Indo – German Energy Program

Energy Transition with DISCOMs

Draft Roadmap for Capacity Building of Distribution Utilities in India

Consulting Partners

Feedback Infra Pvt. Ltd., India

&

Energypeople, UK

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List of Abbreviations

Abbreviation	Full form
AC	Air Conditioned
ADMS	Advanced Distribution Management System
ARR	Annual Revenue Requirement
AGM	Assistant General Manager
ASCI	Administrative Staff College of India
BMZ	Federal Ministry for Economic Cooperation and Development
CBIP	Central Board of Irrigation & Power
CCNA	Cisco Certified Network Associate
CEA	Central Electricity Authority
CIRO	Content In Result Out
CIPP	Context, Input, Process and Product
ckt kms	Circuit Kilometres
CMD	Chairman & Managing Director
CRM	Customer Relationship Management
DDUGJY	Deen Dayal Upadhyaya Gram Jyothi Yojana
DISCOM	Distribution Company
DSM	Demand Side Management
DT	Distribution Transformers
EA	Electrical Assistants
ERP	Enterprise Resource Planning
EV	Electric Vehicle
EWE	Energieversorgung Weser-Ems
FIPL	Feedback Infra Pvt. Ltd.
GIS	Geographical Information System
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GoI	Govt. of India
GM	General Manager
HR	Human Resources
HRMS	Human Resource Management System
ISO	International Organization for Standardization
JA	Junior Assistants
KPI	Key Performance Indicators

Abbreviation	Full form
KRA	Key Result Areas
kVAr	kilo Volt Ampere reactive
LT/ST	Long term / short term
LMS	Learner Management System
MDAS	Meter Data Acquisition System
MDMS	Meter Data Management System
MIS	Management Information System
MNRE	Ministry of New & Renewable Energy
MoP	Ministry of Power
MU	Million Units
MVA	Mega Volt Ampere
NSGM	National Smart Grid Mission
NTP	National Training Policy
O&M	Operations & Maintenance
OMS	Outage Management System
PDP	Personal Development Plan
PFC	Power Finance Corporation
PM-KUSUM	Pradhan Mantri Kisan Urja Suraksha Evam Utthaan Mahabhiyan
PMS	Performance Management System
QMS	Quality Management System
RDSS	Revamped Distribution Sector Scheme
RE	Renewable Energy
REC	Rural Electrification Corporation Limited
SAP	Systems, Applications & Products in Data Processing
SCADA	Supervisory Control & Data Acquisition
SGKC	Smart Grid Knowledge Center
T&D	Transmission & Distribution
TMS	Training Management System
TNA	Training Need Assessment
TI	Training Institute
ToT	Training of Trainers
UKPN	United Kingdom Power Networks

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Chapter 1: About the project

About GIZ

Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH is a federal enterprise that supports the German Government in achieving its objectives in the field of international cooperation for sustainable development. For over 60 years, GIZ has been working jointly with partners in India for sustainable economic, ecological, and social development. India is fast emerging as an economic and industrial power. It is a member of the 'Group of Twenty' (G20) as well as one of the five major emerging national economies, namely Brazil, Russia, India, China and South Africa (BRICS). The thematic areas of GIZ in India are:

- Energy
- Environment, Climate Change and Biodiversity
- Sustainable Urban and Industrial Development
- Sustainable Economic Development

The Federal Ministry for Economic Cooperation and Development (BMZ), the Federal Ministry of the Environment, Nature Conservation and Nuclear Safety (BMU) as well as the Federal Ministry for Economic Affairs and Energy (BMWi) are the main commissioning parties of GIZ in India. Other clients include Indian public sector clients, the European Union and foundations.

About the Project

Capacity development of Indian DISCOMs is one the major components of the project - "**Energy transition in India with distribution companies (DISCOMs)**". This said project is under the umbrella of Indo – German Energy Programme being implemented in India by Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH on behalf of the Federal Ministry of Economic Cooperation and Development (BMZ) in Germany. The program supports Ministry of Power in India in building up a broad-based, technically, and economically efficient, socially, and ecologically sustainable energy supply by supporting the DISCOMs. The project is working with Ministry of Power (MoP), Central Electricity Authority (CEA) and select DISCOMs in India on various themes associated with data analytics, asset management and operation & maintenance (O&M) of distribution networks. The project aims to development of a roadmap for Indian distribution utilities to achieve the desired levels of capacity development in their organisation. There are three major tasks of the project – to prepare a national as-is scenario, to understand and benchmark the best international practices and finally to prepare a roadmap document for capacity building of DISCOMs in India.
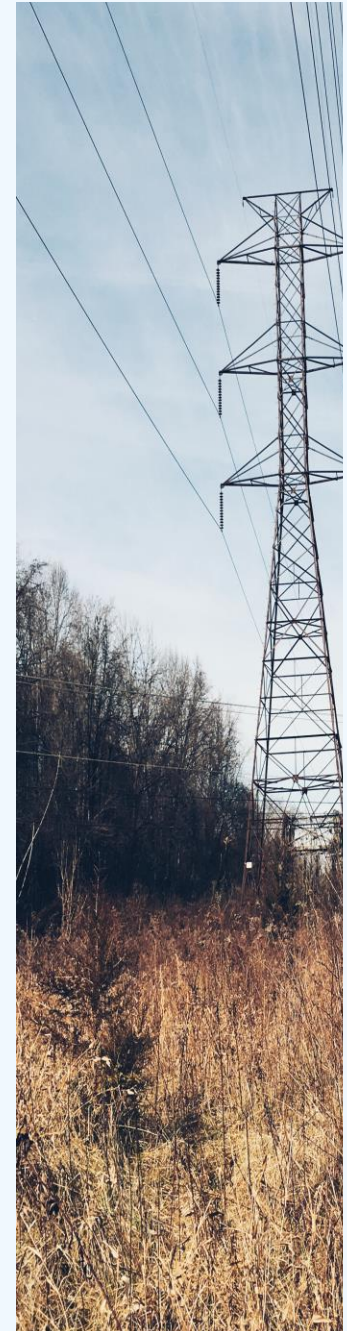
Executive Summary

Chapter 2: Executive Summary

India possesses vast potential to become an energy superpower in the South-east Asia region. However, power distribution continues to be the weakest link in the supply chain of the power sector. Power distribution industry by nature is a highly capital-intensive industry where human element is the most vital input. It requires technically trained manpower for various roles such as project planning, implementation, erection, commissioning, testing, O&M etc. This study attempts to provide a roadmap for training and capacity building mechanism that can be employed by the distribution utilities of India. For an adequate comparison, training and capacity building measures employed by two utilities (referred as **comparator utilities**) from developed economies have also been studied to understand the best practices that can be adopted.

Most distribution utilities are making major losses because of expensive long-term power purchase agreements, poor infrastructure, and inefficient operations, among others. These losses, in turn, prevent them from making the investments required to improve the quality of the power supply and to prepare for the wider penetration of renewable energy.

In the near future, many emerging technologies will have an impact on the grid and on other key elements of our electrical systems, operation, and the broader infrastructure. These technologies can help overcome the current problems faced in the distribution sector to an extent. However, the staff of these distribution companies need to be trained on these new technologies. Absence of sufficient sources of training may lead to the shortage of skilled workforce which is likely to adversely impact the growth of the industry. Therefore, there is an urgent need to identify the gaps, assess the demand, build skilled workforce in millions for which all the stakeholders need to work collectively.

In addition to the above, to keep pace with the technological advancements, distribution companies need to undertake measures like smart metering, smart grid technology, switching to renewable sources of energy, adoption of blockchain in managing distributed energy resources and other initiatives related to artificial intelligence. All of this shall call for upscaling of existing workforce and preparing future power sector professionals to make stronger impact in the power sector. Availability of well-established training institutions is crucial to train and avoid the scarcity of astute power sector professionals.

In this backdrop, the Consultants conducted As-Is analysis of 8 Indian DISCOMs based on a common framework using a standard questionnaire as data collection instrument which is explained in detail in subsequent section. The capacity building initiatives of 2 International DISCOMs were also studied to serve as benchmark and for better understanding of the gap which may exist.

