

SMART GRID MARKET ANALYSIS: INDIA

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1 Introduction

India's GDP has been growing on an annual average of 6 per cent between 2008 – 2017, making it one of the fastest growing economies globally. India's per capita electricity consumption has grown from 91 KWh in 1971 to 1010 KWh in 2015. With a population of 1.3 billion, India still has 300 million people with no access to electricity, and 500 million more who continue to rely on biomass as a primary energy source. With a well-documented positive correlation between electricity demand and economic growth, India's energy ambition continues to focus on developing *access* and *security*. At this time, the majority of India's energy supply is met through coal and oil. The country's installed capacity stood at 330 GW in 2016, with an ambition to grow to 372 GW by the end of 2019. India has put a strong focus on the importance of developing its renewable energy capacity, with specific attention to solar. In 2015 India led the development of the International Solar Alliance and put forward domestic targets of development of 175 GW renewable energy capacity by 2022, with 100 GW being solar. This notwithstanding, with electricity demand growing at an average of 5 per cent annually, it is expected that coal will continue to dominate the country's energy mix in the near term.

India has a federal system of government, with 29 states and 7 union territories. Union territories are of strategic importance for the country and are administered by the Central Government. Electricity is a *concurrent* subject in the Indian constitution. This means that both the Centre and the states are involved in developing policy, regulation and operations for the Country's electricity market. Generation of electricity is a monopoly activity by the Central Government. States are responsible for transmission of electricity and state-owned distribution companies (discoms) undertake last mile distribution of electricity. Electricity has been long used as a vote bank issue, with free power being provided to facilitate political agendas at the state level. Average transmission and distribution losses stand at 23 per cent across the country, with some states as high as 40 per cent. The current government has set a target to have 'Power for All' by 2022. Availability, affordability, reliability and quality of supply are the boundaries for success. The challenge to achieving this goal is not in power generation but in last mile distribution. The irony is that most states continue to experience distribution shutdowns or 'load shedding', when India today is officially a power surplus countryⁱ.

The difficult position of state discoms, the misalignment along the value chain of India's electricity landscape, the growing demand being placed on the system, the need to develop additional energy sources, and the role of demand side management for energy savings provides the starting point for

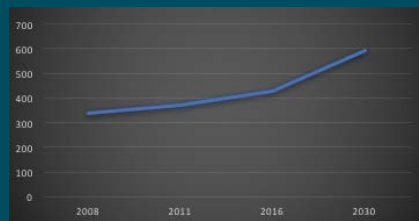
India's smartgrid discussion. The formation of the public-private 'Indian Smart Grid Forum', the government 'Smart Grid Task Force' and the development of *The Smart Grid Mission* provides a strong indication of intent on developing a Smart Grid agenda. Smart meters, electric vehicles, renewable energy integration, and power quality monitoring all become important aspects of realising the overall ambition of fiscal efficiency and operational expansion of the energy system.

2 Electricity market

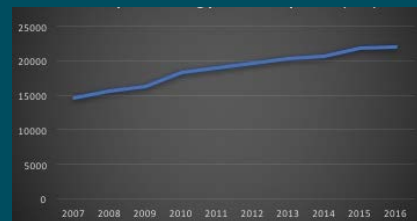
2.1 2040 and India's Energy Mix

India is the 3rd largest global energy economy, after the US and China. GDP growth has averaged 6 per cent over the last 10 years, making it also one of the fastest growing economies. Census data reflects that there has been a 44 per cent reduction in poverty between 2001 and 2011. However, resource equity continues to be a challenge for the country. Per capita electricity demand has increased from 563 KWh in 2008 to 1075 KWh in 2016, with an estimated increase to 2924 KWh by 2040. But, of the country's 1.3 billion population, almost one third rely on biomass as their primary energy source (FY 2015-16). India still has a lot of opportunity to improve its current indicators for electricity access. The current administration has set a 'Power for all' target for 2022. This would entail delivering electrification to 18452 currently un-electrified villages and all households in India.

Graph 1: Urban Population Growth (millions)



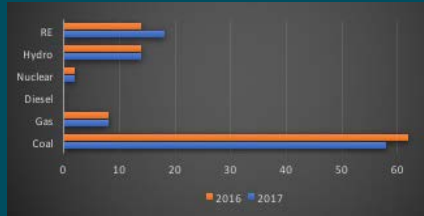
Graph 2: Per capita energy consumption (MJ)



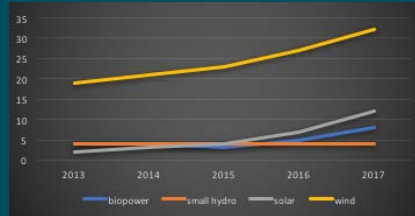
Source: World Bank online data; Draft National Energy Policy, NITI Aayog

India continues to import 80 per cent of oil requirements and 18 per cent of its natural gas needs. Because of growing demands on infrastructure, electricity and transport, it is estimated that by 2040 India's oil demand will be on par with the United States. India's draft National Energy Policy has models for growth in both a 'business as usual' scenario as well as an ambitious target model, with regard to energy utilisation. In both these cases, coal, oil and gas continue to dominate India's energy mix, with a continued dependence on imports (Graph 5).

Graph 3: Installed Generation Capacity India 2016/2017



Graph 4: India's RE Capacity growth (GW)

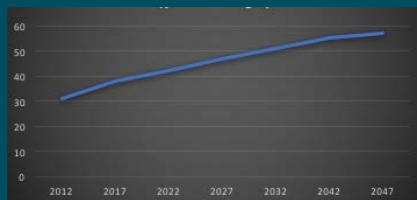


Source: Ministry of New and Renewable Energy, Government of India; Ministry of Power, Government of India

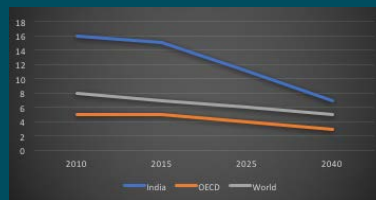
This is not to say that India is not putting focus on renewable energy development. Between 2013 – 2017, the country's renewable energy capacity has doubled from 28 GW to 57 GW (graph 4).

India has been a relative latecomer to the international consensus on climate change and the critical need for developing decarbonised roadmaps for growth. But the current administration has understood the importance of working within a climate constrained context. In October 2015, India submitted its Intended Nationally Determined Contribution to global 'climate justice' to the United National Framework Convention on Climate Change. In this, the country committed to increase non-fossil fuel by 40 per cent and reduce emissions intensity of the economy by 33-35 per cent by 2030, from 2005 levels. As is evident (Graph 6) these commitments are already being implemented, with positive results. India is expected to meet its climate targets with recent policy actions on energy efficiency, demand side management and renewable energy generation.

