some notable ones include:

- **Smart City Mission Guidelines (2015)** document released by the Ministry of Urban Development[8]
- Technical report on **ICT Deployment and Strategies for India's Smart Cities (2015)**[9] released by the Ministry of Communication & Information Technology
- Technical report on **Design & Planning Smart Cities with IoT/ ICT (2019)**[10] released by Ministry of Communication & Information Technology
- Ministry of Housing and Urban Affairs' policy draft – **National Urban Policy Framework** (NUPF) – outlines an integrated and coherent approach towards the future of urban planning in India.
- Envisioning IoT as critical to the development of Smart Cities, Ministry of Communication and Information Technology has released a **Draft Policy on the Internet of Things.**
- Ministry of Urban Development's **Draft Standards for Smart Cities** aims to establish benchmarks and indicators for the various features of cities in the Smart Cities Mission.

The Union Ministry of Urban Development is responsible for implementing the Mission in collaboration with the state governments of the respective cities. It lays down the key aspects of India's smart city, among other things: smart parking, intelligent transport system, telecare, smart grids, smart urban lighting, waste management, smart city maintenance, digital-signage, water management, and woman safety.
While the Government's Smart Cities Mission is decidedly a step in the right direction, there is speculation about whether India's aggressive plan to develop 100 smart cities in a span of 5-10 year is an achievable reality.

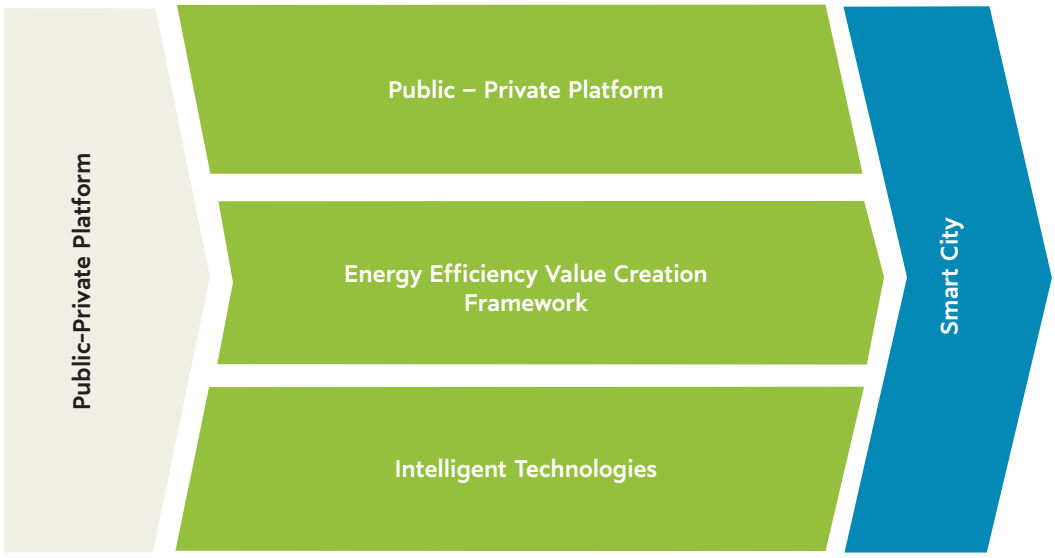
What are the Key Challenges (and Opportunities!)

- **Critical need for a paradigm shift – holistic and cross-functional approach for city planning and development:** A city is a complex juxtaposition of systems, involving many different domains, infrastructures, organisations, and activities: all of these needs to be integrated and then work together effectively for that city to become smart. This integration needs to take place at many levels, not just technical, but also integrated strategies and regulations, combined with business processes and management. The government, as the primary implementer of the Smart Cities Mission, will have to establish seamless cross-functional collaboration, breaking the old 'vertical silos' approach and fostering cooperation and synergies.
- **Significant capacity assistance needed:** Understanding the concepts of retrofitting, redevelopment and greenfield development by the policy makers, implementers and other stakeholders at different levels will require capacity assistance, and this, in turn, will need substantial investments in time and resources. States and ULBs will play a key supportive role in the development of Smart Cities. Smart leadership and vision at this level and ability to act decisively will be important factors determining the success of the Mission.

