

# Human Capital Challenges in the Indian Power Sector



Interim Report



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# **Human Capital Challenges in the Indian Power Sector**

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## *Executive Summary*

India is expected to maintain a robust economic growth rate of over 8% in the coming decade. This implies substantial increase in economic activities and raises the challenge of adding the infrastructure necessary to enable this development. India has ambitious plans of adding over 180,000 MW of generation capacity as well as associated Power Systems in the 11<sup>th</sup> and 12<sup>th</sup> plans, more than the cumulative capacity addition achieved till date. With such an ambitious target, the power sector requires augmentation of capacity across the value chain including manufacturing, construction, fuel and material supplies, project planning and implementation, financial management and operations and maintenance management.

While large-scale investments have been planned and numerous projects are underway, the lack of competent manpower to execute these projects and subsequently operate and maintain them is already being felt. The scarcity is increasing by the day and unless the Government, industry and all other stakeholders invest in attracting and training the available talent on an urgent basis, it has the potential to become a major bottleneck and derail the rapid growth in the sector that has just begun. This report addresses some of the key human resource challenges in the power sector today and lays out strategies for attracting fresh talent, retaining existing manpower and creating the necessary infrastructure for sustained training and development.

The total manpower in the power sector at the end of 10<sup>th</sup> plan was approximately 9.5 lakhs as per the report of the Planning Commission's Working Group on Power for 11<sup>th</sup> Plan. Even in a scenario where employee productivity is projected to increase leading to decreasing Man/MW ratio, it is estimated that over five lakh technical manpower and 1.5 lakh non-technical manpower need to be inducted into the sector in the 11<sup>th</sup> and 12<sup>th</sup> plan periods. In addition to the technical manpower, tens of thousands of highly skilled managers will be required in areas such as project planning and management, project monitoring,

project finance, contracts and materials management, human resources management etc. Further, with increasing focus on energy efficiency and renewable energy, there is an opportunity to productively engage millions of people to participate in harnessing small hydro, biomass & biofuels, solar and wind resources, provided they have the appropriate specialised knowledge. Moreover, demand side management, power trading, carbon credits, smart grids etc. will also require manpower with specialised training.

One of the key hindrances to ensuring adequate manpower for the sector is the lack of training infrastructure. While infrastructure for Thermal induction is sufficient, it is grossly inadequate for Hydro and Power System induction. Further infrastructure for Refresher Training required for updating skills and knowledge is just 3% of the required capacity and is a key reason for inadequate availability of manpower with right skills and competencies. Most importantly, there is huge deficit in infrastructure for managerial training, which currently caters only to 4% of the requirements. This has a significant impact in decision making capabilities, efficiency and effectiveness of organisations. At a time when the sector is undergoing rapid growth amidst a changing environment, lack of managerial competencies would hamper the ability of organisations to adapt and grow. In such a scenario, it is important that managerial talent is oriented towards commercial, social and environmental aspects of the industry.

Some of the strategies outlined in this report for creating human capital for the power sector are :

- Attract talent by showcasing opportunities, improving brand image and changing the work environment
- Expand training to cover behavioral & attitudinal changes Strengthen ITIs and other vocational skill development centres
- Standardise curriculum and develop certification standards
- Expand existing training facilities and create new infrastructure
- Ensure proper utilisation of training funds through direct reimbursements

- Introduce electives at graduate engineering programs and specialised programs at post-graduate level
- Create awareness on energy efficiency among all stakeholders and incorporate mandatory training for personnel involved in energy intensive processes

Finally, for the strategies to be successful and for development of the Indian Power sector, it is important for all the stakeholders to recognise the importance of developing human capital and invest in it.

# ***1. Introduction***

India has been witnessing high economic growth for the past decade with increased investment across industries post-liberalisation. The high level of economic activity has put strain on basic infrastructure services while also providing significant opportunities for large scale investments in the core areas of the economy. While India witnessed spectacular progress in the telecommunication space with full privatisation in place, other infrastructure segments like roads, ports and electricity lacked similar progress due to a variety of bottlenecks. While the Electricity Act, 2003(EA 2003) laid the framework for rapid development of the Power sector and it is attracting significant investments, the bottlenecks continue to remain. India has ambitious plans of adding over 1,80,000 MW of generation capacity as well as associated Power Systems in the 11<sup>th</sup> and 12<sup>th</sup> plans, more than the cumulative capacity addition achieved till date. The Power sector is at a critical juncture today with large scale capacity addition required to sustain the growth of the economy.