Graph 5: Overall Import dependence (percentage)



Graph 6: 2040 – Energy Intensity



Source: India Energy Security Scenarios, NITI Aayog; Outlook for Energy; a view to 2040, ExxonMobil

Given the exponential growth expected in electricity generation, India's focus will be to diversify its energy mix and move beyond, what has been, a grid centric view of electricity generation and distribution. Efforts to increase competition in the market will also spur efficiency. For the country to meet its set targets, it will require continued progressive policy support, the development of financial infrastructure to support innovation and technology, especially in the off-grid / micro-grid space.

A significant shift in the ground scenario is the mainstreaming of decentralised energy systems. Off-grid, in the Indian context, has been seen to be concomitant with base-of-the-pyramid energy access. Given the traditionally assumed low-income customer base, and the social focus of off-grid energy, market development for off-grid has been slower than compared to grid-connected renewable energy. However, with the limitations of the grid, decentralised systems such as rooftop solar, mini-grids and street lighting systems have now reached a pan-national audience.

2.2 Governance of the Energy System

Governance of India's energy system is fragmented, with decision making authority existing within multiple central ministries as well as state governments. As table 1 indicates, the smart grid space has several related Ministries and Agencies responsible (Table 1). The complexity continues down to the state level, as each central Ministry has line Departments with mirrored responsibilities at the state level. Creating transparency, alignment and communication for the goals set by the Government of India in the energy domain, is at the centre of the NITI Aayog *National Energy Policy*.¹

¹ NITI Aayog takes over from the Planning Commission as the Central Government's planning body, think tank and actor for policy coordination.

Table 1. Governance of India's Energy System

	<i>Tasks</i>	<i>Policies</i>
<i>Ministry of Power</i>	Policy development and administration of Electricity Act 2003 Power project development (largescale), rural electrification (off grid and grid)	R-ADRP (2008), Integrated Power Development Scheme (2015), Smart Grid Mission (2015)
<i>Ministry of New and Renewable Energy and Coal</i>	Renewable energy development, off grid energy development, Coal mining and coal auctions, energy efficiency govt. actions	National Solar Mission (2009) National Wind Energy Mission (2022) Renewable Energy Access including Decentralised Distributed Generation (<i>draft</i>) National Policy on RE based microgrids
<i>Ministry of Environment, Forest & Climate Change</i>	Coastal management, forestry management, sustainable development, pollution control,	National Action Plan on Climate Change (2008)
<i>Ministry of Finance</i>	India Treasury National Fiscal Management	National Clean Energy Fund (2010)
<i>Ministry of Urban Development</i>	Policy, planning, development for all India housing and urban affairs	National Smart City Mission (2014)
<i>Ministry of Science and Technology</i>	Cross sector research and development.	Mission Innovation, R&D financing for smart grid technology, PACE-R for smart grids and energy storage
<i>Department of Heavy Industries and Public Enterprises</i>	Supporting development of public sector enterprises Developing world class / best in class automotive sector	The National Electric Mobility Mission Plan 2020 Faster Adoption & Manufacturing of (hybrid &) Electric Vehicles [FAME] (2013)

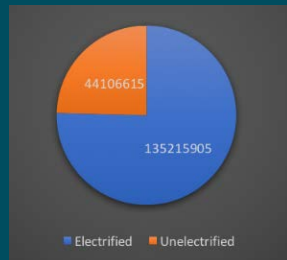
2.3 Electricity Market

Grid connected power, in India has long been a public-sector monopoly, across the supply chain of generation, transmission and distribution. Because of this there has been low commercial urgency to develop a system that is cost-effective and there has been limited overall investment in infrastructure. Subsequent Central Governments have understood the

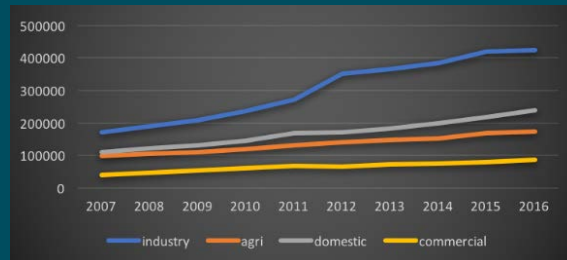
importance of introducing competition into the electricity market, to strive for quality investment as well as the need to develop consistent distribution. Several crucial policy steps have been taken to develop such a market. However, as of 2016, over 85 percent of the electricity market was still held in public hands. In December 2015, India achieved a uniform interconnected grid. Prior to that the country had 5 regional grids, working independently. With the achievement of 'One Nation, One Grid, One Price' distribution, companies could buy/ sell power for peak load and deficit management.

Electricity generation has increased by 200 per cent in the last 10 years, currently at 302088 MW. Renewable energy's share of this total has more than doubled, from 6 per cent in 2007 to 14 percent in 2016. India has set a target of 175 GW of renewable energy generation by 2022, of which 100 GW will be from solar. Additionally, 40 GW will be from distributed energy sources such as rooftop solar. In the last two years, 13523 villages have been electrified, although this has not been at the individual household level, leaving approximately 44 million households still un-electrified (Graph 7).

Graph 7: Electricity Access at the Household level 2016



Graph 8: Consumption of Electricity by Sectors kWh



Sources: India Smart Grid Forum, White Paper on offgrid electrification, MNRE, Government of India