- **ICT is vital but mostly uncharted territory:** ICT is recognised as the real enabler of the smartness in every aspect of the smart city paradigm. However, city administration, consulting companies, service companies, and technology companies must work and agree on what ICT components are necessary and how cities should approach this agenda. The smart technologies (ICT) market also suffers from many barriers. The data and privacy risks associated with ICT/IoT also need to be addressed.
- **Enabling effective citizen-involvement will be important:** The Smart Cities Mission requires engaged and smart people who can actively participate in governance and reforms. Citizen involvement is much more than ceremonial participation in governance. Alignment of interests of the citizens, the city management, the state and central governments alongside a supportive regulatory policy framework will be critical for the success of Smart Cities.
- **Need for an enabling market ecosystem:** Inter-disciplinary understanding and relationships will become vital for businesses, as Smart Cities drive up the need for integrated solutions and services rather than stand-alone products. Market mechanisms such as innovative financing options and block-chain enabled legal frameworks, and seamless integration between the digital and the physical will be critical enablers of smart cities.

The above challenges also present opportunities for public and private collaboration, along with aligned investments, to maximise the gains and realise the goals of making the cities liveable, sustainable and economically competitive. These challenges will require a holistic approach where a city's overarching energy strategy aligns well with and supports the environmental, technology, and social policy. The Smart City Transition framework below (Fig 3) shows how a triad of Public-Private Platform, AEEE's Energy Efficiency Value Creation Framework and Intelligent Technologies can work together to transform a traditional city into a smart city. Closely tied effort among all stakeholders, including the citizens, are likely to lead to a viable, scalable and sustainable solution to build a smart city. Such a solution is now possible due to the emergence of intelligent technologies, such as digitalisation, data analytics, IoT among others, and the socio-economic trends such as globalisation, urbanisation, shifting of the economic centre of gravity from West to East, and the growing awareness of the environmental impacts of our cities.

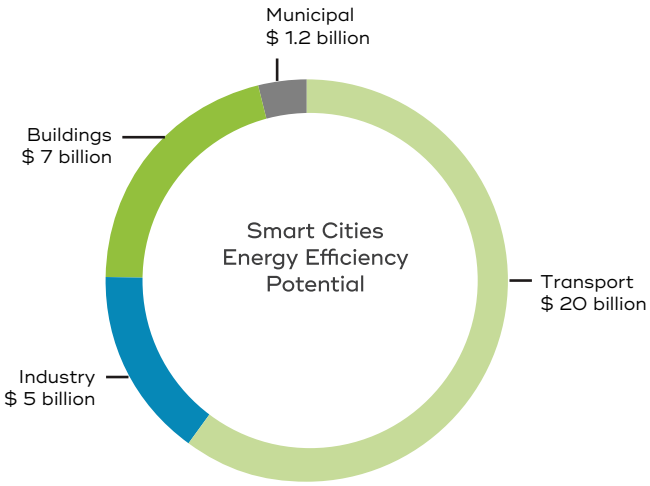
Fig 3: Smart City Transition Framework



Supporting India's Smart Cities Through "Energy Efficiency Value Creation Framework"