The power sector requires augmentation of capacity across the value chain including equipment manufacturing, fuel resources, construction, project management and Operations and Maintenance (O&M). While investments are being made to address the various challenges, availability of skilled manpower is becoming a major constraint. While large scale investments have been planned and a large number of projects are being launched, the lack of high quality human resources is becoming a key constraint with most of the current skilled manpower being derived solely from a few public sector utilities. It is important for the Government, Regulators and the industry to invest in attracting and training high quality resources for long term sustainable growth of the sector. This report addresses the key human resource challenges in the power sector today and lays out strategies for attracting fresh talent, retaining existing manpower and building capacity for training and development.



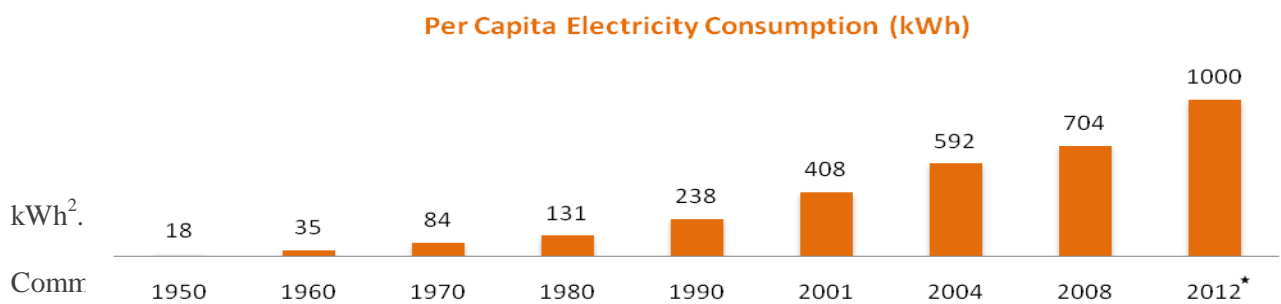
### Positive policy environment for Power sector

While at the time of independence the country had a power generation capacity of 1,362 MW, it stood at 156,784 MW in January 2010<sup>1</sup>. The Indian power sector has been witnessing progressive developments beginning with the Electricity Act, 2003. Positive legislations, competitive bidding policies, opening up for private investments as well as surging growth in electricity demand have all contributed to the growth of the sector.

- Electricity Act, 2003
- National Electricity Policy, 2005
- Rural Electrification Policy, 2006
- National Tariff Policy, 2006
- Integrated Energy Policy, 2006
- The Electricity (Amendment) Act, 2007
- New Hydro Policy, 2008

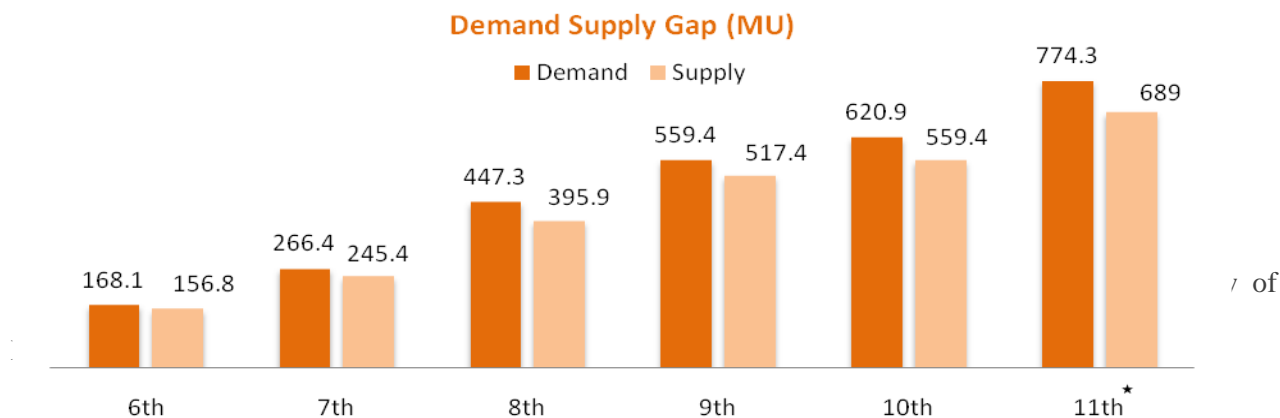
### Increasing Power consumption

In line with the high economic growth rates, the demand for primary energy consumption as well as power has been growing in India post liberalisation. The per capita electricity consumption stood at 704.2 kWh for 2008 (as per UN statistics). However, India's per capita consumption is still significantly less than the developed countries as well as major developing countries like China. As the country moves towards an urban industrialised economy, the energy demand is likely to increase significantly. The per capita consumption at the end of the 11<sup>th</sup> five year plan (FY 2011-12) is projected to be 1000