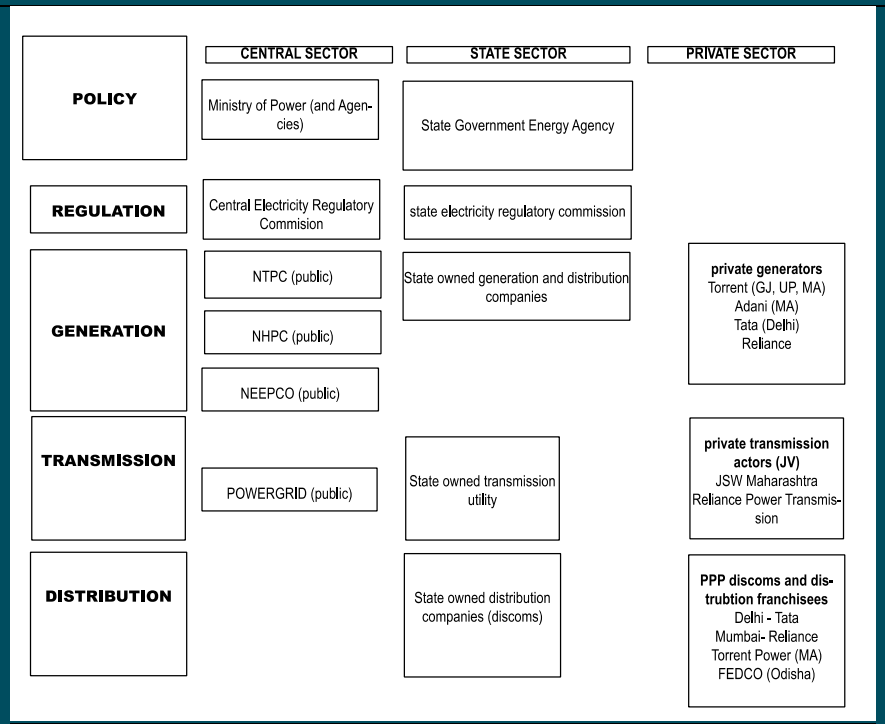
3 Regulation

There has been consistent development of the electricity landscape in India, since Independence in 1947. With the Electricity Act (2003) and the National Electricity Policy (2005) the Government undertook the separation of Generation, Transmission and Distribution. This was part of its program to implement forward looking structural reform. It also mainstreamed the need for development of renewable energy and introduced broad sectorwise reorganization (Table 2). Electricity generation was made a non-licensed activity. Economic approvals formally required by the Central Electricity Authority were removed, and captive power plants previously discouraged were now permitted to operate. The Act is considered a watershed moment for the power sector in India, with far-reaching vision about the needs the sector required to develop sound management, through increased competition, unbundling, and a focus on market pegged tariff pricing and commercial power trading.

Table 2 – Key Policy Reforms to introduce market competitiveness into India’s electricity sector

Policy / Legislation / Regulation	Year	Key Focus
Electricity Regulatory Commission's Act	1998	Independent Regulation
Electricity Act	2003	Sector Reorganisation and competitive markets
National Electricity Policy	2005	Overall sector development
National Tariff Policy	2006	Performance Based Regulation
Guidelines for Competitive Bidding	2006	Transparent tariff based bidding for new generation
Rural Electrification Policy	2006	Access to all (orig. 2011-12)
Hydropower Policy	2008	Accelerated hydropower development
Terms and Conditions of tariff, CERC	2009	Generation and Transmission tariff determination
Indian Electricity Grid Code Regulations	2010	Grid Operations with competitive markets and renewables
Power Market Regulations	2010	Transparent power market operations
Sharing of Transmission Charges Regulations	2010	Efficient pricing

Political Economy of Power



Source: Private Sector Participation in the Power Sector India, World Bank Group

Graph 9: Political Economy of Power

State distribution utilities, because of State Electricity Boards, have long been considered the weak link of India's electricity market. Power sector loss in 2011 was INR 618 billion (USD 14 billion), which was equal to 0.7 of the country's GDP, and sat largely with public distribution companies. Financing this loss was done through heavy borrowing from public and commercial banks, with high interest rates, and backed by state government loan guarantees. Further subsidised borrowing, to finance payments of existing loans, was done from public corporations such as Power Finance Corporation of India. This process perpetuated a cycle of fiscal distress on the utilities and locked up lending potential of the banks, with high unpaid debt. In 2011, banks were directed to cease funding insolvent utilities. A large-scale bailout package was put forward by the Ministry of Power, for indebted utilities. State governments took on half of the loan, with restructuring being done for the remainder with central government support. Losses affected the stability of the banking sector as well, with non-

performing assets in the power sector leading to an overall decrease of commercial lending.

Although the Electricity Act did start a process of change, most ownership still lies in the hands of public actors and trading is still done by public entities through long-term Power Purchase Agreements. The private sector currently makes up approximately 20 per cent of the entities working in the power sector. At the state level, the State Electricity Regulatory Commission are autonomous bodies with the mandate to set tariffs across generation, transmission and distribution, facilitate interstate transmission and act as final arbitrator for disputes within the sector in the state. Despite the policy push for increased private sector participation in the sector to reduce billing inefficiency and power theft, state utilities have been hesitant to give up control of distribution assets. However, the business model of distribution franchisees (DF) is an alternative route to reach fiscal objectives with the state still in ultimate oversight. DFs assures assets are maintained with the state but the function of distribution is given to a private company.

Evaluation of DFs have shown a strong positive trend towards improving returns. Examples of Torrent Power in Maharashtra, bringing down losses by 25 per cent and FEDCO in Odisha doubling collections has also highlighted the value of smart meters.

4 Commercial and political development

The 2011 discom bailout did not last long. As of June 2016, Non-Performing Assets of public banks (NPA - loans that remain unpaid after 90 days) amassed to approximately USD 100 billion. Power sector NPAs accounted for 6 per cent of total debt and has led to stressed assets that were not able to be off-loaded by affected banks to other lenders. This is because of the lack of confidence in state discoms and their ability to respect payment terms. Commercial and public banks are recovering from bad loan choices. Although the power sector is a small part of the overall debt crisis, the process of resolving the problem will be long-term as it will require changes to a process that has consistently encouraged irresponsible management. The lasting impact of this is that there should be limited expectation of available domestic financing for the country's power sector development.

The *Ujwal Discom Assurance Yojana (UDAY)* scheme, launched in 2016, focuses on both restructuring debt and loss, but also targets management of the public-sector utilities along with increasing private sector participation in the sector. UDAY is seen to be the first bailout scheme that appreciates that the performance of the discoms, in addition to being self-inflicted, is also the result of a faulty power sector overall, with a need to increase bulk power purchases which would subsequently lead to more liquidity in the market. UDAY is a voluntary scheme, with tri-partite MoUs on refinancing being signed by the discom, respective state government, and the Central Government. To date, nearly all public sector discoms have signed on for relief. UDAY mandates smart metering, increased investment in infrastructure, deployment of energy efficiency systems such as LED street lighting, and a strong alignment between state and discom fiscal obligations. Such a voluntary uptake by discoms, for actions that can challenge long-held vested interests, is a strong positive sign for investors.

4.1 Smart grids; Policy and competition

The Smart Grid discussion in India is quite a unique development. It combines both high tech elements of communication inter-operability, renewable energy integration, prosumer market dialogue as well as the relatively basic objective of developing robust fiscal management, reducing transmission and distribution losses and creating confidence in the system. Introducing efficiency into a traditionally mismanaged system challenges vested interests. In so doing, it becomes critically important to develop strong business cases for change.

The understanding that the grid system required infrastructure overhaul, across the generation, transmission and distribution supply chain, is not a new discussion in Indian political circles. The Restructured *Accelerated Power*

Development Programme (R-APDRP), first introduced by the Government of India in 2008, aimed to reduce Aggregate Technical & Commercial (AT&C) losses to below 15 per cent. It also focused on the mainstreaming Information Communication Technology (ICT) innovation for accounting and baseline data collection. R-APDRP will come to an end in 2018.