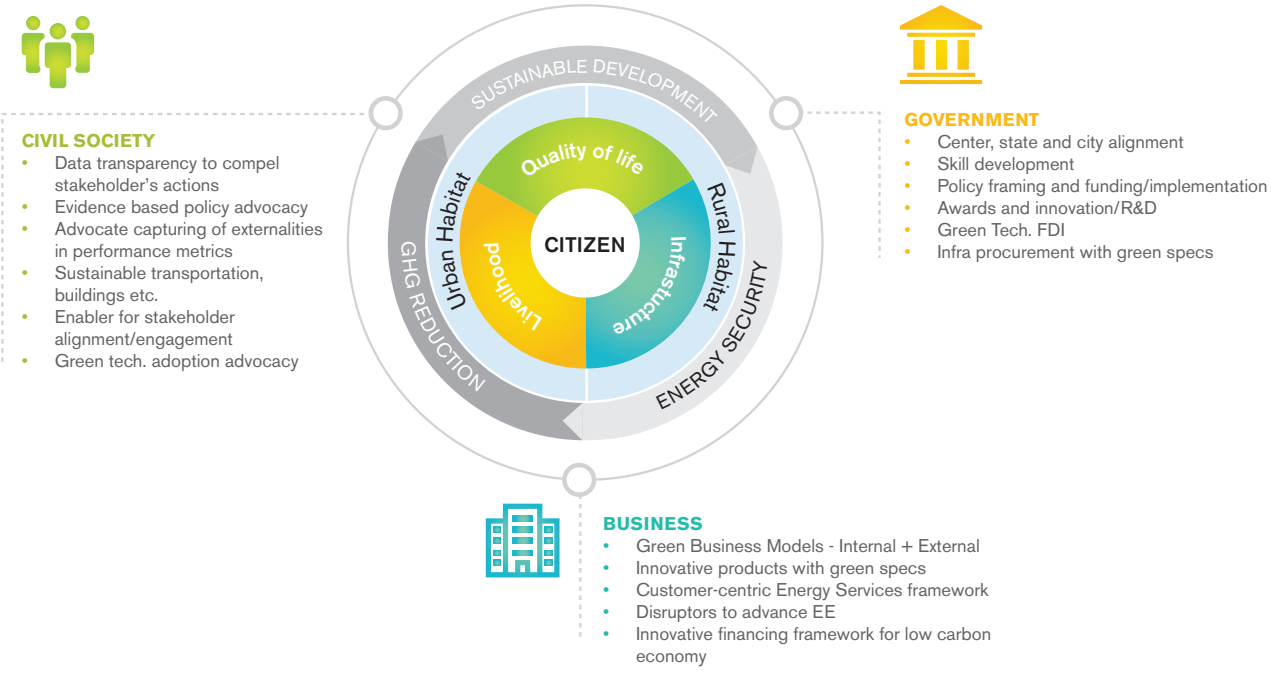
Frost & Sullivan estimate11 that smart cities have created a $1.5 trillion global market in 2020 for products and services in buildings, transportation, healthcare, security, governance, infrastructure and energy applications. Smart Energy will account for ~$250 billion growing at CAGR 19.6% (2012-20). For India, while there is still a range of unknowns, AEEE's broad estimate pegs this smart cities energy efficiency market potential at around $33 billion (INR 23,000 Crores) (Fig 4). Transportation systems and buildings are the major markets estimated at $20 billion and $7 billion respectively. Energy efficiency, resource efficiency, emissions reduction, and sustainability are the underlying objectives of of the smart cities' products and services solutions.

Fig 4: Estimate of India's Smart Cities Energy Efficiency Potential



Within this context, AEEE has developed an integrated 'Energy Efficiency Value Creation framework' as shown in Figure 5. This framework positions citizens of India, whether living in rural or urban habitats, at the centre and as the target beneficiary of energy efficiency and sustainability efforts. Further, it integrates the national goals of Sustainable Development, Energy Security and Reducing GHG Emissions, and Smart Cities Mission with the mutually complementing roles of four key stakeholders – government, businesses, civil society, and research organisations, and the residents of the city, who will ultimately pay for the services.

Figure 5: Energy Efficiency Value Creation Framework



Private sector companies focused on enhancing their shareholder value on a sustainable basis are expected to contribute to the creation of shared social value by integrating energy efficiency into their core business strategy and not keep it on the fringes. This focus should translate into manufacturing of energy-efficient products and technologies, developing and adopting innovative, customer-centric approaches and aiding smart cities to have a green infrastructure. Many businesses have internally and externally implemented disruptive, high-performance technologies while developing smart campuses, neighbourhoods, townships and partnered with city officials to bring in smart city solutions. Banks and financial institutions are developing innovative finance models to fund low-carbon infrastructure while smart grid technologies based on IoT, sensors and ICT are making intelligent linkages possible at multiple levels in cities. These linkages covering sustainable buildings, transportation, utilities (energy, water, telecom, etc.) offer insightful metrics utilising advanced data analytics to enable smart governance that brings needed transparency for enhanced quality of life for all the citizens while reducing the environmental impact.

The government, on its part, is expected to contribute with the framing of enabling policies, skill development, funding/incubating innovative technologies, building collaborative partnerships with the private sector, and allow for proactive consultation and resolution of issues.