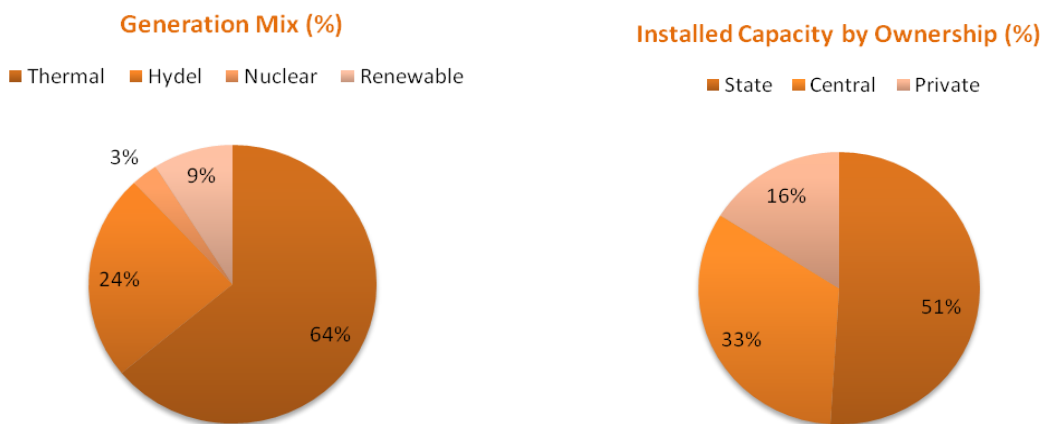


### Persistent power deficit

The energy requirement during FY 2008-09 was 774,324 MU<sup>3</sup> while the energy availability was only 689,021 MU resulting in energy shortage of 11 %. Similarly the peak demand for energy during FY 2008-09 was 109,809 MW while Peak demand met was 96,685 MW with a consequent peak shortage of 12%.



**Generation scenario**



Source: CEA Monthly Review of Power Sector, Sep 2009

India’s power generation capacity stands at 156,784 MW in January 2010 and is the fifth largest in the world. The state sector accounts for a large share of installed capacity, followed by central and private sectors. The generation capacity continues to be predominantly thermal power based even as the overall

capacity is increasing. Nuclear power is expected to get a fillip given the positive international cooperation in the area.

### ***Transmission Scenario***

Establishment of an integrated national grid is very important to handle the growth in the power sector and channelise the flow of power from the energy surplus regions to the energy deficit regions. The inter-regional power transfer capacity was around 21,000 MW in 2007 while the target for 2012 is 37,700 MW with the planned establishment of the Integrated Power Grid.

### ***Distribution Scenario***

The Distribution system remains the most challenging area in terms of reforms and privatisation. While the unbundling of the State Electricity Boards has been undertaken in most states, the distribution utilities in most states continue to perform poorly in terms of the loss levels. The AT&C loss levels have continued to remain at high levels and were at 32.07% in 2006-07 as per CEA data.

### ***Massive capacity addition required to maintain economic growth***

India is expected maintain its current high level of growth rates and is projected to grow at over 8% in the coming two decades. At 8% growth rate, India would need an installed capacity of 220 GW by 2012 and 306 GW by 2017<sup>4</sup>. By 2032, the installed capacity required is projected to be almost five times the current installed capacity. The past track record in capacity addition has been poor, falling significantly short of the planned targets. Unless the required capacity addition is achieved, there would be a serious risk to the nation's ability to maintain high economic growth rates.

Year	Total Energy Required (Billion kWh)	Projected Peak Demand (GW)	Installed Capacity Required (GW)
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	At GDP Growth Rate of		At GDP Growth Rate of		At GDP Growth Rate of	
	8%	9%	8%	9%	8%	9%
2011-12	1,097	1,167	158	168	220	233
2016-17	1,524	1,687	226	250	306	337
2021-22	2,118	2,438	323	372	425	488
2026-27	2,866	3,423	437	522	575	685
2031-32	3,880	4,806	592	733	778	960

Source: Integrated Energy Policy, Aug 2006

### *Challenges for growth of the power sector*

The Indian Power Sector, while set for strong growth aided by positive policy environment and increased private sector participation, faces significant challenges given the quantum jump in capacity addition required in the coming decades. Some of the key challenges which must be addressed include:

- Development of conventional fuel resources both in India and purchase of global assets to ensure continued supply
- Induction and development of skilled manpower for handling the capacity addition and subsequent operations and maintenance
- Building heavy equipment manufacturing capacities in order to prevent delay in equipment supplies
- Ensuring capital availability for large scale investments
- Ensuring transparent and speedy environmental clearances
- Ensuring low carbon intensive development to address the current global climate change concerns
- Developing alternative energy resources as cost effective and reliable resources

## ***2. Human Resources Requirements***

The Power sector is a capital and technology intensive sector requiring large number of engineers, technicians and other skilled workers. Power projects require specialised technical manpower during the project construction phase as well as the Operation and Maintenance (O&M) phase. Due to the technology intensive nature of the business, technical and managerial competency is critical in ensuring timely implementation of projects and optimum performance upon commissioning.