R-APDRP is seen by many as the first step to make India 'smart-grid' ready and developed parameters that would be leveraged within more focused smartgrid development. While distribution, the role and functionality of the state distribution company and fiscal management is at the heart of the country's smart grid activity, so too is the push to develop 'beyond grid' opportunities for energy access. These include the development of bi-directional tariff mechanisms for rooftop solar, mandatory deployment of rooftop solar in public building, development of micro-grids, EV infrastructure, and battery storage, battery R&D.

4.2 Smart grid “Mission mode”

India often works in 'Mission' mode to set overarching direction and aspiration. Missions are not policy, and are not commitments by the Government, but rather indications of further policy that might be developed. It also acts as an indicator for potential stakeholders that would be part of the developing market engagement and capacity building. India's National Solar Mission (2010) is perhaps the strongest reference case to date to help explain the continued expectation of developing private sector participation by creating indicative incentives. In 2010 the country had only 17.8 MW of solar capacity but by 2012 this had reached 506 MW. Private sector participation drove this increase and pushed prices to record lows. Foreign participation and investment was also a critical component of the Mission's success.

The Government of India released the Smart Grid Mission guidelines in 2016. This however was subsequent to a number of Central actions that focused on developing an operational understanding of the market viability. *The 11 smart grid pilots that were developed and tendered in 2013 provided a litmus test for the Indian Government about the viability of technology in the market, and the areas in which cost effective deployment could be developed. The 2016 projects, coming out of the lessons of 2013, are seen to be commercial full-scale pilots. India is now ready for commercial engagement in the smart grid space. International partnerships will need to self-finance pilots should they be required before full rollout.*

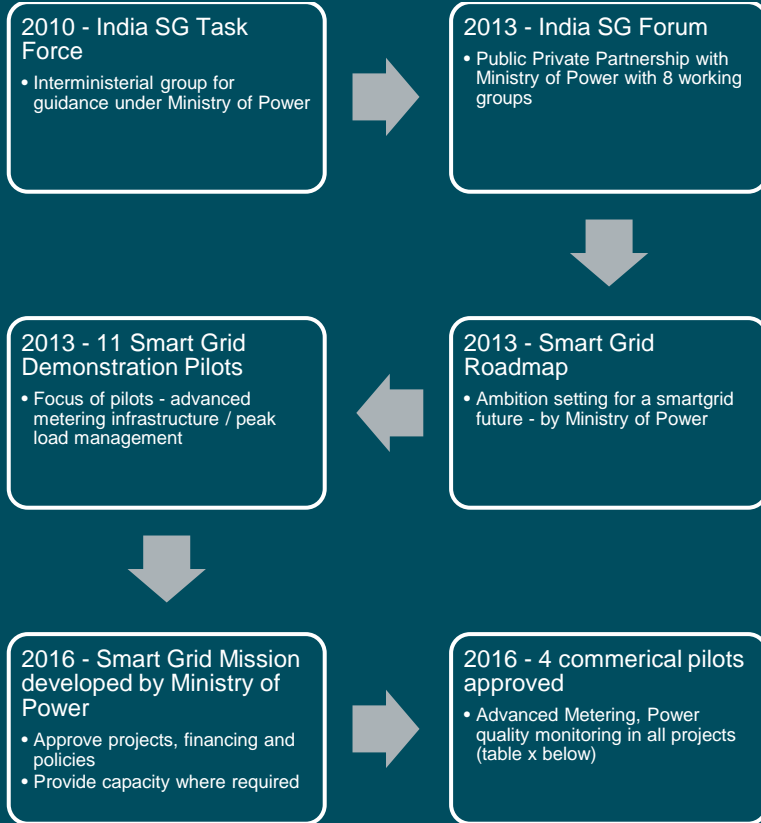
Unlike the National Solar Mission, there has not been a subsequent step by the Government of India to develop a specific policy framework at the central level that can be then modified by states. The breadth of definition within the smart grid sector, challenges the opportunity of having one overarching policy that is able to operate across a large number of differing jurisdictions. The Mission remains 'an

institutional mechanism for planning, monitoring and implementation of policies and programs related to Smart Grid activities’.

For this reason, there is also no specific legal framework that pertains to smart grid project development. States have final decision on the legal landscape for energy issues. While the Central Government has indicated frameworks for compliance such as the Renewable Purchase Obligation (RPO) – a ceiling for renewable energy to be purchased by states – there has been limited compliance at the state level for such measures. As of December 2017, it was estimated that only six states had complied with the RPO targets. For those that had not complied, there was little action taken. Legal frameworks have not been a strong trigger for action within the energy space in India. The poor financial health of most state discoms compounds the challenge faced by a weak legal framework.

The Smart Grid Mission, led by the Ministry of Power, will take over from R-APDRP and continue to push the reduction of losses to 10 per cent by 2027. Although it could be argued that the objectives set are ambitious and unlikely to be met in the given time, it does give a clear signal that the Government is developing an understanding of the steps that need to be taken, along the supply chain (Graph 9). Scale is the main approach, in the Indian context, to bring down cost. Cost will be at the centre of deployment discussions, and until such time as lifecycle costs are not taken into consideration in tenders, this will work against most international actors without a local base.

Supply chain



Source: India Smart Grid Forum

Graph 10: Supply chain

MAIN ELEMENTS OF INDIA SMART GRID ROADMAP 2014		
	DISTRIBUTION	TRANSMISSION
GOAL SET BY SMART GRID ROADMAP	<ul style="list-style-type: none"> • 100 % electrification – 8hours / day (2017) • Availability of low cost smart meter (2014) • Following successful pilot testing, rollout for all users in phased manner (2017; 2022 ; 2027) • Rollout to be combined with sustainable financing model development • Development of micro-grids, storage options, virtual power plants to manage peak demand • EV charging facilities to be created • Microgrids in 10,000 villages / industrial parks / commercial hubs, which can island from the main grid during disturbance (2022) 	<ul style="list-style-type: none"> • Development of Renewable Energy Monitoring Centre's to facilitate grid integration of renewable generation • Implement power system enhancement to facilitate evacuation and integration of 30 GW renewable energy (2017), 80 GW RE (2022), 130 GW RE (2027) • 50,000 kms of optical fiber to be installed over transmission line (2017)

Source: Ministry of Power, Smart Grid Mission

5 Smart grid developments

5.1 Smart Grid Market

India's recent history of new technology development and largescale infrastructure deployment has been to create enabling incentives for private sector engagement. While these incentives have been open to international participation, there will always be a strong focus on developing and supporting a domestic base. The areas outlined below have been specifically selected because of the focused market and policy actions that have been taken, with regard to developing participation. As an international actor, it will be important to understand the areas of focus for the Central government with regard to smart grids, and how these translate to the states and subsequent support measures. Business development will happen at the state level and has, more often than not, followed closely in line with indicated policy support from the centre.