Civil societies comprise of city residents, non-profits and research organisations that can bring government and businesses together, bring about social movements and foster collective actions. They can engender policy action using data-driven constructs and analysis, fiscal discipline, improved city governance and monitoring of the progress of collaborative efforts, subsequent to the launch of ambitious and transformative initiatives by the central, state and city level leaders. They can exert influence and modify consumer, company and government behaviour into buying energy-efficient products, services, and solutions. They can also be a catalyst in advocating energy efficiency and sustainable development and do it through research, analysis and evidence-based data by developing subject matter expertise and proactively participating in government committees seeking public participation and ideas. Civil Society organisations also assist cities in developing a blueprint for sustainable mobility and tying it with neighbourhoods and building design to create clean, vibrant and more liveable cities.

Finally, the city resident, the end-user and payer of all services, sits at the very centre of the framework. Instead of being a passive user of services, the residents can leverage the smart technologies and apps to proactively provide inputs in the shaping of a coherent strategy for their cities and also provide live feedback as a user of the services.

This framework essentially envisages the smart city as a platform that is co-shared and co-led by these four primary stakeholders. It lets these stakeholders co-imagine and co-create the smart city by using intelligent technology that allow:

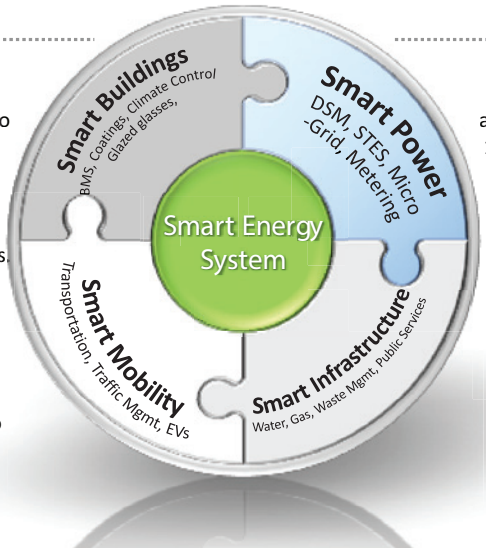
- Securing alignment among its citizens, the city management, the state and central governments around a common and shared vision, the definition of city's unique strengths, gaps, opportunities, the compelling needs, and enabling policy and solutions framework.
- Developing a solution framework that seamlessly blends Internet of Everything (IoE) technologies (digital technologies, connected devices, data analytics, design thinking, social media software, etc.) and the advanced hardware (the pumps, wires, air conditioners, pipes, utilities, drives, construction technologies etc.) that are connected with the help of sensors, meters and wireless and cloud technologies above and below the surface of a smart city.

Holistically designed and implemented, the digital platforms interface with hardware in a way that the two interact seamlessly in real time to put in place a smart energy ecosystem that secures energy and resource efficiency in core systems of a smart city as shown in Fig 6 below.

Fig 6: Smart Energy System Framework

People spend over 80% of their lives inside a building[12]. For businesses, its costs are second to salaries. Comfort and security is key to feeling of well being and productivity. Smart Buildings leverage energy efficient solutions to address these factors.

Driving or commuting consumes ~4% of our lives. Between 17 years and ~79 years of age, one will spend more than 37,000 hours and could possibly drive to the moon and back — three times![13] Smart Mobility makes travel less stressful and productive



Power is and will remain essential necessity of individuals and businesses. Power constitute 10% to 40% of businesses. Smart Power solutions decouples economic growth and fossil fuel based energy with energy efficient solutions

City infrastructure determine how productively exchange of goods and services take place among individuals and businesses. Smart Infrastructure combines needs of competitive supply chain and the sustainability

Smart Energy Systems focus on achieving sustainability with 100% renewable energy by leveraging and building on energy efficient smart city indicators under ISO 37120 of Energy, Transportation, Economy, Environment, Urban Planning, Governance, Safety, Solid Waste, Wastewater, and Water & Sanitation. The Smart City planners are challenged to be creative in their design of energy systems architecture to maximise the comfort and enhance its economic competitiveness.