As discussed in the previous section, the country is poised to build more power generation capacity as well as supporting power systems in the next 10 years as compared to the previous 60 years. This necessitates induction of significant manpower in to the sector. Even though the country produces a large number of new engineers every year, it is not possible to directly deploy them in to the work force without proper training due to the technology intensive nature of the industry. The induction programs currently specified by the CEA range in duration between six to twelve months for engineers, operators, supervisors and technicians based on the technology area. Further, experienced professionals are required for critical activities and it is difficult to augment the number of such professionals in a short period of time. Hence adequate capacity building measures need to be undertaken to ensure the ready availability of manpower required for achieving the plan targets. Further, continuous training should be provided to the current manpower to ensure up-to-date technical skills, higher motivation and productivity.

The total manpower in the power sector at the end of 10<sup>th</sup> plan was approximately 9.5 lakhs as per the Planning Commission's Working Group on Power for 11<sup>th</sup> Plan. The following are the requirements for additional manpower for the 11<sup>th</sup> plan assuming addition of 68,869 MW of generation capacity, 100,000

ckt.Kms of HV, EHV and UHV transmission lines and 16 crore distribution consumers. It should be noted that the generation capacity addition target was revised to 78,700 MW which further increases the manpower requirement.

11th Plan Additional Manpower Requirement (in thousands)			
Area	Technical	Non-Technical	Total
Thermal	31.4	12.3	43.7
Hydro	25.3	7.1	32.5
Nuclear	3.9	1.6	5.5
Power System	202.1	60.6	262.7
Total	262.7	81.7	344.4

Source: Planning Commission Working Group on Power for 11<sup>th</sup> Plan

For the 12<sup>th</sup> plan, based on the earlier target of generation capacity of 82,200 MW, transmission capacity of 63,000 ckt.Kms, and about 14 crore distribution consumers, the required manpower addition has been estimated as in the table below. However, as per revised target, at least 100,000 MW is to be added in the 12<sup>th</sup> plan and the requirement for manpower correspondingly increases.

12th Plan Additional Manpower Requirement (in thousands)			
Area	Technical	Non-Technical	Total
Thermal	26.9	10.0	36.9
Hydro	37.5	6.3	43.8
Nuclear	13.2	5.6	18.8
Power System	148.4	45.1	193.4
Total	226.0	67.0	293.0

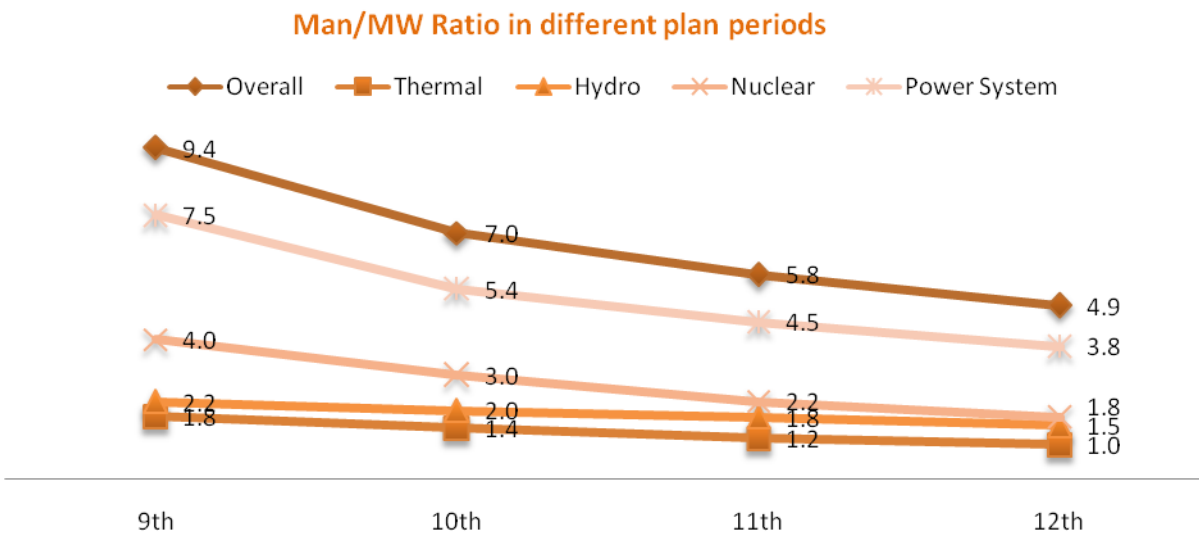
Source: Planning Commission Working Group on Power for 11<sup>th</sup> Plan

Based on the above estimates, it can be seen that at least five lakh skilled manpower another 1.5 lakh non-technical manpower needs to be inducted into the power sector in the 11<sup>th</sup> and 12<sup>th</sup> plan periods. In addition

to the technical manpower thousands of highly skilled managers will be required in areas such as project management, planning, project finance, monitoring and review.