5.1.1 Smart Meters

With the focus on effective fiscal and operational management of the distribution companies, *advanced metering infrastructure* becomes a point for action. The goal of having 100 per cent smart meter rollout for end users has been specified within the *UDAY* restructuring scheme for discoms, as well as in the Smart Grid Roadmap. The first tranche rollout, for customers with a monthly load in excess of 500 kWh was set for December 2017. The second tranche is for customers with a monthly load between 200 kWh – 499 kWh, and to be concluded by 2019. Deployment has begun, but targets are far from being met.

In August 2016, the Energy Efficiency Service Limited (EESL), a joint venture of 4 public sector enterprises, and under the Ministry of Power, put out a tender for 5 million smart meters. These are to be deployed in the states of Uttar Pradesh and Haryana, with aggregate technical & commercial losses of 38 per cent and 24 per cent respectively. The tender was done on a Build-Own-Operate-Transfer (BOOT) model. EESL will take all upfront capital costs, and utilities will payback with costs savings. EESL selected General Packet Radio Service (GPRS) as the technology choice for the smart grid tender, despite the strong argument from technology providers that Radio Frequency Mesh Technology would have required initial infrastructure investment but would have proved cheaper and more reliable in the long-run. Private sector actors and distribution companies are opting for RF Mesh technology.

National Standards for smart meters were issued by the Bureau of Indian Standards in August 2015 and based on feedback from actors such as the Indian Smart Grid Forum, standards were modified in in 2017. It is estimated that 35 million smart meters will need to be rolled out by 2019, to keep on track with the Smart Grid Roadmap and UDAY.

India has had overall 3 financial bailouts for state discoms. In each instance, the importance of billing, monitoring and revenue generation has been stressed. However, there has been resistance to deploying solutions in this regard. With the UDAY scheme and the smart grid rollout, smart meters are here to stay. Sweden's experience of rolling out smart meters, investments required to make this successful, and changes to the business model would be of importance to Indian regulators and utilities.

5.1.2 Electric Vehicles (EVs)

The electric mobility discussion has taken hold of the Indian imagination. City commissioners responsible for putting forward smart city ambitions, essentially to make their urban areas more economically productive, have put forward city plans that include electric vehicles for public transport. In 2015, Piyush Goyal, at that time the Union Minister for Renewable Energy and Coal, made a bold statement that by 2030 all vehicles in India would be electric. Unlike the clear domestic trigger factor of reducing fiscal mismanagement and create stronger opportunities for revenue collection, the EV ambition is strongly linked to climate goals, and the recognition that transport will have to be the strongest factor of change in developing a decarbonised economy.

India's electric ambition's policy timeline started in 2013 by the National Electric Mobility Mission Plan 2020 of which Faster Adoption and Manufacturing of Hybrid and Electric vehicles (FAME) was a part. The aim of the Mobility Mission was to have 6 million electric cars, and 7 million hybrid cars, on the ground by 2020. As has been the pattern with recent governance in India, the aim of these mission documents was to create incentives to develop a local market and private sector initiative to drive desired change. During 2015 – 2016 most states implemented lower VAT duties on electric vehicles. Karnataka issued 5 percent VAT on an electric four-wheeler as opposed to 15 per cent on a gasoline car. By December 2016, there were 400,000 electric two-wheelers and approximately 5,000 electric cars on the road. To push the market, EESL put out two tenders for first 5,000 and subsequently 10,000 electric vehicles to be deployed in the Delhi area for Union Government officials and their line agencies. Deployment would be done over a 4-year period. The tenders were awarded to Indian automotive giants, Tata Motors Ltd. and Mahindra & Mahindra. FAME is only available to cars / vehicles manufactured (assembled) in India.

Table 3: Policy Actions and Market incentives to develop EV uptake

	Policy / Framework / Action	Target / Support
Centre		
Department of Heavy Industries, Government of India	FAME 2.0 (Faster Adoption and Manufacturing of Electric Vehicles - 2017)	EVs for public transport approved for Delhi, Mumbai (Maharashtra), Ahmedabad (Gujarat), Bengaluru (Karnataka), Jaipur (Rajasthan), Lucknow (Uttar Pradesh), Hyderabad (Telangana), Indore (Madhya Pradesh), Kolkata (West Bengal), Jammu (Kashmir) and Guwahati (Assam) 60 per cent capital subsidy provided to states for charging infrastructure
Department of Science and Technology	Call for R&D Across all Technology Areas as part of Mission Innovation (July – March 2018)	
Energy Efficiency Services Ltd	September 2017 – tender for electric charging stations	5000 charging stations – snap bid, closed in Nov 2017 to support EV tender for 5000 four wheelers
States		
Karnataka	Electric Vehicle & Energy Storage Policy 2017	55,000 jobs Inward investment of INR 31,000 crore ² (39 billion SEK)
Maharashtra	Electric Vehicle Policy 2018	5000 EVs by 2022 15 percent subsidy provided to first 100,000 EVs registered in the state INR 1 million subsidy (SEK 125, 460) to development of charging station INR 5000 (SEK 630) subsidy for two wheelers / INR 12000 (1500 SEK) for three wheelers and INR 100,000 (1245 SEK) for four wheelers

² A Crore is 10 million

The EV discussion is also paving the way for showcasing new trends in the automotive industry. Ola taxi, a domestic ride sharing app, has joined together with vehicle manufacturer Mahindra & Mahindra to develop the country's first electric mass mobility eco-system, to be accessed on Ola's app, providing seamless point to point travel. This is being supported by both the Central government, as well as the Maharashtra state government.

Company	Investment	Sites
JSW Energy, Mumbai	INR 3,500 Cr-INR 4,000 Cr (4.4 billion SEK – 5 billion SEK) to be invested in manufacturing sites between 2017 - 2020	Manufacturing sites to be located in Andhra Pradesh, Gujarat, Tamil Nadu, Rajasthan, and Maharashtra
Maruti Suzuki (India JV)	INR 3200 crore (4.8 billion SEK)	to be invested in manufacturing factory in Gujarat for 2.5 million units to be rolled out by 2025
Mahindra & Mahindra	INR 3200 Crore (4.8 billion SEK) additional investment to develop EV portfolio over 3 years. Current portfolio e20 hatchback, e-vertigo sedan, esupro 3 wheeler	
Tata Motors	Won EESL bid for 10,000 EVs in Delhi 2017. Aims to develop mass production of EV portfolio; 2 meter electric bus, passenger cars- Tiago EV, Tigor EV, Racemo EV	

The Society of Indian Automobile Manufacturer's (SIAM) report on the sector, published in December 2017, indicates that market measures have resulted in a strong uptake in sales of EVs in the country, with 40 per cent more vehicles being sold as compared with 2012. SIAM's report also calls for an R&D 'giga-factory' to be developed in the country to provide opportunities to move beyond lithium-ion batteries.