As-Is analysis

A qualitative evaluation framework was developed to evaluate and compare each DISCOM's training and development regimen based on the following key attributes as shown below-

Adequacy

Planning & Process

Effectiveness of training
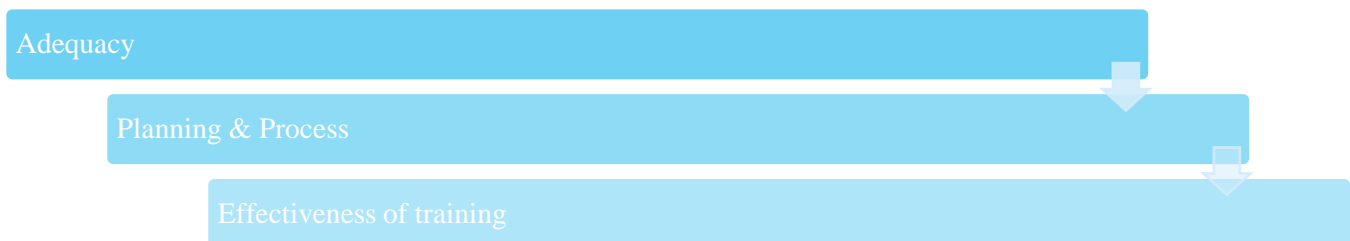
Each of these key attributes are further divided into sub-attributes. These sub-attributes are rated based on the responses of the DISCOMs on the deployed questionnaire. The table summarizes the number of DISCOMs under each of the sub-attribute.

Table 1: No. of DISCOMs under various capacity building attributes

Capacity building attributes & sub-attributes	No. of DISCOMs meeting the said sub-attribute (out of 8 DISCOMS)
Attribute - ADEQUACY	
Sub-attribute : Infrastructure	
• Neither in-house nor outsourced	0
• If completely dependent on in-house or completely dependent on outsourced	1
• Healthy mix of in-house as well as outsourced	7
Sub-attribute : Trainers	
• No fixed pool of either in-house or outsourced trainers	0
• Fixed pool of in-house trainers but ad-hoc assignment of outsourced trainers / institutes	1
• Fixed pool of in-house trainers and well – organized methodology of assigning outsourced trainers and institutes	7
Sub-attribute : Content – Induction training	
• No system of induction training	0
• Ad-hoc induction training	1
• Regular and regimented induction training with fixed curriculum for most departments	7
Sub-attribute : Content – O&M training	
• Negligible O&M training	0
• Irregular / ad-hoc O&M training	0
• Regular O&M training with well-defined curriculum which is constantly kept updated	8
Sub-attribute : Content – Safety training	
• No system of regular safety training	0
• Irregular / ad-hoc system for conducting safety training	1
• Regular safety training with mix of classroom and practical aspects	7
Sub-attribute : Content – New technologies training	
• Less than 50% of new technologies used by DISCOM are covered	0

Capacity building attributes & sub-attributes	No. of DISCOMs meeting the said sub-attribute (out of 8 DISCOMS)
• About 50% - 80% of new technologies used by DISCOM are covered	0
• More than 80% of new technologies used by DISCOM are covered	8
Sub-attribute : Content – Career progression training	
• No system of career progression training	0
• Need-based system of career progression triggered by the candidate individually	6
• Well defined and regimented system of career progression training triggered before the employee joins their new position.	2
Attribute - PLANNING & PROCESS	
Sub-attribute : Budget	
• Ad-hoc budget – not fixed at the beginning of the year	0
• Fixed budget for each year	1
• Fixed budget – utilization more than 80 %	7
Sub-attribute : Process / policy documentation	
• Undocumented process and policies	0
• Clearly documented policy and processes	0
• Documented and deployed policy and processes	8
Sub-attribute : Training Need Assessment	
• Not done at all in the DISCOM	0
• Done at departmental level	6
• Done at individual level	2
Sub-attribute : Trainer development	
• No process – ad-hoc	0
• Managed process for development of trainers	6
• Managed and improved process	2
Attribute - EFFECTIVENESS OF TRAINING	
Sub-attribute : Evaluation of effectiveness	
• Not evaluated	1
• Evaluated but not organized	5
• Evaluated and organized	2

Capacity building attributes & sub-attributes	No. of DISCOMs meeting the said sub-attribute (out of 8 DISCOMS)
Sub-attribute : Correlation with business results	
• Not correlated	1
• Correlated but not documented	5
• Correlated and documented	2
Sub-attribute : Key performance indicators	
• Not measured	0
• Measured	7
• Measured and improved	1

For new technologies, the evaluation was carried out on the technologies that the DISCOM has adopted and whether relevant departments / individuals are trained or not. The following table outlines the list of technologies evaluated at the DISCOM level –

Table 2: Details of the technologies being implemented in DISCOMs

Sl. No.	Name of the technology (Column A)	No. of DISCOM where technology has been adopted (Column B)	No. of DISCOM where Training conducted against the technology adopted as given in Column A
1	Enterprise Resource Planning	8	8
2	Smart grid, Advanced Distribution Management System	5	5
3	Geographical Information System and Asset Management	8	8
4	Supervisory Control & Data Acquisition (SCADA)	8	8
5	Outage Management System	7	7
6	Demand Side Management	8	8
7	Customer Relationship Management	8	6
8	Smart Meters, Meter Data Management System	7	7
9	Reactive power management	7	7
10	Energy Audit / Energy Accounting	8	8
11	Integration of distributed RE prosumers	6	3

Sl. No.	Name of the technology (Column A)	No. of DISCOM where technology has been adopted (Column B)	No. of DISCOM where Training conducted against the technology adopted as given in Column A
12	Management of solar feeders (under PM – KUSUM scheme)	3	3
13	Impact of EV load	2	2
14	Disaster Management Training	8	8

Many emerging technologies are likely to impact the grid operations and other key elements of the electrical systems, electrical operations, and the network infrastructure. These technologies can help overcome the current problems facing the distribution sector. Therefore, increased coverage on training for new technologies can be strived for.

Furthermore, documentation and analysis of the impact of training on business results is not evident. There is need for enhanced focus on creating more skilled individuals on O&M area such as transformer maintenance, 33 kV circuit breaker maintenance etc. rather than on merely fulfilling training man-day goals.

In government DISCOMs, performance management is not linked to financial incentives, promotion etc. which may lead to lack of seriousness towards training goals. Therefore, initiatives in these lines may be taken up.

Analysis of international DISCOMs

The consultants undertook an objective analysis of UKPN (United Kingdom) and EWE (Germany). The inferences from the study are summarized below -

- Strategy and succession plans are in place in both companies. In EWE they are reflected in the external reporting. Whereas in UKPN, these are reflected in the price control submissions to the regulatory authority as well as in external reporting.
- Training need assessment is undertaken both at an organizational, long term / strategic level as well as individual level through personal development planning (PDP) process. Both companies use Learning Management System (LMS), which enables training needs to be captured and reports on progress generated.
- In both companies, evaluation takes place at an organizational level, using standard measures of effectiveness and value.
- Investment in training people is treated as other investments in non-tangible assets. Most technical training falls into the category of 'must do to be in business'.

Developing the roadmap for capacity building

Capacity is regarded as the ability of individuals, organizations, state institutions, coalitions, and society itself to catalyze change to achieve their development objectives. Emphasis is usually laid on the ability of individuals, organizations, and enabling environment to set and achieve their own development objectives, and the ability of human beings to perform, self-sustain, and self-renew.

With the fast changing paradigm due to technological advancement in power sector, it is utmost crucial to go beyond the direct equivalence that defined "capacity building as training,". Such a holistic vision includes various sets of actions like:

(i)   Building abilities, relationships, and values.

(ii)   Strengthening the processes and the rules that influence collective and individual behavior; (governance pertains to the structures, processes and systems that define decision-making)

(iii)   Enhancing people's technical competences, soft skills, and attitudes to enable them to be proactive players for development.

The consultant has analyzed multiple aspects which are important to make any training roadmap/plan a feasible one, and list of all such aspects are provided below –

- Training Infrastructure
- Training Faculty
- Evaluation of the Faculty
- Training Records
- Training other than technical training
- Options for International training
- Types of training
- Training policy
- Training Budget
- Training Needs Assessment/Job Analysis3
- Review/Evaluation of Training Programs
- Training Organization Structure

Based on the above, a detailed roadmap has been prepared and discussed in chapter - 5.

International best practices

Chapter 3: Global best practices of International DISCOMs

Introduction to International Utilities

The following section provides input to the design of a capacity building roadmap for electricity distribution and supply companies (DISCOMs) in India. It has been prepared to provide an overview of capacity building practices in two international utilities operating in developed economies that have also had to confront the need to transform their networks and services to reflect the requirement to 'green' electricity supply.