### **Improving productivity**

The improvements in technology and the increasing scale of operations would help reduce the manpower requirement per MW. However, this also increases the criticality of each employee and hence the importance of adequate training increases. It is projected that the overall Man/MW ratio at the end of 12<sup>th</sup> plan would come down to 4.93 from 7 as at the end of the 10<sup>th</sup> plan.



### **Training requirement in the Power sector**

Training requirements in the power sector include mandatory training after induction, refresher courses for keeping the personnel updated and managerial training to build competencies. The induction level training requires significant time and investment as the fresh graduates lack the technical knowledge specific to the power equipment and processes. As mentioned earlier, the induction training can vary between six to twelve months and it forms the major component of the training needs of the industry. The National Training Policy (NTP), 2002, specifies the training policies for the power sector.

### ***National Training Policy***

The National Training Policy (NTP), 2002, is a key policy intervention to improve the training practices in the power sector. The NTP mandates that “Every Organisation in the Power Sector should have written Training Policy Document containing strategies to ensure training for all for a minimum period of one week annually for each employee”. The NTP requires organisations to allocate adequate funds to training and development activities for meeting the stipulated training requirement. A minimum of 1.5% salary budget may be provided initially, gradually increasing it to a level of 5% depending on organisation’s requirement.

### ***Requirements in Renewable Energy***

The labour intensity of energy production, i.e. the labour required per unit of energy produced, is much higher in renewable energy sources than in conventional energy production primarily due to the lack of scale and distributed nature of the projects. These distributed renewable sources of power not only provide clean, green and sustainable form of energy but also have enormous potential to generate employment in the rural communities. Small Hydro, Solar and Biomass based energy can go a long way in powering rural communities currently not connected to the grid. As the country is seeking to increase the renewable energy capacity, it is important to ensure that we train and equip manpower in these emerging areas.

As per a study done in 2007<sup>5</sup> there are 78,800 sites in the Himalayan regions spanning Arunachal Pradesh and Tripura in the east to Jammu and Kashmir in the west, with a potential of less than 5MW each. These sites can generate 9,500 MW of power for hilly communities which are otherwise expensive to connect to the grid. If this potential is to be realised in an economically viable manner, people from local communities should be trained to handle the construction and maintenance of these small projects. The authors estimate



that implementation of these projects will need employment of 2.3 million person-years on activities associated with surveys, investigations, planning and design, construction, operation and maintenance.

Biomass and Biofuels also offer a significant opportunity to generate employment and improve income levels in rural communities while creating valuable domestic fuel resources. As per a study in 2002<sup>6</sup>, vast stretches of cultivable wastelands that can be utilised for development of energy plantations consisting of fast-growing tree crops which can serve as fuel for a nation-wide network of small, decentralised bio-mass power plants that would also bring down transmission and distribution losses. These power plants, ranging in size from 6-25 MW, can generate thousands of megawatts of power from renewable, forest-based fuel sources in a cost-effective manner. The author estimates that 40,000 MW of capacity would require about 10 million hectares of energy plantation crops and require around 5 million people. As far as bio-fuel from *Jatropha* is concerned, the author estimates that cultivation of 5 million hectares to produce 3.75 million tons of fuel annually will require 2.5 million people all-the-year round.

Wind and Solar Energy are the most popular renewable energy resources globally. While the wind industry has matured, the Solar Energy industry is in the process of rapid technological development and commercialisation. Among all renewable energy resources, Solar Energy is most promising due to its abundance and wide spread availability, especially in a sunny country like India. The importance attached to Solar Energy as a potential solution to meeting India's long term energy need is evident from the recently launched National Solar Mission with an objective of adding 20,000 MW of Solar Energy by 2022 in three phases. The objectives of the National Solar Mission include achieving 20 million sq. meters of solar thermal collector area and deployment of 20 million solar lighting systems for rural areas by 2022<sup>7</sup>. This kind of large scale deployment would require lakhs of technically trained manpower.