While the focus of policy and market incentives is on the vehicle, much work will need to be done to develop the EV ecosystem. Batteries, charging infrastructure and business models will be critical in developing commercially viable system in the country, such that by 2030 all vehicles on the road, in India will be electric. Sweden's SMEs have a strong window of opportunity to engage here, while the country is gearing to go electric, there will be a lag in the component manufacturing required to make the shift in a short period of time.

The automotive sector in India is one of the strongest in the country and contributes to over 8 per cent of the country's GDP. The auto-components sector employs upto 25 million people and has evolved into a mature and

skilled area. The Make in India flag will be high for the EV rollout, as a means of reassuring the sector that disruptive innovation will not come at the cost of jobs and livelihood. Reskilling will be an important soft target that could win a lot of attention within the sector.

5.2 Embedding Change – Working from the top down

India's smart grid development will work in parallel with, ICT and grid flexibility as much as it will with transformer upgradation, power quality monitoring and reduction of power theft. A lot of the smartgrid roadmap ambition assumes an overall mentality shift of embedded actors across generation, distribution and transmission. In order to make this shift possible, and to ensure that it is sustainable, stakeholders at all levels of the supply chain will need to be convinced of that value of the changes being developed. At the core of this will be the shift in incentives, returns and results.

From a Swedish SME perspective, looking at low hanging fruit and working within available bandwidth, working with transmission is the part of the energy landscape that is most amenable. Creating workshops, exchanges, and other such opportunities to develop this understanding will be an important part of creating the chance of competitiveness.

6 Challenges

Trade between India and Sweden reached USD 2.2 billion in 2016. There has been a strong and productive Government to Government relationship, with Sweden's Prime Minister visiting India in 2016, followed by India's president coming to Sweden. While the Sweden brand is strong in India, and the country is well respected with regard to sustainable development, clean technology and quality delivery, there is a danger of Sweden being seen as not necessarily relevant in terms of relative population and size. The scale India requires, for any given product is a challenge.

Given the cost component of domestic tenders, there is every likelihood that competitive bids will only be won through local production and manufacturing, which is not an option for many SMEs at the start. Many SMEs at this time work with local distributors and agents, rather than locate in India.

Access to finance is a hurdle for SMEs. Options for flexible finance mechanisms are lacking on both the Indian and Swedish side. India is ranked 100 in the World Bank's *Ease of Doing Business* scale. While this is a jump of 30 places between 2016 and 2017, it still indicates a regulatory environment that can be burdensome to navigate, especially for SMEs. Although India has undertaken aggressive reforms to improve market access, since the 2014 Modi Administration, operational issues at municipality level continue to suffer from relative lack of transparency. Payments from the public sector, while 100 per cent assured, are in no ways guaranteed in timeliness.

It is important to have strong and credible local partners that will be able to help SMEs make the required connections in the most effective manner. Understanding local culture and trust building is an important part of the business network in the country, but a strong business model will continue to be the bottom line for discussion.

In the Swedish case, building on the narrative that has already been created by Brand Sweden will be an important and positive factor for SMEs. Working with private sector partners at the outset, rather than engaging with public sector buyers will be a stronger entry.

India is on an aggressive path of growth that is far from business as normal. While this disruptive environment settles, Sweden has a strong opportunity to develop dialogue on partnerships at the SME level.

6.1 Barrier Analysis

Many of the issues that arise when engaging in the Indian market are size neutral. Bureaucracy, lack of transparency, land acquisition, and opaque policy norms are common challenges in India. Access to finance for feasibility studies and project development, the challenge of distance, influencing adoption and product desirability, and effective trust building are more specific to the SME discussion when looking at market engagement from a Swedish perspective. It is these areas that will need to be the focus of an India Promotion Plan.

In 2017, India was ranked 100 on the World Bank's Ease of Doing Business Reportⁱⁱ. This was a jump up of 30 places from the previous year. India's move up the rankings is seen to be as a result of a number of aggressive reforms the Modi led government had taken to increase transparency, regulatory ease, and protect investors. The Goods and Services Tax (GST) has introduced a system of 'One Country, One Tax' which removes the individual 29 state specific taxes that were levied on businesses and movement of goodsⁱⁱⁱ. Reallocating debt on non-performing loans is another way the country has improved investment opportunities. India has also introduced a Bankruptcy and Insolvency Code and to add single window clearances for business processes^{iv}. These all work to unlock bad debt and improve confidence in the system. Access to domestic finance in India has been an issue because of high risk aversion by lenders. Risk aversion is increased with a faulty system and little confidence in repayment.

Domestic loans have both higher interest rates than foreign credit, as well as shorter payback times^v. India's alternative energy development landscape has been associated with high startup costs. This, matched with a domestic finance sector but one that still tends towards 'reliable' investments poses a challenge^{vi}. Swedish companies looking at India as a possible market, will have to keep in mind that access to finance in the Indian system should not be an expectation, especially in the first steps of partner engagement.

The success of the National Solar Mission has done much to set in motion a move towards alternative energy investments. Access to Green Bonds and international finance with increasingly competitive repayment rates has contributed to strong market development. Investors such as YES Bank are an example of this. In 2015, YES Bank, the country's 4th largest private bank committed mobilising USD 5 billion towards projects that fulfil climate targets by 2030^{vii}. In 2017 this was increased with an additional USD 1 billion focused on solar power development. YES Bank has finalised partnership with the Development Banks of France, Germany and the Netherlands to provide support for joint country partnerships for sustainable development, specifically with 'sunrise' sectors such as electric vehicles, and battery R&D and innovation.

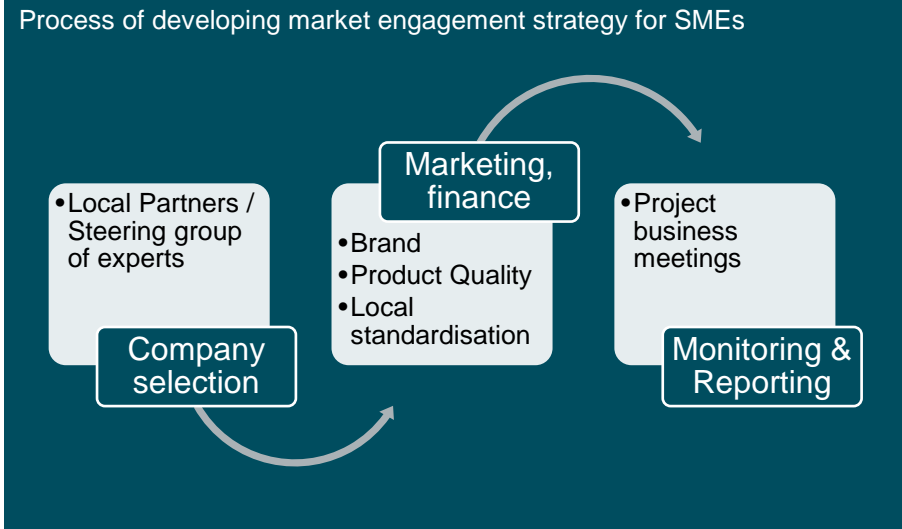
Table 1: E.g. of Investment opportunities available for Smart Grid relevant cases