Role of The Private Sector in Helping Create India's Smart Cities

India's Smart Cities Mission is opening up a multi-billion dollar market for innovative products, systems, and services. By taking a proactive stance towards this opportunity, businesses can play a vital role by providing innovative and integrated services and solutions in the core areas of Smart Cities: Smart Buildings, Smart Infrastructure, Smart Power, and Smart Mobility. These solutions should be designed and executed to help cities provide sustainable, affordable and resources efficient services: energy-efficient and IoT enabled appliances, equipment and systems for buildings, transport, and utilities; automated industrial processes for smart manufacturing; energy-efficient data centres and computing infrastructure to support the high level of digitalisation and cloud-computing needed in smart cities; and, tools for monitoring, evaluating and managing water, energy and the environment.

Many examples of having deployed aforementioned capabilities are available in the private sector including in AEEE member companies. The following narrative showcases the potential of Indian businesses in catalysing solutions for smart cities with disruptive products, digital revolution that's underway and/or business models' possibilities. In particular, they can play a strategic role by making a compelling case for close collaboration with the government, having implemented comprehensive and intelligent solutions in cities, within buildings, industries, and campuses of their specific customers. The proven solutions of these businesses will go a long way in persuading government authorities to involve and integrate the private sector in planning and implementation of smart cities projects.

Smart Cities Solutions Enabled by Private Sector

A review of smart cities landscape shows that AEEE member companies have implemented several innovative solutions in smart cities projects in India and abroad as highlighted below:

SMART BUILDINGS

At 632 meters, Shanghai Tower is one of the tallest building in the world. More than 50% of its annual energy use goes towards the HVAC system. Danfoss valves were able to reduce energy consumption by 20% and also improved its air quality. It was fitted with 6700 Danfoss valves to ensure stable water flow all around the building to ensure the desired temperature at the top floor, regardless of temperatures needed on the lower floors. Further 660 Danfoss variable-speed drives ensure that pumps, compressors, and fans never run faster than required to deliver the set point temperature optimising comfort and energy use. Through this innovative technology, Danfoss helped achieve a 20% to 40% reduction in energy consumption.[14]

According to case study shared by Smart Joules, St. Stephen's Hospital (SSH) – an iconic Hospital in the heart of Delhi used Building Management

Solutions of Smart Joules (SJPL) to help reduce their energy consumption and become a more environmentally responsible organisation. Smart Joules helped reduce cooling load in the Hospital by 20% and the chiller plant's efficiency has improved to 0.80 kW per ton. Cumulatively energy consumption has reduced by 25%.

According to Infosys, the company has deployed a range of technologies to reduce its per capita energy consumption by 49% from 2008 to 2016. Infosys campuses have office buildings, food courts, retail areas, sports facilities, guesthouses. The Mysore campus is a mini city in itself, spread over 350 acres, with 12 million sq. ft. built- up area and the capacity to host more than 15,000 trainees, 8,000+ employees, and several thousand contract workers. While the company grew from 85,000 employees to 200,000 employees in these eight years, the absolute energy consumption has increased by just 18% through smart and efficient designs and KPI driven operation and maintenance practices that put energy efficiency at the centre of their strategy. As per article "Infosys Brings Home The Green" (Fortune India, July 2015), United Technologies Corporations in India partnered with Infosys to develop the high-tech command Centre that captures data from Infosys's 75-odd smart buildings – interconnected through a network of sensors, actuators, controllers, and feedback systems.

The Minneapolis-St. Paul International Airport (USA) used Saint-Gobain's Sage Glass products to enhance travellers' and employees' comfort by optimising daylight while preventing heat gain and the Sun glare. The company reports that the use of high-performance glazing has led to the reduced stress level of employees and higher productivity. It also led to increased travellers' satisfaction from being able to enjoy the outdoors without the heat and the glare.[15]