In launching India's National Action Plan on Climate Change on June 30, 2008, the Prime Minister of India, Dr. Manmohan Singh stated:

*“Our vision is to make India's economic development energy-efficient. Over a period of time, we must pioneer a graduated shift from economic activity based on fossil fuels to one based on non-fossil fuels and from reliance on non-renewable and depleting sources of energy to renewable sources of energy. In this strategy, the sun occupies centre-stage, as it should, being literally the original source of all energy. We will pool our scientific, technical and managerial talents, with sufficient financial resources, to develop solar energy as a source of abundant energy to power our economy and to transform the lives of our people. Our success in this endeavour will change the face of India. It would also enable India to help change the destinies of people around the world.”*

The development of all the renewable resources to their fullest potential will require millions of people to contribute to the growth and development of these resources. However, unless adequate care is taken for the training and development of manpower who will be involved in managing these assets, the investments may become dependent on government subsidies rather than sustainable and self-sufficient.

### ***Other Emerging Areas***

Driven by the imperative to mitigate climate change, there is an increasing focus on energy efficiency and conservation. This includes implementation of energy efficient systems, monitoring and auditing. Other key focus areas include loss reduction in distribution utilities and improving demand side management (DSM). These would help efficient management of the power systems and generation facilities, reduce losses and provide better quality of service. Monitoring systems for detecting losses as well as DSM techniques require usage of advanced IT and communication systems which call for a large number of personnel to be trained in these specialised areas.

With the emergence of competitive markets and Power trading systems, a large number of highly skilled professionals with commercial and technical knowledge are required in this area. Other key decision makers and managers also need to develop a good understanding of the trading systems in order to make commercial decisions.

### 3. Key Challenges

As the power industry grows rapidly, it faces challenges across the board. While the initial growth may be spurred by investments, timely execution and long-term performance would require addressing different challenges that the industry faces. The challenges range from attracting fresh talent to updating the skill sets of existing personnel, to bringing about attitudinal and behavioural shifts and building managerial competencies.

#### *Attracting Fresh Talent*

While the pool of potential recruits is sufficiently large, the challenge is in attracting the young graduates to the power sector, providing them adequate training and satisfactory work environment. With a large number of other growing industries and manpower intensive sectors like IT becoming the preferred choice for the best talent, the Power Sector needs to find ways of attracting well qualified manpower. Today, the Power Sector is not a preferred choice for young talent which prefers the lifestyle offered by the urban service sector to working in projects and plants which are remotely located. The industry also suffers from a negative image of being heavily bureaucratic with limited opportunities for

As per CEA's assessment of the manpower available for induction in the Power Sector -

- About 1,346 Engineering Colleges in India approved by All India Council of Technical Education (AICTE), seat capacity of 4,40,000 are available. This includes the students who would acquire a specialised B.Tech. / B.E. degree in Power Engineering (about 180 nos.) from NPTI
- In addition to this, there are Polytechnic Colleges with a seat capacity of 2,65,416
- Over 2 lakh apprentices in various trades pass out every year from the Industrial Training Institutes

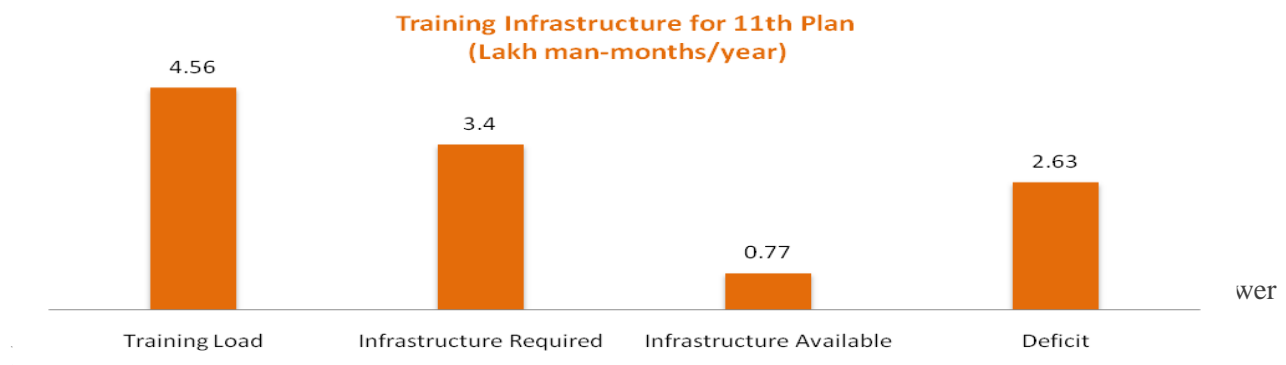
growth due to its strong association with state-owned utilities most of which fare poorly in terms of work environment. Apart from attracting new talent, the critical bottleneck in inducting manpower in to the sector is inadequate training infrastructure.