Fund / Resource Partners	Amount	Utilisation requirements
European Investment Bank / YES Bank	USD 400 million 2018 - 2030	Support towards wind / solar / evs
National Clean Energy Fund (coal cess)	Budget for 2017-2018; INR 8700 crore / 108 million SEK	Projects funded in 2013-2016 focus on grid connected solar rooftop, and renewable power evacuation in states, including Maharashtra and Karnataka
Reliance Commercial Finance	INR3 billion (US\$46 million) from IREDA for	

Bringing this down to a more operational level, two programmes in India, that work with SMEs and market engagement are worth taking into consideration when developing a Promotion plan for India. The Swedish Energy Agency India Sweden Innovations' Accelerator (ISIA), and the International Finance Corporation's (IFC) Suryodey Programme. ISIA focuses on business to business delegations of innovative energy SME companies from Sweden to India, working with Confederation of Indian Industries as their India marketing arm and business Sweden. Suryodey aims at bringing solar SME companies into the rural energy market.

The lessons across the two programmes are similar; companies with reference cases fare better, low capital cost solutions are easier to integrate within the India system, companies that are willing to have a registered base in India are easier to engage with, more agile in response to demand and closer to clients. Local partners, embedded within the government system, have been key to both programmes. IFC works with a number of key actors such as TERI, and ISIA works with CII. Local partners become the efficient dialogue partner with government. IFC's engagement strategy looks to put a value chain in place prior to developing company introductions.

Process of developing market engagement strategy for SMEs



Graph 11: Process of developing market engagement strategy for SMEs

7 Opportunities for collaboration and key stakeholders

When looking at opportunities for collaboration in India within a specific sector, it is important to understand the political context in which the country finds itself. The Narendra Modi led Government won the elections in 2014 on the back of a campaign that focused on anti-corruption, inclusive growth, and development. The government has taken on a series of aggressive reforms, to push forward the country's economic and development agenda. Demonetization, a Uniform pan-national Goods and Services Tax, and Bankruptcy code are some of the main reform actions that have been taken during the first few years of the Modi led Government. These have been bold moves and have had a short-term negative impact on growth, but seed a stronger base with which, both domestic and international actors can do business. India is increasingly open to international feedback and criticism. In 2017 India ranked 100 on the World Bank's *Ease of Doing Business* report. This was a jump of 100 places. Indian media spent a lot of time talking about this change, and the positive reflection this has on the current administration, and how the country was becoming more attractive to International partners. Similarly, media espoused the government's ambition to move up even further in the next year, based on the continued policy development that is expected, focused on ease of doing business factors such as access to energy.

Ambitious policy positions, tied together with domestic and international target setting that will require an entire system overhaul. From a very operational level, to make this ambition a reality will require bringing in the right solution providers, be they international or domestic. But tendering for tomorrow's technology, with yesterday's regulations is going to cause a problem. Requests for proposals for all areas can only go as far as existing policy / regulatory boundaries will permit. India's infrastructure tenders are most often put out on a 'L1 basis' or lowest upfront price. A Lifecycle cost perspective is not yet fully appreciated within the Indian system. Similarly, technology parameters in tender documents can only be as far reaching as the knowledge of the individual penning the document. Like in the case of the smart meter tender put out by EESL. Rather than being technology agnostic, specific technology choices were made, that could be argued would be short-lived. Similarly, the 14 pilot projects in the smart grid arena were also tendered out with a focus on the financial bid, and not the technical. For this reason, a number of pilots were delayed in deployment because of change in project actors or were cancelled due to lack of operational capacity.

This 'here and now' mentality is positive in that there is an eagerness to action plans, but it can also be a very expensive way to learn about alternatives. SME companies will continue to struggle with the existing ecosystem of tender processes in India. Although organisations such as CII and the India Sweden Business Leaders Roundtable are working to create mechanisms for change, it is unlikely to happen in the near-term.

Similarly, although India claims the age of the pilot is done, many SME companies have engaged in a process of 'proof of concept' (PoC) exchanges before their first commercial contract. Such PoC costs are borne entirely by the solution provider and can be a challenge for market engagement. Access to finance will be a very important consideration in the Action Plan.

With a domestic unemployment rate of 3 per cent, which is considered under-reported, the Modi Administration has also focused on pushing domestic employment through a) manufacturing and b) re-skilling. This is across sectors and will impact all programmes that focus on international partnership. Make in India (MII) is the underpinning agenda across all politics and programmes, with the core focus on increasing India's manufacturing productivity from 16 per cent of GDP in 2014 to 25 per cent in 2025. In line with aggressive reforms, in order to push these goals, there have been incentives put in place for local manufacturing.

7.1 Key Stakeholders

Despite steps being taken towards smart-grid development, as early as 2008, India's smart grid landscape is still at a very nascent stage. With smart grid ambition moving between low-end transmission efficiency to relatively high-end goal of increasing prosumer engagement in grid interaction, India's smartgrid ecosystem is a top-down, policy driven environment. Although India's economic landscape has opened up opportunities for market leadership in the private sector. This is early days, but we can already see that the market movement is informing policy in areas such as smart meters and EVs.

There are a number of industry associations and think-tanks – both domestic and international relevant to smartgrids. Confederation of Indian Industry (CII), Federation of Indian Chambers of Commerce and Industry (FICCI) and Association Chamber of Commerce and Industry (ASSOCHAM) are a few of these that are all membership bodies, that the Government works with, without bias. One organization that is to be taken seriously, as a spokesperson for both industry and government is the India Smart Grid Forum (ISGF). This is a voluntary public private partnership with the Ministry of Power, India. ISGF has been part of the smart grid discussion since its inception and has assisted in drafting a number of policy and regulatory

measures that are now an integral part of shaping the smart grid road map. ISGF has eight working groups, each led by either a member of the private sector or respective Ministry and has held four of its annual conference - *The India Smart Grid Week*, to provide large-scale networking opportunities for smart grid actors. The Clean Energy Access Network (CLEAN) launched in 2014, by a number of funding organizations including WWF-India, the Ashden India Renewable Energy Collective, and USAID, has organically developed into a membership cluster body and the main forum for decentralized energy providers.

For larger actors, both domestic and international, there is limited need to rely on these informal networks. However, for smaller players, having the backing of intermediaries such as ISGF will continue to be an important factor for timely uptake of solutions.