By reviewing and evaluating good capacity building practices in these international utilities it will (a) contribute directly to the content of the roadmap and (b) introduce ideas and analyze practices that might lead to MoP/CEA/DISCOMs exploring new possibilities in the field of capacity building and workforce development in their own organizations.

The criteria for selection of the distribution business of these organizations should have demonstrated:

- adoption of futuristic smart grid technologies.
- integration of high shares of renewable energy sources in their distribution grid; together with
- high system reliability i.e. low SAIFI/SAIDI

Based on the above EWE AG and UK Power Networks (UKPN) were the two distribution utilities selected for the comparator study.

EWE AG is a multiutility headquartered in Oldenburg, offering energy telecommunications, and information technology solutions. The focus is on the supply of electricity and natural gas, water management, communication infrastructure, energy trading, and energy management. The company is 74% owned by EWE-Verband (59% Weser-Ems-Energiebeteiligungen GmbH, 15% Energieverband Elbe-Weser Beteiligungsholding GmbH). Since 2020 Ardian, an investment management company focused on infrastructure, has owned 26%. Through EWE NETZ the company plans, builds, operates, and maintains electricity networks in the northwest of Germany (the Weser-Ems and Weser-Elbe areas) and these activities are the focus of this report. The EWE NETZ network is almost completely underground and is considered to be one of the most secure networks in Europe.

UK Power Networks (UKPN) is a distribution network operator (DNO), holding three licenses to build, operate and maintain electricity networks up to and including 132kV in the London metropolitan area, the east and south east of the UK. The network is a mix of urban, primarily underground, and rural, mainly overhead lines.4 UKPN is owned by the CK Group, which operates globally and has electricity distribution businesses in Hong Kong, Australia, and New Zealand.

As DSOs they have 'an important role in the European energy market as neutral market facilitators, but also as innovators driving the transition of the energy system towards a more sustainable future'.5 Within the regulatory framework, they must develop network investment plans that reflect the trade-off between expanding the distribution network and procuring flexibility to deal with the local system peaks. Some of the assets likely to create new peaks in distribution such as electric vehicles and heat pumps, can also be part of the solution if they can be 'smartly' managed.

They are both committed to creating a skilled workforce. There is a debate about what makes a 'learning organization' and its characteristics. In summary, a learning organization is one that is successful at creating, acquiring, and transferring knowledge, and at modifying its behavior to reflect new knowledge, new technology and changes to its environment. The two companies who have helped with this study are characterized by their commitment to training and workforce development, in their policies and practice. They demonstrate pride in being recognized as a good place to work6; an openness to new ideas and a willingness to learn from others.

The approach to this study has been to conduct a review of the relevant literature on policy and practice in the comparator companies. Based on this a questionnaire was developed on the key themes in the ToR, which the two companies responded to. The approach is summarized in this chart.

Inference from study

The distribution systems in Germany and the UK were developed during the twentieth century to distribute electricity from generators, through the transmission grid to end customers. Distribution networks were typically well engineered in terms of capacity. Networks were passive and automation relatively limited. Although this evolution has been described as a 'fit and forget' approach, this characterization is oversimplified in that distributors did what was required of them - planning, constructing, and maintaining distribution networks using cost effective technology to deliver safe, reliable, and secure electricity supplies. The approach to training and the development staff reflected these stable technologies; the focus was on craft engineering skills, with steady, often linear career paths, an emphasis on seniority and years of experience, and stable, hierarchical organizations. As networks were largely passive, so the demands of customers too were less volatile. The training, however, was comprehensive, developing broad based engineers who were mobile across the range of distribution engineering skills required and developing at the time.

The study for the comparator companies has also been benchmarked using the similar evaluation framework as that for the Domestic DISCOMs.

Training Adequacy

Infrastructure

UKPN has a well-developed and professional in house learning and development team, as described below. Some 30 external providers are used for specialist training (e.g. working in confined spaces). They have a partnership with educational institutions for certain programmes (e.g. apprenticeship classroom/academic/basic workshop content is conducted offsite using a college partner).

Task 2
Good practice in international DISCOMs

Desk top study of published data

Data gathering questionnaire

Analysis of data, using analytical framework developed for as-is assessment of Indian DISCOMs

Findings

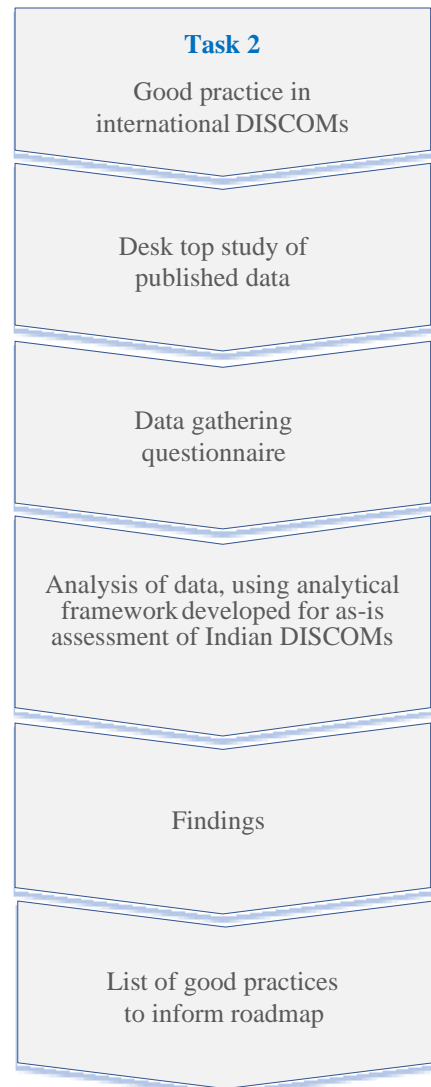List of good practices to inform roadmap

Figure 1: Task 2 Approach

The emphasis is on 'hands on' training for core developing/refreshing technical skills - overhead lines, cables, and plant - through two in house training facilities (reflecting the company's geography) equipped with examples of technology in use and new developments.

Management and leadership training typically uses outsourced classroom and conference facilities when needed.

Programmes are accredited where relevant (e.g. the graduate scheme is IET accredited and leads to chartered status.) A learner management system enables individual and organization level understanding of training activity and outcomes . To set this in context, UKPN uses the recruitment and training 'routes' listed in the box.

EWE has an Academy and technical training worships/laboratories.

> ❑ Apprentice programmes (skill level 3)
> ❑ Engineering development programme (skill level 4-5)
> ❑ Graduate recruitment (skill level 5-7)
> ❑ Market place recruitment (skill level 1-8)
> ❑ Contractor delivery
>
> UKPN *Workforce renewal programme*

Figure 2: UKPN Workforce renewal programme

The national dual system is of benefit in ensuring technical foundation level knowledge to new entrants. Management/leadership training is organized separately from technical and other training; it is handled through the EWE Academy, which is a corporate, in-house resource, for all EWE businesses. (https://business.ewe.de n.d.)

Further training in the technical area and that delivered for external (third party) companies is valued at approximately €0.8 million per year.

Learner management system enables individual and organization level understanding of training activity (including a training calendar/programme) and outcomes.

The main HR functions are centralized at EWE AG Group level. These include HR strategy as well as the areas of staff development and recruitment. The EWE Group functional division 'Occupational Health and Safety' centrally controls the processes and programmes for occupational health and safety and reviews. Of significance in this context, there is an overarching Code of Conduct set by EWE Group which all subsidiary companies (including NETZ) must adhere to. Continuous education and training is provided by a Training and Further Education department. UKPN is an autonomous electricity distribution company and these functions – HR; health, safety, and welfare; learning and development etc. - are all dedicated to its operation as a DNO.

Training Staff

The UKPN technical training and assurance team has 80 core staff, of which 27 are dedicated instructors/trainers. A learning technologist is employed and the company is working to make as much learning as practical blended – preliminary and 'theory' online before attending workshop/seminar.

External training provision, in specialized areas or major programmes, is acquired in line with well governed procurement/selection process.

At EWE, around 30 staff are committed to education and training as well as management development. (EWE NETZ distribution network business approx. 1,800 employees approx. 100 of which are managers). In 2018 there were a reported 957 participants in training (3 categories with 4 subcategories each) and about 200 seminar offers. External speakers are 'bought in' for about 20% of the above courses. In addition to this, other individual training by the technical experts/specialists is provided as required.