### **Training and development infrastructure**

The training and development infrastructure in the Power Sector in India includes the following:

- Sixty eight training institutes recognised by CEA for imparting statutory induction training in Thermal, Hydro, T&D and Power Management.
- Lineman Training Institutes operated by most distribution utilities
- Training facilities outside power sector offering refresher and management programs

The estimated training load and infrastructure availability as per the CEA's Manpower Projections (Nov 2009) are illustrated in the following chart.



As can be seen in the chart above, the training infrastructure for power sector in the country is grossly inadequate and caters to barely 23% of the optimal training infrastructure required. At a time when the sector faces massive capacity addition challenges, lack of sufficient training infrastructure would hinder

optimal utilisation of the existing talent base as well inducting new talent. The following table provides the breakup of the training load for various key areas.

Training Load Projections for 11 <sup>th</sup> Plan (In Thousand-man-months/year)				
Area	Training Load	Infrastructure Required	Infrastructure Available	Deficit
Thermal Induction	103.57	51.78	38.86	12.92
Hydro Induction	39.21	19.6	4.26	15.34
Nuclear Induction	-	-	-	-
Power System Induction	110.65	55.32	27.98	18.41
Non-Tech Induction	27.91	27.91	-	27.91
Refresher (Tech + Non Tech)	150.46	150.46	4.53	145.93
Managerial	37.6	37.6	1.5	36.1
Total	469.4	342.67	77.13	256.61

Source: CEA Manpower Projections, Nov 2009

While the Infrastructure for Thermal Induction is sufficient, it is grossly inadequate for Hydro and Power System Induction. Further, the infrastructure for Refresher Training required to upgrade skills and knowledge is just 3% of the required capacity and is a key reason for inadequate availability of manpower with right skills and competencies in the sector. Most importantly, there is huge deficit in infrastructure for managerial training, which currently caters only to 4% of the requirements. This has a significant impact in decision making capabilities of organisations. At a time when the sector is undergoing rapid growth amidst a changing environment, lack of managerial competencies would hamper the ability of organisations to adapt and grow. In the evolving scenario, it is important that managerial talent is oriented towards commercial, social and environmental aspects of the industry.

## *Development of Existing Resources*

It is important for organisations to not just update the technical skills of the manpower but ensure all round development to ensure that the employees possess the right skills, competencies and attitudes to perform effectively in their organisational roles. While technical training is seen as essential, personality and soft skill development are neglected in most organisations and leads to poor work culture.

The NTP recommends a periodical Training Need Analysis (say once in two years) for evolving an annual need based **training intervention** agenda encompassing the following areas:

- Technical training and skill upgradation
- Personality Development
- Organisation Development Issues
- Information Technology and Computer Skills

The NTP also suggests **education upgradation plan**

- Employers shall facilitate leave and financial opportunities to employees for acquiring higher educational qualifications.
- For non qualified workmen to qualifying in ITI
- For ITI Certificate holders to Diploma in Engineering
- For Diploma Holders to Graduate in Engineering
- For Engineers and Executives to acquire PG level qualifications (M.Tech. /MBA, etc.)
- For Postgraduates – research work leading to PhD

### **Management Development Programs**

- At least one long term training opportunity/ program in a career should be planned for middle and senior level officers.

The Power Sector while being a technically intensive sector dependent on primarily engineering work force needs competent managers especially in the changing environment of reforms and move towards competitive market environment. While the Power Sector has a large number of highly qualified engineers in senior roles, there has been inadequate focus on building managerial competencies. As outlined in the NTP, at least one long term Management Development Program should be planned for middle and senior level officers while they make the transition from primarily engineering roles to managerial decision making roles.



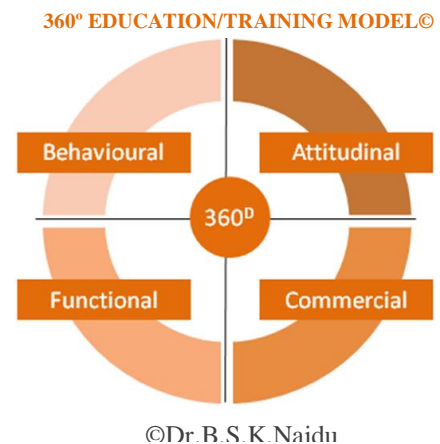
## 4. Strategies for Developing Human Capital

### *Attract talent by showcasing opportunities, improving brand image and changing the work environment*

As discussed in this report, the power sector is unable to attract the best available talent despite the fact that this is a sector that offers good salary and benefits packages, has relatively structured training & development programs, has several organizations with good employer reputation and, most importantly, with immense opportunities for a meaningful career. The power industry needs to showcase these opportunities and create awareness among the young talent pool. Industry groups as well as large companies in the sector need to work on creating a positive brand image for the industry in order to attract fresh talent. Further, companies should work on changing the work environment through better human resource practices, soft skills training, reducing hierarchical barriers and creating career development maps for the personnel. Experienced HR managers from other sector should be inducted to incorporate best practices from other sectors.