Some of the member companies are enablers of original technologies and materials that have significant potential to reduce energy use in smart buildings. One such example is Covestro, with innovative materials like the game-changing polycarbonates. The transparent polycarbonates that are flexible and capable of being moulded into any shape and design serve as an excellent solution for roofs and facades for structures like stadiums, railway stations, and airports, shields occupants from wind, rain and UV rays without blocking the natural light. Besides its application in the construction industry, polycarbonate is also the primary material for lenses used in LED lighting, enabling energy savings and more durability than the traditional lenses made from glass. Covestro also offers innovative solutions for the building envelope: Polyisocyanurate (PIR) is an advanced insulation technology with superior fire ratings. Extending support to affordable housing, Covestro has developed house models based on PIR panels which can be erected quickly, can withstand high wind speeds, and make houses more energy-efficient and thus cost-effective. These affordable houses are commercially viable and also suitable for relief areas after a natural disaster and can be deployed to impart thermal integrity to millions of low-cost homes. Covestro recently inaugurated a model of a four-storey building in Jaipur for the Rajasthan Housing Board (RHB). The project aimed at providing low-cost houses utilises Covestro's pre-fabricated PIR panel technology. The PIR panels insulate both external and internal walls, RCC column and beam slab, and have also reduced half of the overall cement consumption in the building.

SMART MOBILITY

Mobility in urban areas, particularly concerning air quality and congestion, has a profound effect on our quality of life and is one of the biggest challenges that arise when cities grow rapidly. Traffic congestion and the associated slow urban mobility is having an adverse impact on both the quality of life and the economy. Traffic congestion during peak hours in major cities like Delhi, Mumbai, Bengaluru, and Kolkata, costs the economy Rs. 1.5 lakh crore (trillion) annually. The mean travel speed across Indian cities is just 24.4 km per hour, much slower than the mean travel speed of 38.5 km per hour in metropolitan cities in the US. Mumbai deployed real-time, adaptive traffic control systems from Schneider Electric to optimise traffic at 253 crossings. A central traffic management control centre supervises and reacts to traffic disruptions. Schneider reports a 12% reduction in average traffic time in the city, along with an 85% reduction in energy usage from the city's traffic lights.

As Indian cities grow, they must find innovative ways of boosting the efficiency of their transportation systems to raise their capacity while simultaneously reducing CO2 emissions at the same time. For example, Mumbai's suburban trains carry over 7.1 million passengers daily with the highest passenger density in the world up to 16 people per square meter. Siemens's mobility technology has helped the Mumbai local trains reach a top speed of 100 kilometres per hour, compared to the previous 80 kilometres per hour, saving commuters up to 20 minutes a day each way. Besides, Siemens' propulsion system reduces annual energy costs by 5 million rupees per train.

SMART POWER

Affordable LEDs for All (UJALA) by EESL has led to significant energy savings and reduced carbon emissions. The UJALA initiative has led to a reduction of annual household electricity bills by about 15% which is equivalent to the gross domestic product (GDP) of Mumbai. It has also helped save scarce energy resources and cut India's carbon emissions by around 3 million tonnes of CO2 per year. The energy savings under the UJALA programme are equivalent to the annual emissions of one 500 MW coal-fired power plant or removing 2.7 million cars from the road per year.

Siemens, with its solutions for Smart Grid and Power Distribution, has implemented smart power solutions in Vienna and New York and is already involved in the Restructured Accelerated Power Development and Reforms Programme

(R-APDRP) of the Government of India for installing smart grid solutions in some cities in India. It has also worked with the Indian Railways and other public entities in the areas of Metros, Integrated Mobility Platforms, Airport Links, Passenger Coaches, Rail Services and Maintenance, Urban Traffic Control, Rail Signalling, and other advanced Transportation Solutions.

SMART INFRASTRUCTURE

Several cities, aspiring to become smart, are faced with the challenges of ageing city infrastructure, recognise that a robust, scalable infrastructure, that leverage an integrated system solution approach, digital technologies, and enhanced products & services, can be an unmatched source of its competitive advantage. These can help cities secure ~30% energy savings, ~30% reduction in street crime and ~20% reduction in travel time and traffic delays. The qualitative benefits are as substantial as better quality of life, in turn, ensures sustainable job growth and helps attract and retain talent pool, fuels business growth and eventually leads to the increased city and state tax collections. One vital requirement is that conceived solution should integrate with other systems seamlessly.

In Takeo province in Cambodia, Grundfos implemented its Demand-Driven Distribution solution. This intelligent water distribution system automatically adjusts the water flow using remote sensors, reducing excessive pressure in the water pipes. This system limits water leakages and losses, minimising wastage and energy. Chemical usage is also significantly reduced due to more data being available to ensure accurate dosage.