Content – Induction training

UKPN has a full, well documented policy and practice, tailored to the needs of the new entrant to UKPN (and especially young people new to work) or the employee being promoted. A good example is the induction programme for foundation apprentices.

EWE similarly comprehensive well documented policy and practice, tailored to the needs of the new entrant to EWE (and especially young people new to work) or the employee being promoted. e.g. apprentice or master training as an engineer, bachelor's or master's degree in various subjects (electrical engineering, economics, mechanical engineering) EWE also offers various dual training and study courses.

Content – O&M training

UKPN has a well-developed O&M training regime; defined curriculum; two dedicated training schools covering the core technical skills/competencies (which reflect the geography of the company) and team of qualified instructors. Training is conducted in house (the exception being some manufacturers'/suppliers' training on new plant, equipment or systems) or specialist training (e.g. working in confined spaces).

EWE has a well-developed O&M training regime; defined curriculum; specialist workshop and team of qualified instructors. In addition to traditional electricity skills, in 2020 EWE created new, additional apprenticeships for IT specialists and plant mechanics. A virtual reality module is under development for switching operations in 20/110 kV substations).

Content – Safety training

In both companies, for operational safety, technical competencies are clearly defined; training and assessment of competence recorded well documented; with regular time- bound refresher training.

To give a concrete example from UKPN, a standard Senior Authorized Person refresher course runs with 15 delegates for two days every two years; outcomes are recorded on the LMS.) Safety performance targets are set, with routine monitoring and reporting of performance, internally and externally.

Content – New technologies training

New technologies such as power electronics, modern sensor and control systems and data analytics are revolutionizing the way electricity is distributed. UKPN is currently on a transition journey from being a Distribution Network Operator (DNO) to a Distribution System Operator (DSO), providing more active, market-focused services to the evolving demand of customers. UKPN, has published its published 'Digitalization Strategy and Action Plan 2021' (2020) and its intent to be a data-centric utility. (https://www.ukpowernetworks.co.uk/digital-strategy n.d.) While operational-led technology will remain important, and is embedded into basic and refresher training, the focus is increasingly on preparing for the evolving DSO functions. eLearning and hybrid learning are of increasing significance especially in recent trends namely RE integration, Digitalization etc.

SCADA and network monitoring

UKPN are developing a toolbox of smart solutions to enable the uptake of low carbon technologies at the lowest possible cost to their customers. This includes Advanced Distribution Management System (ADMS), which is responsible for the control and monitoring of all aspects of the distribution networks including secondary substations. It also includes any other points on the LV networks where automated equipment is installed. In addition, UKPN operate Supervisory Control and Data Acquisition (SCADA) communications networks. The

principal function of the SCADA network is to enable communication between the central OT systems such as the ADMS, and the remote devices that monitor and control the distribution networks. UKPN on a routine basis keeps upgrading /replace a significant amount of SCADA equipment, including RTUs and communications system to enable innovative technologies to be deployed and to realize better asset information and enhance its management.

Monitoring of HV- MV- LV networks is seen as one of the most important aspects for ensuring reliable power. UKPN continues to continuously monitor the higher voltages, however there is currently limited monitoring or visibility of the LV network past the LV tails of the transformer due to the vast number of assets connected at this level.
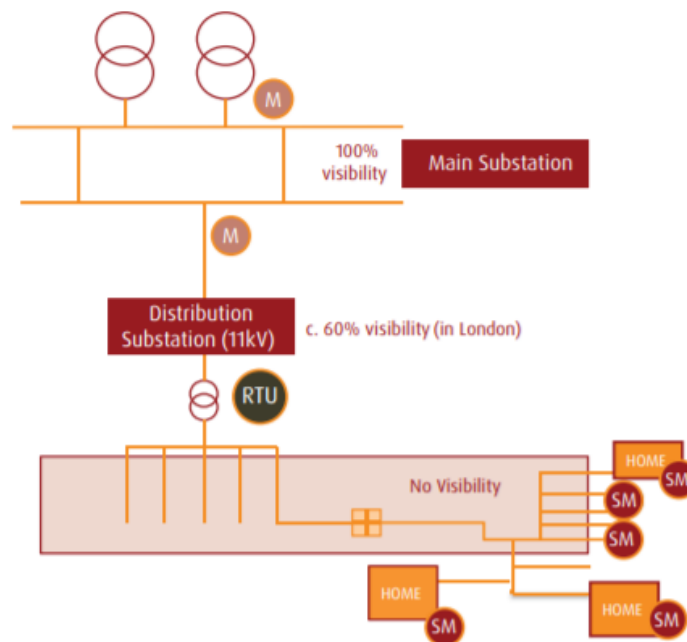
Figure 3: Monitoring of Networks in UKPN

UKPN is currently investing in state-of-the-art technology, from sensors in substations through to Artificial Intelligence, and utilizing smart metering data to get the most granular and accurate view of all low voltage networks, which would help to maximize their utilization.

In India by comparison, monitoring of transmission system takes place on large level, however automation & monitoring in MV /LV distribution system is not as prevalent as compared to the comparator utilities.

In both the comparator utilities, training is determined by functional need rather than seniority or status; for business leaders and senior managers an overview or appreciation is typically regarded as sufficient.

Smart Metering

Smart Metering was one of the largest installation programmes undertaken by the UK energy industry in a number of years, posing a wide variety of challenges. One of the key issues was to understand the precise impact of the Smart Metering Programme on the distribution network and the associated resources. After taking into account the existing resourcing levels and allowing for a 2-year training lead time, UKPN increased the training volumes for apprentice and adult trainee programmes.

Good training management practice indicates the need for a rigorous training needs analysis (TNA) and business case prior to international 'training'. Important as implementation events are, such as manufacturer training,

preparing staff for new technologies must be a continuous process and not one that is just associated with major projects or programs. The experience of these comparator companies suggest that this is taken seriously at an organization and individual level.

Workforce renewal is part of UKPN's business plan recognized due to the fact that future technologies can only be successfully implemented by a flexible workforce trained and ready to accept them. eLearning and hybrid learning are of increasing significance especially in recent trends namely RE integration, Digitalization etc.

Content – Career progression training

In UKPN, here are established career paths in technical and operational roles. Apprentices (Foundation and advanced) move into technician roles, depending on vacancies/assessment of future needs. Graduate electrical engineers move initially into junior engineering roles. Transition from craft to engineer is also supported (in UKPN by an Engineering Development programme), as is 'adult learning' whereby unskilled staff can be supported to attain qualifications.

Beyond that, the emphasis in both companies is on preparing individuals for their next career move (via a personal development plan, part of the performance management process); achieving promotion however is very much a competitive process within a framework that values technical capability but also ensures company standards on equality, diversity and inclusion are met.

Each year, EWE Group recruits university graduates. An average of 19 trainees were employed in 2020 (2019: 21 trainees). In a two-year programme they are systematically prepared for their future tasks as specialists and managers of the EWE Group – which includes NETZ. Outstanding employees go through various management programmes but these do not guarantee a specific career path. In 2020 a new type of programme for high potentials was piloted - the iPE programme.

Training processes and policies

Evidence of a long term/strategic perspective

Strategy and succession plans are in place in both companies. In EWE they are reflected in their external reporting. In UKPN, these are reflected in the price control submissions to the regulatory authority - and subsequent Ofgem determinations. They are also reflected in external reporting.

Budget allocation

In both companies there is a formal budgeting process (within framework of regulatory allowances and agreed corporate objectives), monitoring and reporting on performance. The language of budgeting in training has moved from 'has the budget been spent' to 'has valued training been delivered'.

In UKPN, the technical training and assurance budget is GBP 10 million. There is also, in addition, significant expenditure on other L&D (e.g., leadership and some soft skills programmes). Use is made of Government funding (e.g., apprentice training levy).

In EWE, the budget for training and development (2018) was approximately €7 million p.a. This does not include the costs of management development (e.g. EWE Academy) or subsidies for external training and development (State and Municipality support).

Process / policy documentation

Good documentation is used in both companies that follows accepted L&D good practice (formal curriculum, learning objectives, indicative content, assessment).

Certain UKPN training activities are externally inspected/audited. This generates independent evidence on quality of delivery and outcomes which guides the company on ways in which to improve and develop.