### *Expand training to cover behavioural & attitudinal changes*

The training interventions, education upgradation plans and management development programs designed for personnel should ensure holistic all-round development of the personnel. One of the comprehensive models for training, the 360° Training Model<sup>©</sup>, provides a platform not just for functional skill development but incorporating behavioural and attitudinal



orientation while creating an appreciation of the commercial aspects of business. While companies are generally able to offer core functional training, behavioural and attitudinal training expertise is lacking in a majority of the firms. Hence, companies should seek to ensure that the training is not limited to narrow functional role perspectives but overall organisational and social perspectives as well.

### ***Strengthen ITIs and other vocational skill development centres***

Given the current requirement for a large number of manpower for project construction, ITIs can be strengthened and utilised better for the development of skilled construction workers as well as O&M personnel with the help of the existing players in the industry. The “Adopt-an-ITI” scheme has been launched to address the issue of skilled and trained manpower and around 52 ITIs have been currently adopted by both public and private sector utilities. Adoption of ITIs close to large project sites would allow the companies to both recruit local manpower and also create goodwill by providing employment opportunities to the project affected people. Given the large requirements, at least 200 ITIs can be adopted in the medium term by the power sector. The Government can also consider collaborating with specialist training service providers for operating the ITIs.

### ***Standardise curriculum and develop certification standards***

It is important to standardise the curriculum for training of skilled and semi-skilled workers in order to effectively train a large number of workers. Certification standards have to be developed and implemented in order to ensure consistency in quality. In addition, having standard certified programs will allow multiple specialist training service providers to offer these courses to a wider cross-section as employment-oriented programs and prepare a steady pool of qualified manpower taking the burden off the limited available infrastructure.

### ***Expand existing training facilities and create new infrastructure***

While the National Power Training Institute (NPTI) and the training centres of NTPC and some of the state utilities cater exclusively to the training needs of the Power sector, they are not sufficient to meet the training needs of the sector. New training infrastructure needs to be created urgently in order to avoid a manpower crisis that is already looming large. This can be done by

- Providing incentives to existing training institutions in both the public and private sectors to conduct specific programs
- Encouraging the private sector to set up new training infrastructure with attractive incentives such as land at concessional rates, grants and loans
- Creating centres of excellence which can act as resource centres for other institutions
- Introducing new applied programs at existing academic and industrial institutions

### ***Ensure proper utilisation of funds through direct payments***

A major cause of the lack in development of training infrastructure is due to mindset that training facilities are cost centres and are non-critical. With most of the utilities in the past being loss making, training budgets were usually curtailed. It is precisely for this reason that the NTP mandated a minimum allocation of 1.5% of salary expenses towards training. Investment in training can be increased through directed measures like the following:

- Part reimbursement of training expenses directly provided to training institutes by the Central Government
- Apportioning of training budgets to a special Training & Development fund by the regulators and direct reimbursement to the training institutes in order to ensure proper utilisation of these funds

***Introduce electives at graduate engineering programs and specialised programs at post-graduate level***

- Introducing electives at graduate level would help generate interest in the Power sector as well as provide sound theoretical base for the engineers seeking to enter it
- Degrees in renewable energy, environment management, and energy efficiency should be provided in universities and leading academic institutions like IITs at post-graduate level
- R&D centres should be established in academic institutions to develop knowledgebase in emerging areas like solar energy, smart grids, etc.

***Create awareness on energy efficiency among all stakeholders and incorporate mandatory training for personnel involved in energy intensive processes***

While energy auditors and managers are certified by the Bureau of Energy Efficiency (BEE), awareness on energy efficiency needs to be propagated to all stakeholders from retail consumers to the managements of firms. Awareness on energy efficiency across the value chain is critical for preserving scarce resources, reducing pollution as well as increasing profitability for businesses. The measures to improve awareness should include:

- Orientation programs for key decision makers
- Mass awareness campaigns reaching out to different consumer groups
- Mandatory training for operators of energy intensive processes
- Incorporating energy conservation measures in to school and college curriculum

Finally for the strategies to be successful and for development of the Indian Power sector, it is important for all the stakeholders to recognise the importance of developing human capital and invest in it.

## *References*

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