Implementation of this system required innovation in its business model too. In this approach, the plant operator pays for the pump system through annual instalments, which is financed by the money saved on energy and water bills through the equipment upgrade. Savings are tracked through Grundfos' Remote Management system, an Internet-based remote monitoring, management and

reporting system for pump installations. In Takeo, the Grundfos solution and new business model helped the plant save more than 270,000 kWh in electricity and around 200,000 m3 water per year, with a projected payback period of two and a half years.[16]

According to Schneider Electric, at a project in Beijing, China, its solutions helped make four water treatment plants more energy efficient by delivering 52% reduction in energy usage, allowing the project to pay for itself in less than 18 months. Schneider's Supervisory Control And Data Acquisition (SCADA) systems have been deployed in cities to manage water flow that can bring 30% savings on the energy used to maintain the water systems, 20% reduction in water loss, and 20% reduction in water outage.

Davis Public School District in Utah has used Schneider's EcoStruxure Building Operation to reduce HVAC energy consumption by 7% even as the campus grew by 18%.[17] Carson City in Nevada and Zaragoza City in Spain with innovative tools, capabilities and solutions also use Schneider's Wonderware platform that leverages advanced mobile communications and data management technologies to achieve several favourable outcomes. These include a 15% reduction in operations staff hours, reduced work week from five eight-hour days to four ten-hour days, delivers more than 22 million gallons of water while processing 6.9 millions of gallons of wastewater each day.

Data Centres on a global level already consume more electricity than the UK and emit the same amount of carbon as the entire airline industry. Danfoss helped Facebook make its data centre in Luleaa, Sweden, the cleanest and one of the most efficient of its kind in the world. This was accomplished by deploying high-pressure Danfoss pumps with capacities of 13,000 litres/hour to cool Facebook's servers using mineral-free water that guarantees 100% sanitisation, which is good for both employees and data. This system already saves Facebook 50% on costs. The data centre is also solely hydro-powered and emits no carbon dioxide.[18]


SPEEDING
FINES
INCREASED

Way Forward

As we saw before in the Frost & Sullivan report, the global market for 'smart energy' products and services is ~$250Bn growing at CAGR 19.6%, and from our AEEE estimates, India market for energy-efficient solutions is $33Bn. As big this market is, the challenges in selling smart solutions are quite significant too. It will be necessary for the companies to recognise these challenges and make necessary changes in their organisational capability mix. Companies are encouraged to factor in the following when framing their solutions and pitching them to the smart city buyer organisation:

a) Each brownfield or greenfield city is distinct because of its needs and the vision for the future it seeks. With a legacy element present in every aspect of a brownfield city or the thought process for a new city, the solution design has to be customised and its unique value proposition defined.

b) Because of the complexity and multi-dimensionality involved in smart cities, the solution selling process will inherently involve cross-sectoral and technological collaboration, long sales cycle, relationship management of multiple stakeholders, needs of innovative business model including financing besides other implementation unknowns.

c) In most cases, the government is the prime owner and a major buyer of capital equipment and services associated with the delivery of public services, e.g. energy, transportation, traffic, water, waste management, security, health, and education. Government officials, who are mandated to create common good while maintaining the integrity of capital/funds spend process, may be extra cautious during the procurement process, making value selling a challenge. There is an urgent need for the government to lay down clear life-cycle based procurement principles to ensure that the government gets the best value taking into account the longevity and reliability aspect of smart city infrastructure.

d) Smart Cities require a customer-centric thinking and in-depth knowledge of various domains (e.g., design thinking, urban planning & policy, legal, financing tools, urban layout, intelligent technologies, electro-mechanical hardware, etc.). Against this backdrop, it is not enough for the private sector companies' sales or business development team to know their products and services. One critical success factor that AEEE team has learned from its discussions with successful teams is that the team should include members that bring this diverse set of knowledge and expertise specific to smart cities.

While making a transition from a product or services to a comprehensive solution selling, the companies' mindset will be tested to its fullest in the smart city market space. The leadership team of private sector companies must incorporate superior and multi-dimensional capabilities in their customer-facing teams as they make a strategic commitment to participate in this market profitably and deliver on the gains energy efficiency promises for GHG emissions reduction and the Smart Cities.

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