Training need assessment

This is undertaken both at an organizational, long term/strategic level (as discussed above, and individual level through personal development planning process. Both companies use an LMS which enables this to be captured and reports on progress generated.

Training Effectiveness

Evaluation of effectiveness

In both companies, evaluation takes place at an organizational level, using standard measures of effectiveness and value.

For example, at UKPN, evaluation takes place at an organizational level (e.g. reported percentages pass rates for apprentices; reports from independent assessors; numbers of competent persons by level of competence); and individual level (e.g. end of course assessment, through to application of new skills, performance improvement considered at appraisal/competency assessment, fitness for promotion/development).

Correlation with/impact on business results

Investment in training people is treated as other investments in non-tangible assets. Most technical training falls into the category of 'must do in order to be in the business' – for example; ensuring the right number of craft technicians and engineers for the size and shape of the business over the next decade; maintaining the number of qualified CPs/SAPs sufficient to enable construction, operation and maintenance of the network.

Getting this right is critical to the sustainability of the business and efficiency improvements required to meet regulatory/customer/shareholder expectations. It is therefore unsurprising that it is a feature of the smart grid development and emerging DSO functions.

Examples of best practices

Table 3: Examples of international best practices

Different national educational systems, similar outcomes	The German and UK educational systems are different. The 'dual system' is acknowledged as among the best at creating a cadre of young people ready and equipped to move into technical occupations. Evidence from UKPN suggest that even without this, or an equivalent model, the company can invest in and develop its own apprenticeships and training schemes and work collaboratively with other businesses in the sector to create a future workforce. The debate about who owns training facilities should not 'crowd out' the underlying need for good quality resources.
External inspection and accreditation	Both companies make full use of the support for technical training that is available from their Governments. Training in both companies is subject to external and independent audit of Government funded schemes. External and independent audit is also undertaken by awarding bodies (Agencies that have been granted the authority to award qualifications, or Government where state funding is involved).
Learner management system	A digital LMS (accessible to managers for their teams and individuals for their own data) enables the analysis of training planned, undertaken and competence achieved, that is based on reliable, up to date data.

	This is an example of a simple and low cost technology but for Indian DISCOMs, the relative labor/capital cost ratio will be different to that in northern Europe – and may help explain differences in the rate of adoption.
Increased role for eLearning	Investment in eLearning for developing skills has been and continues to be a priority. eLearning also plays a part of a blended approach. The evidence is that this has been accelerated (and increasingly embedded) as a result of measures to control COVID-19. This is a relatively new area for Training teams - UKPN now has a dedicated learning designer.
Practical training, at a training school/ workshop, on network plant and equipment with existing and new technologies	Broad concerns about reducing the companies' carbon footprint, minimizing travel and becoming digital will provide further impetus to learn online and remotely. Practical training, at a training school/ workshop, on network plant and equipment with existing and new technologies. However, academic and classroom training continues to have an important place in building knowledge and developing skills in newer technologies - but this has to be alongside the investment in 'physical' training facilities which enable learners to practice their skills on the new technologies being introduced. Both companies have technical training facilities equipped with assets for trainees to 'work' on. This provides an essential foundation for later OJT, when working alongside qualified and experienced technicians/engineers. As eLearning is substituting for some classroom learning, so in an increasing number of situations simulation/VR is set to play a greater role. The range and content of training is evolving; EWE have introduced an IT apprenticeship route.
Training is recognized as central to business success – and this is endorsed by leaders of the business	High quality training, professional development and career opportunities are central to both companies' 'Employee Value Proposition' and employer branding. This is regarded as key to attracting and retaining the best people in a competitive labor market. Associated with this is the very public endorsement of training as a source of competitive advantage. Senior leaders acknowledge its centrality to business success. If it is a senior leadership priority, evidence suggests it quickly becomes a priority of others. The career offering is also important. There are routes for better craft technicians to progress to more senior roles and educational support/training and development schemes to enable this.
Training is led by a workforce plan (company) and TNA (team/individual)	Workforce planning and the future profile of the workforce guides the investment in training. The process is well developed. In the UK it is reflected in longer term business plans required as part of the regulatory framework. At the individual level it is led by the performance management and personal development process. These are not optional business processes but central to how the company is managed.
Indicators of performance	Both companies set objectives and a range of targets, measure performance, and report outcomes to stakeholders. Examples are provided in the text.
Importance of competencies, assessment and certification	Apprenticeships (entry typically from school) and professional engineering programmes have formal curricula and assessments against standards. Clear definitions of competence, especially in relation to operations on the network are critical. There are many and complex factors at work which lead to these two distribution businesses achieving high safety

	performance. However, essential components are clear safety rules and operating procedures; well defined standards of competence; training and assessments of competence; regular refresher training and re-assessment (examples are provided in the text); and management focus on the maintenance of safe working practices. Technical competence is critical but behavioral factors are also important to companies.
Competitive progression from 'craft' to 'professional'	There is a well-developed practice of enabling the progression from craft (foundation) apprenticeship and technician (higher) to professional engineer. Evidence from those in the companies suggest this has produced some of the most competent and flexible engineers (that do have not necessarily full professional engineer status) who have delivered significant benefits through their application of practical power distribution skills to building, operating and maintaining the network. In the future however, the proportion of specialist technical engineering roles may increase, especially in the newer DSO functions.

Gap Identification

Chapter 4: Gap Identification

A qualitative evaluation framework was developed to evaluate and compare each DISCOM's training and development regimen based on the following key attributes–

Adequacy

Planning & Process

Effectiveness of training

To evaluate the current practices in framework, thorough data collection was carried out through a detailed questionnaire. 8 DISCOMs were shortlisted in consultation with GIZ and in-person and online discussions were carried out with concerned officers. A data format was prepared to gather the quantitative data as well the existing training themes and training calendars from DISCOMs. Further, Field visits to DISCOM offices and the training institutes was conducted to gather the required data and interaction with the necessary field officials. The main activities conducted on such field visits were –

- Interaction with the concerned officials, briefing them of the project.
- Administering the Survey questionnaire
- Taking note of relevant best practices
- Visit to Training Institutes to gauge the training infrastructure for conducting training programs and workshops.

The DISCOMs have been analyzed based on three attributes - Training Adequacy, Training process /policies and the effectiveness of the training imparted. These attributes have been further divided into sub- attributes. The discussion in this section shall revolve around the gaps identified across the attributes.

Inferences from the study

Adequacy of training

Training infrastructure across most DISCOMs is adequate for imparting quality training to employees. As most DISCOMs follow the process of 'in-house' as well as 'external' training, the content and trainers are also regularly updated and abreast of latest technology changes in the sector. It is observed that 7 out of 8 DISCOMs have a regular and robust mechanism of imparting safety training. Similarly, most DISCOMs follow regimented process for induction training of new joiners. In 6 out of 8 DISCOMs, it was observed that career progression training is not practiced or practiced at varying degrees of deployment. This leads to deficit in required competencies versus developed competencies for higher positions.

Planning & Process

In all DISCOMs, the budget allocation for training was found to be systematic barring a stressed DISCOM. However, it was observed that the training budget allocation was less than the prescribed levels as per National training policy. It was also seen that in many DISCOMs the budget which is already under the prescribed levels is also underutilized. There is adequate policy documentation in all DISCOMs however proper implementation of the same is yet to be achieved. This shows that Indian DISCOMs are committed to the tenets of Training & Development but require a systematic approach for achieving their capacity building goals.

In regard to identifying the training needs, it was found that most DISCOMs practice a 'superior's recommendation' process. Typically, the HR department discusses and finalizes the proposed training calendar for the year with heads (superiors) of each functional department. However, a structured process for training need assessment, such as competency mapping is required. Such a process shall accurately reflect the different training needs of various classes / skill levels and seniority levels of the workforce. This process will immensely help the DISCOMs to focus on the right kind of training for their employees.

Development of trainers is another area where Indian DISCOMs may accord special attention. Focus on training of trainers (ToT) programs will help to develop more in-house competencies and hence reduce dependence on external training.

Training effectiveness

In most DISCOMs, feedback on training is taken from candidates as well as trainers. However, to reap the full benefits, analysis and evaluation of the feedback received is required. This will help DISCOMs to design more engaging and empowering training sessions for the employees. Indian DISCOMs have defined Key Performance Indicators such as training man-days or nos. of training sessions held. While these are helpful in tracking the progress of training, there can be enhanced focus on creating more skilled individuals on certain subjects. For example, no. of skilled linemen in 33 kV maintenance. This will help DISCOMs to extract value out of their capacity building programs. One noteworthy example of correlation of training with positive business results is from a DISCOM where regular safety training has resulted in few safety incidents. Such examples can be seen in other DISCOMs; however, no evidence was observed due to lack of documentation of results.