7.2 Existing Swedish Footprint

There are three relevant Government to Government Memorandums of Understanding between Sweden and India; Environment and sustainable development; Sustainable Urban Development; Renewable Energy. MoUs are important in the Indian condition, because they are a public indication of the Indian Government's willingness to engage with the stakeholders in question. MoUs are effectively the door opener to operational activities at the ground level. It will be important for the Sweden to develop engagement with India that has connections from the Central level to the ground, to allow for maximum integration between policy dialogue and related operational activities.

With an understanding of the potential of the Indian marketplace, the growing income profile of the average consumer and the broad range of products and services that will be required to get India to where it needs to be 2040 and beyond, it is not surprising that India is on the radar for countries looking to internationalize. With specific relevance to the power sector and smart grids, Team Sweden and allied industry actors have programmes in place that can be leveraged and complemented by the Swedish actors, as they engage with India.

The India Sweden Innovations' Accelerator (ISIA), developed by the Swedish Energy Agency (SEA), and partnered by Business Sweden and the Confederation of Indian Industry (CII) has created a strong brand since 2010, with a focus on providing market engagement strategies for Swedish SME companies working with innovation in the energy space. SEA has led 10 business delegations since 2010 and focused on providing market entry opportunities. SEA has developed a network of Indian partners to work with and has also partnered with ISGF during its previous *Smart Grid Weeks*. ISOA has not had a specific technology or sector focus but all their

companies are smart grid relevant. Their initiative has focused more on the market engagement mechanism through matchmaking with the Indian private sector. Each ISIA company is given the opportunity to participate in ISIA actions over 1.5 years, with individual market engagement action plans being done for 3 delegations from Sweden to India. After this time, the company is considered *alumni* and are welcome to public events organised for subsequent delegations. A number of these companies have begun to successfully engage with the Indian market, but still require a level of handholding before they become profitable in the Indian landscape. SEA and the business development focus of Innovations' Accelerator have not engaged looked to engage with government or with a specific focus on policy area.

Smart City Sweden – in India (SCSI), is made up of three main programme partners; Teknikföretagen, IVL, and SIBC. This platform partners with CII in India. All three programme partners are member organisations, with companies who have an interest in India. The objective of the platform is to align SME actors, in Sweden, with opportunities in India, in the areas of; waste and wastewater, ICT and networked services, energy, and mobility. India's smart city initiative, launched in 2014 developed a framework for sustainable urbanisation. Smart city development in India is challenged by the complex system of decision making authority between central, state and municipal actors. The question of energy, smart grids and questions such as smart meters and EVs are issues city leaders i.e. municipal commissioners, are currently in a position of developing planning protocols for their cities. Municipal commissioners do not have sole authority to decide about transport decisions in their city, beyond road maintenance. Commissioners do not have authority to develop local energy systems, as that decision-making authority lies with the state. For this reason, there is a potential disconnect between smart city visions and ground level operations. SCSI, together with CII aim to bring planning into focus, with both city and state officials.

The main requirement for winning tenders in India, at the smart city level, continues to be L1 costs or upfront cost. Lifecycle cost, something that international actors are more likely to rely upon, is still largely missing from the Indian discussion. SCSI aims to contribute towards closing this gap by engaging with policy dialogue, regulatory reform, and ultimately developing a more operational lifecycle framework from tender to project development.

The India Sweden Business Leaders Roundtable (ISBLRT) is another strong platform that has potential to be leveraged. On the Indian side the process is coordinated by the Ministry of Finance, Government of India. It has four working groups; defence, digitisation, smart cities and skill. Meetings are held on an annual basis, and outcomes are submitted to Prime Minister's in

both countries. Developed by business leaders on both the Swedish and Indian side, SIBC and CII act as secretariats for the working groups. ISBLRT is made up of large cap industry members, and their inputs are reflected in the action points under the annual Joint Statement. Within the Joint Statement which outlines targets for the year focus is given to the importance of smart grid development. Specific mention is made to electric vehicles, battery development, and micro-grids.

7.3 Swedish company presence

There are 170 Swedish companies present in India (Annex II). The first companies established themselves as early as 1900. Between 2006 – 2016, 77 large-scale companies entered India and 30 SMEs. Relations between Sweden and India have been growing from strength to strength, with the visit of Prime Minister Stefan Löfven to India for Vibrant Gujarat in 2016, with one of Sweden's largest business delegations, marking a high point in bilateral relationships. The first *international* Make in India corporate networking and partnership event, was held in Sweden in 2017 as testament to the depth of Swedish engagement in India and confidence in continued Firms such as Ikea and H&M have established their presence in the country over the past two years.

ABB is one of the bigger players in India's power sector landscape. Their first project in India was for the HVDC project in Vindhyachal in 1989. More recently ABB has been selected by Power Grid Corporation of India to develop a power link set over 1,800 km and targeted to reach 80 million people. A new wave of energy relevant companies has joined the Indian Swedish landscape; Clean Motion, CyanConnode, and Metrum are a few examples of SME companies who are successfully navigating the Indian marketplace.

8 Conclusions

India's continued GDP growth will assume expanding energy demand. While fossil fuels will continue to play a strong part of the country's energy mix, future growth will be undertaken with a focus on climate commitments. Renewable energy ambition, specifically solar will play a large part of future energy supply. India's main focus within the smart grid space is currently to limit continued loss of income within the power sector, to reduce government support for mismanagement, to free up bank credit, and to create a sustainable energy sector.

Following policy markers to understand the areas of immediate interest to India and the correlated market potential, within the smartgrid space, leads to a focus on smart meters, the electromobility ecosystem, and capacity for retraining, skilling and engaging with a disruptive energy future.

With the objective of developing market engagement specifically for SMEs, there is a value to working within the existing Swedish footprint that has been established both by companies having come before, as well as other stakeholders that are developing relationships with the Indian government at the central and state level. With strong Swedish presence in Maharashtra, Delhi and Karnataka together with concrete policy incentives in these states, and mature private sector engagement, it makes sense to focus on these areas for an SME action plan.

ⁱⁱ World Bank, Doing Business 2018, available at <http://www.doingbusiness.org/-/media/WBG/DoingBusiness/Documents/Annual-Reports/English/DB2018-Full-Report.pdf>

ⁱⁱⁱ Goods and Services Tax – India, available at <http://www.gstindia.com/>

^{iv} Insolvency and Bankruptcy Code, available at <http://www.ibbi.gov.in/>

^v Observer Research Foundation (ORF), Mobilising private capital for green energy in India, December 2017

^{vi} Discussion with ICICI Bank, India's largest private bank. As of July 2017, there were no relevant projects on their books, as feasibility reviews found projects high risk.

^{vii} YES Bank USD 5 billion commitment to climate targets, available at <https://www.yesbank.in/media/press-releases/fy-2015-16/yes-bank-commits-to-target-mobilizing-usd-5-billion-for-climate-action-by-2020-on-the-occasion-of-cop21-paris>