Inputs for capacity building roadmap

The consultants have studied 8 Indian DISCOMs to derive the strengths and weaknesses of the Training & Development function in the context of Indian power distribution system on an overall level. These are listed below –

Strengths

- Presence of adequate training infrastructure – classrooms, libraries, etc.
- Commitment of top management for budget allocation, policy definition etc.
- Updated curriculum with inclusion of new technologies which are being implemented in the DISCOM
- Regimented curriculum and duration of Safety as well as O&M training
- Fixed induction training for new joiners

Areas of improvement

- Systematic knowledge transfer and career progression training is not evident.
- A structured process for Training need assessment – especially competency mapping, is required
- A systematic approach towards development of in-house training expertise is required
- Analysis and evaluation of training feedback to measure effectiveness is not evident
- There can be enhanced focus on creating more skilled individuals on certain subjects such as transformer maintenance, 33 kV circuit breaker maintenance etc.
- Documentation and analysis of business results with training and development activities
- In government DISCOMs, performance management is not linked to financial incentives, promotion etc. This leads to lack of seriousness towards training goals.

Key considerations for Roadmap preparation

- Focus on online modes of imparting training
- Focus of systematic approach for need identification and creation of training plan
- Large levels of disparity in training practices conducted among DISCOMs
- Varying degree of adherence to the National Training Policy.
- Career progression and ToT trainings for reduction of external dependence and creation of in-house expertise
- Stronger emphasis on Performance management system. KPIs (at department level) and KRAs (at individual level) based on realistic and practical goals of the organization

Learnings for Indian utilities

There is a large scope of learning for Indian utilities from their international counterparts in regard to:

a) identify good practices for scale-up and
b) implement cost sharing mechanism to utilize strengths of available infrastructure and resources.

Emphasis is required on conceptualization and development of state-of-the-art training centers to promote capacity building for new technologies. This will give an opportunity to DISCOMs to optimize training plans by associating with training centers.

One such example is Smart Grid Knowledge Center (Manesar, India) which aims to be a leading Center of Excellence globally, as a platform for workforce development through customized trainings and exchanges.

The Smart Grid Knowledge Center (SGKC), a state-of-the-art platform for demonstration and outreach for smart grid technologies, has been established by the POWERGRID with support from the Ministry of Power (MOP), Government of India (GOI) and the National Smart Grid Mission (NSGM). The SGKC showcases smart grid technologies through live demonstrations and provides training and capacity building support to power distribution companies (DISCOMs). SGKC showcases smart grid technologies through demonstrations and provides training and capacity building support to power distribution companies. The table below summarizes the existing as well as proposed infrastructure at SGKC[1].

Table 4: Existing and proposed infrastructure at SGKC

Existing infrastructure at SGKC	
Live Demonstrations	Advanced Metering Infrastructure
	Smart Home Energy Management System
	AC Microgrid
	Utility-Scale-Grid-Connected RE
	Outage Management System
	Training Infrastructure
	DC Microgrid
	Power Quality Measurement Laboratory

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[1] References from SGKC Strategic Roadmap (https://www.nsgm.gov.in/sites/default/files/SGKC-Strategic-Roadmap-June-2020.pdf)

Existing infrastructure at SGKC	
Training Infrastructure	National Transmission Asset Management Centre (NTAMC)
	400 kV GIS Sub-station
	Laboratories for Research and Development (R&D)
	Training Facilities

Proposed infrastructure/vision	
Innovation Park	The Innovation Park will serve as a platform to demonstrate frontier products and technologies relevant to the power sector. It will showcase cutting-age solutions to varied stakeholders (utilities, researchers, policy makers, and consumers) through physical assets, technology or software solutions and virtual demonstrations. This will help in capacity building, knowledge sharing and innovation.
	The park will function as a networking and knowledge exchange hub for smart grid technologies.
Technology Incubation Hub	The Technology Incubation Hub will support innovative ideas to become commercially viable products/solutions.
	The SGKC will provide mentorship (through empowered groups comprising national and international experts) and facilitate access to national and international platforms through the lifecycle (technical, financing, challenge competitions, etc).
Capacity Building and Outreach	The SGKC will serve as the go-to platform for all power sector related trainings. Tailored training programs on relevant topics for stakeholders including utilities, policy makers and regulators will be supported by technical webinars, conferences, industry conclaves, international forums, etc.
	The Augmented and Virtual Reality (AR and VR) setups proposed at the SGKC will provide hands-on knowledge building and experience sharing. This is critical for the post COVID-19 era where the focus of most capacity building initiatives will be online.
	To realize this vision, the SGKC will partner with national and international entities and leverage collective expertise and experience. This will include technology providers, academia, technical institutes, amongst others.

The Innovation Park aims to serve as a platform to demonstrate frontier technologies, products and solutions linked to power distribution. The Park showcases cutting edge smart grid solutions to varied stakeholders (utilities, researchers, policy makers, and consumers) through physical assets, technology or software solutions and virtual demonstrations. This helps in capacity building, knowledge sharing and innovation.

Capacity building measures based on insights from Smart Grid pilot projects

A recent report on insights from pilot projects for scaling up Smart Grid in India[2] categorizes smart grid projects into various stages such as - planning, bid development, implementation, operations, monitoring, and scale up.

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[2] Report prepared under the U.S.-India Bilateral Partnership to Advance Clean Energy Deployment (PACE-D) – available at https://www.nsgm.gov.in/sites/default/files/Insights-from-SGPP-for-Scaling-Up-Smart-Grids-in-India-February-2018.pdf

Following are the key developments in the direction for the development of smart grid in the country: -

- Establishment of National Smart Grid Mission (NSGM) to act as an institutional mechanism for planning, monitoring and implementation of policies and programs related to Smart Grid (SG) activities.
- Target of 35 million Smart Meter to be installed under Ujwal DISCOM Assurance Yojana (UDAY)
- Launch of government schemes like Integrated Power Development Scheme (IPDS), and Deen Dayal Upadhyaya Gram Jyoti Yojana (DDUGJY) for distribution network upgradation and automation with built in or linked components to smart grid.
- Model Smart Grid regulations issued by the Forum of Regulators, and later adopted by various states.
- Release of Bureau of Indian Standards (BIS) Smart Meter standards and Central Electricity Authority's (CEA) Advanced Metering Infrastructure (AMI) Specifications.
- Sanctioning of large-scale Smart Grid projects under NSGM.

Large scale roll-out of smart metering under bilateral agreement between EESL and State(s)/DiscomsDISCOMs may prioritize their capacity building and upskilling measures in the stages where the pilot projects have logged the most issues. For example, many utilities logged issues relating to smart meter supply chain. This points towards a potential gap which may be bridged by training in innovative procurement practices.

DISCOMs which are now embarking on the Smart Grid journey must first clearly understand the goals they want to achieve using Smart Grid technologies. For example, the goal of reducing AT&C losses could be achieved through appropriate investment in Advanced Metering Infrastructure (AMI). This will help the utility in real time accurate energy accounting and addressing the revenue leakage. Therefore, the DISCOM's capacity building efforts must be aligned with complementing training programs on AMI, energy accounting and revenue protection skills.

One key insight from the report relates to skilled manpower in the IT domain -

> *"Lack of dedicated and skilled manpower, particularly in IT domain a key challenge for project sustenance and operations"*

DISCOMs can further conduct a skill-gap identification to address specific IT skill needs relevant to maintain the legacy as well as future IT systems required by the organization.

Gap Identification

Based on analysis of best practices of comparator utilities and As-is scenario of the domestic DISCOMs, a summary of the identified gaps with comparator utilities is provided below. The analysis of DISCOMs was done on the following attributes and sub attributes.

Training Adequacy

Table 5: Training adequacy gap identification

Attribute	Sub Attribute	As – is Scenario Description	Identified Gaps
Infrastructure	Dedicated training institutes	Most of the distribution utilities in India have a dedicated training facility or an associated training institute where mostly classrooms trainings are held, and workshops are limited.	These institutes can hold adequate classroom training programs; however, inadequate practical workshops and simulation infrastructure to impart hands on training was observed.
	Classrooms		
	Workshops		
	Hostel		
	Library		
Training Staff	Dedicated or deputed	Very few distribution companies have dedicated faculties for training. Most of the utilities depute their engineers to training institutes. This is done regardless of their training capabilities and training experience.	Lack of dedicated staff for training while the recruitment process for training staff and technical engineering staff is same.
	In house or External Training		
	Routine Training of Trainers		
Induction training	Course duration	Most of the domestic distribution utilities have a documented induction training policy, duration, and course content.	The comparator utilities are more hands-on training focused whereas the DISCOMs are currently more focused on classroom training.
	Workshops duration		
	Effect on identified KPIs		Induction training coverage is not extended to contractual employees causing disparity in the training process.
O&M Training	No of Trainings conducted in a year	As per the data shared by DISCOMs, regular O&M trainings are being held throughout the year. Adequate coverage among the DISCOM's O&M employees, however very few DISCOMs	There is a scope for further improvement to imbibe the latest best practices & new technologies in O&M training. Comparator utilities by comparison have adopted several of new technologies into their O&M practice and subsequently
	Workshops duration		
	Coverage		

Attribute	Sub Attribute	As – is Scenario Description	Identified Gaps
		also undertake the O&M training needs of the contractual staff.	modified their training practices and course content accordingly.
Safety Training	No of Trainings conducted in a year	Regular safety training courses are being conducted in the domestic distribution utilities. However, the actual safety practices being currently adopted in the field are not reflective of this.	The number of safety training sessions can be further increased. The coverage of the safety training should include the contractual workers as well as regular employees.
	Coverage		
	Effect on Safety KPIs	Generally, exercise to measure the effectiveness is not carried out.	In most of the DISCOMs no co-relation is established between safety training with safety related incidents to analyze the effectiveness of former by reduction in latter.
			In comparator utilities, Safety performance targets are set, with routine monitoring and reporting of performance, internally and externally. The comparator utilities also periodically launch safety campaigns involving significant training for each employee.
New technologies	No of Trainings conducted in a year	Domestic distribution utilities carry out new technology training courses mostly for HQ staff.	The focus of most of the Indian DISCOMs is to improve the operational efficiency. Certain private DISCOMs which are operationally efficient are actively pursuing adoption of new technologies. However, on a national scale it can be said that there is negligible research being conducted by DISCOMs for the upcoming trends like EV, blockchain etc. The training programs being carried out are more knowledge sessions rather than a form of training. The comparator utilities by comparison have already imbued many of new technologies such as smart meters, IOT, ERP, OMS etc.
	Coverage		
Career Progression	No of Trainings conducted in a year	Career progression training is sparsely practiced in the domestic utilities.	A framework may be developed for mapping of competencies of the employee with the desired post he /she is being promoted for and relevant training must be provided.
	Coverage		

Attribute	Sub Attribute	As – is Scenario Description	Identified Gaps
	Effect on identified KPIs	Generally, measurement the effectiveness is not carried out.	Regular monitoring of relevant KPIs to measure the effectiveness must be carried out.

Training Policy and Process

Table 6: Training Policy and process gap identification

Attribute	Sub Attribute	As – is Scenario Description	Identified Gaps
Budget	Allocation	The training budget allocation was less than the prescribed levels as per National training policy. It was also seen that in many DISCOMs the budget which is already under the prescribed levels is also underutilized. In most utilities, no proper plan is prepared at the start of the financial year for utilization of the budget.	There is a need to spend the training budget on improving in house training facilities rather than on external faculty. External faculty may be employed, in cases where in – house capabilities are technically lacking.
	Utilization		
	Planning		
Policy	Existence of Policy document	Most of the DISCOMs have training policy, however, the quality of the policy varies from DISCOMs to DISCOMs. Such policies are not updated regularly to keep with pace with the emerging trends. Most of the DISCOM's policy documents are prepared in line (in content) to the NTP, however there is a need for incorporating the practical realities for each DISCOM in the policy document. The NTP also needs to be updated in a manner that is much easier to adhere to by the DISCOMs.	There is a need for adherence to the policy document. The policy document should clearly indicate the capacity building target of the organization, the institutional framework and implementation strategy. In comparison to comparator utilities, their policy document defines the strategy and approach of the utilities to achieve the desired institutional targets. It is updated on a periodic basis,
	Updation of policy document		
	Adherence to policy document		
	Relevance of policy document		
Training need assessment	Existence of set TNA technique	Absent in most of the DISCOMs except private utilities where TNA is carried out. Certain private DISCOMs have undertaken	Lack of a structured approach for training need assessment in most DISCOMs. In comparator utilities, it was observed that the TNA activity was driven by the institutional targets of the DISCOM.
	Updation of TNA technique		

Attribute	Sub Attribute	As – is Scenario Description	Identified Gaps
	Adherence to TNA technique	innovative measures such as competency mapping	Identification of the institutional targets and identifying the present competency forms the prime basis for selection of training programs for a participant.
Training effectiveness	Existence of set TE technique	Absent in most of the DISCOMs except private utilities where training effectiveness is efficiently carried out.	Lack of a structured training effectiveness framework. Records of feedback received from participants is presently not recorded nor analysed in most distribution utilities.
	Updation of TE technique		
	Adherence to TE technique		

Proposed Roadmap

Chapter 5: Proposed Roadmap

The following section proposes a roadmap for development of capacity of Distribution utilities based on the gaps identified in training practice of domestic distribution utilities and the international comparator utilities. The roadmap has been prepared on the broad understanding of the current practices and working environment of distribution companies in India and considers the best practices followed by Indian distribution companies and international counterparts. The objective of the roadmap is to provide a guided holistic view of the required actions for a DISCOM along with methodology, periodicity, duration, and other details for enacting the same. It is suggested that under the scenario that resources (infrastructure, faculty, expertise etc) are not available, the distribution company must leverage the infrastructure and other resources available with central or state training institutes, other training institutes, private universities, other DISCOMs etc. Selection of appropriate training methodology based on available infrastructure, number of trainings mandays, etc should lie with the distribution company and they should make the best use of available resources to make the plan feasible and implementable.

While conducting the as-is study for domestic distribution utilities, it was observed that there also exists a huge disparity between various DISCOMs in the country.

1. The first level of disparity is in the organization structure, with there being unbundled utilities or integrated utilities.
2. The second level in terms of management with most distribution utilities being state owned and a few private owned utilities.
3. The third level of disparity was observed in the training practices with some state utilities undertaking only basic training, some adequate training practices, while a few utilities have very adept practices almost at par with the international utilities.

Due to the above it is pivotal for any roadmap to be prescriptive based on the DISCOM's present scenario. Hence, the consultants have adopted a three-step approach while preparing the roadmap:

1. The first step is to identify the focal points for capacity building and training. These have been named as 'pillars of the training roadmap' for they are the parameters and attributes which support the structure of the roadmap.
2. The second step is to prepare a framework for classification of DISCOMs into 3 grades based on the maturity level achieved on a specific attribute /pillar. Based on the scoring achieved on the framework a DISCOM may grade itself into Grade A, Grade B or Grade C.
3. The third step is prescriptive actions for DISCOMs ranging from short term, medium term, and long-term periodicity based on their respective Grade.

Pillars for training roadmap

1. Training Infrastructure

Training infrastructure must be looked from two perspective – adequate number of training institutes providing the required training and facilities present – Classroom, Hostels, Laboratories, workshops, Library, ISO certification among others. With the growing adoption of new technologies into operation and maintenance practices, it is recommended to augment the training infrastructure to meet the complex nature of training in the changing scenario. The training infrastructure must cover a variety of fields: engineering, finance, billing and collection, human resources, administration, etc. Further, special emphasis needs to be placed on growing use of smart meters, data analytics, electrical vehicles, renewable energy, blockchain technology, cyber security among others.

The training infrastructure is generally categorized into three categories as mentioned below. It is strongly recommended that either the training institute must be present in either state or at least same region. Further, association/ MoU with specialized institutes, private institutes, universities must be encouraged so as to leverage the available basic infrastructure for training.

Training institutes recognized by CEA for imparting statutory induction training	Lineman Training Institutes	Other Training facility
Availability of such TI in the same region	Availability of such TI in the same region	Association/MoU with specialized institutes, private institutes, universities, etc.
Availability of such TI in the same state	Availability of such TI in the same state	

However, central government must invest in state-of-the art innovation centers for technologies such as simulators for smart grid integration with RE, EV etc. to push a level playing field to government utilities in India.

2. Training Faculty

While the faculties may come from either of the three sources as provided below, a Master Faculty Register must be maintained where details of all the faculties under various themes must be listed along with their expertise. This will help in faster selection of the faculties when required and also indicate the availability of the skilled faculty under various heads. The Central Government may maintain a pool of faculties also on new topics so that the experience and knowledge of such individuals are leveraged to the best extend. Second, proper TOT programs must be organized specifically for new/future themes so that the skilled faculties are available to meet the growing demands of the industry.

In-house faculty

Availability of in-house dedicated faculty

Outsourced Faculty

Availability of outsourced dedicated faculty

Thrid party traaining or consultancy agency

Availability/MoU with agency to provide trainers or conduct trainings
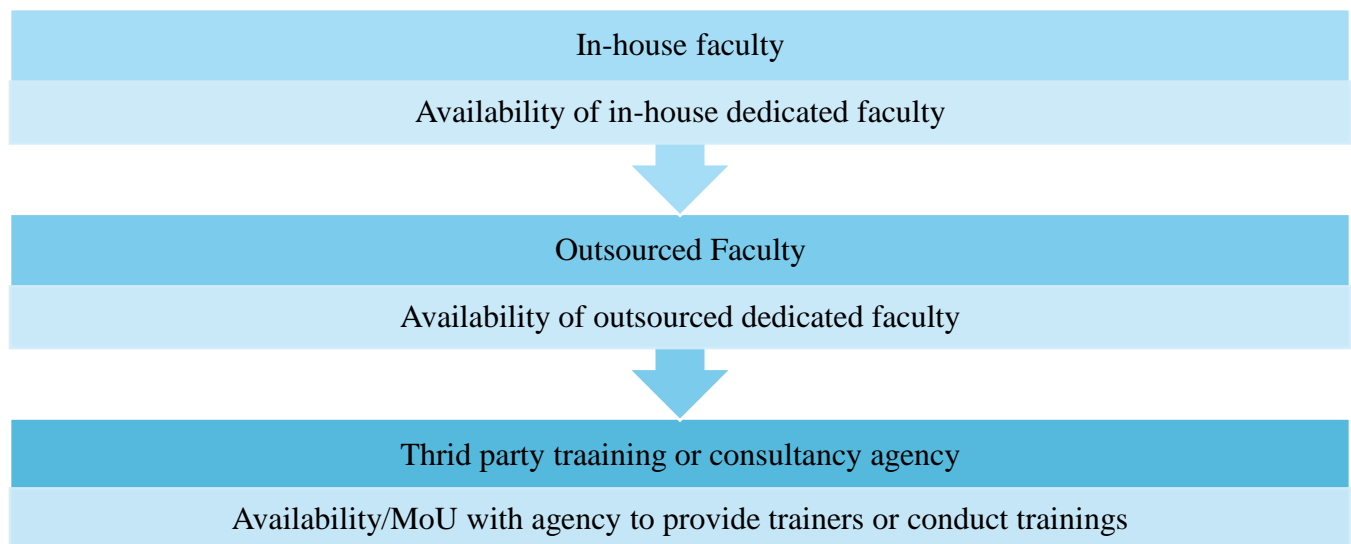
3. Assessment of the Faculty

It is recommended that faculties are selected on the basis of specific qualifications, experience and exposure in the

field of training. Further, a proper feedback mechanism must be implemented and adhered to. It must be mandatory for the participants to provide feedback of training and faculty at the end of each session and such record must be maintained safely. On the basis of the feedback, the assessment of the trainers must be updated regularly and the tracker must be referred during selection of the faculty.

Selection of the faculty	• Every discom must identify the required faculty qualifications and experience against every theme. The faculties should be selected to meet the theme requirements.
Detail evaluation of the Faculty	• Implementation of the feedback framework and maintainence of the assessment tracker • Evaluation by the participants at the end of the training session • Regular updation of the assessment of the trainers as per the tracker

The feedback form for the training sessions may include questions related to soft as well as technical aspects of the trainer. The participants may be encouraged to share their views on presentation of the trainer, knowledge of the trainer, competencies, personal characteris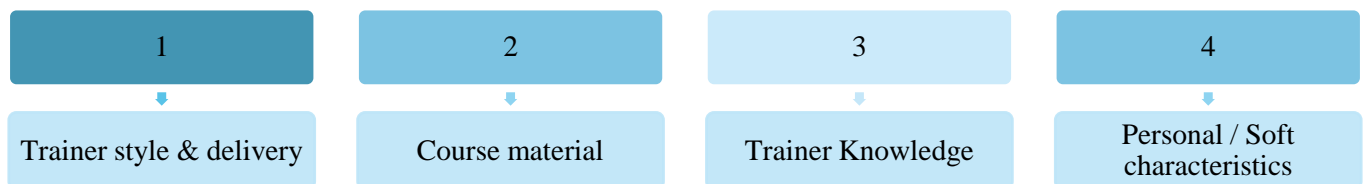tics, overall quality of the training etc. An illustrative list of the parameters to be assessed are provided below for reference -

1	2	3	4
Trainer style & delivery	Course material	Trainer Knowledge	Personal / Soft characteristics

4. Training Records

Currently, the practice of training records is not standardized in DISCOMs. Although most distribution utilities maintain records of the no. of trainings conducted, however the lack of a standard template makes the activity adhoc in nature. Under, the prevalent practice, only the title, and the no. of attendees are recorded by the distribution utility. Some distribution utilities also maintain the name of the employees that attended the training. A few distribution utilities have also employed the use of LMS / TMS based solutions for training records.

The Training Management Information System must integrate trainings, calendar, participants, faculty, and other information. The training MIS can be a simple excel sheet to maintain data or software-based solutions depending upon the distribution utility. The training MIS should also monitor the effectiveness of the training program by allowing a mechanism for sharing and storing the feedback of the participants for further analysis. Proper training records along with other management software such as OMS / ERP can help in finding the co-relation between the training and DISCOM operational practices.

Maintaining proper training records

- List of all the training held along with persons who have received training, type of training and faculty. The tentative cost may also be maintained in the list.

Maintaining MIS for training records

- Maintain of Training Management Information System to integrate trainings, calender, participants and faculty.

Monitor and record the training results and effectiveness

- Framework should be implemented to assess the training effectiveness

5. Training Calendar

Most DISCOMs have a practice of scheduling the planned training programs in form of an annual training calendar. The types of training programs that are included in the calendar needs to be comprehensive to the needs of the utility. Some state-owned utilities have also undertaken the practice of printing the training calendars.

Case Study: Exhaustive printed training calendar

Designing the training calendar for the upcoming year is an activity undertaken by many DISCOMs in India. A prominent state-owned power distribution company in the eastern part of the country undertakes this activity with a lot of thought into the design and usability of the training calendar. Designed and conceptualized by the HRD Training & Performance Management Department of the DISCOM, this informative training calendar is a handy tool to enhance participation in capacity building programs of the company. This in-turn helps the DISCOM to keep its workforce aligned to the company's vision and to realize its business objectives.

Structure and contents

The training calendar booklet starts with foreword and messages from the top management outlining the training and capacity initiatives taken by the company during the past year. Address and contact details of all in-house training centres are conveniently displayed so that the reader can directly communicate with the training centres for queries and registration. Further, there are details of internal and external training for each skill and level of employees. Each course is described with target participants, program contents and duration. Captioned pictures depicting key moments during training in the past year are highlighted to motivate employees to participate in the coming year. This is followed by a detailed, month-wise, and training centre-wise schedule so that employees can plan their nomination and registration at the nearest training centre.

Circulation

The training calendar is printed in bulk and circulated across the organization to each circle, division, sub-division, and section. This ensures that all employees have proper access to the trainings planned for the year and may nominate themselves or subordinates accordingly.

Effectiveness

Over the years, this continued practice has matured and has resulted in enhanced participation from employees. The DISCOM has even been able to generate revenue from training and capacity building by inviting participants from DISCOM employees of neighboring states. Currently, more than five state-owned DISCOMs have been engaged as clients.

a. Training other than technical training

With continuous advancement in technology, the avenues for training are multiple. As such the focus should be put on providing training other than technical training. Few areas where such trainings may be provided are –

Soft skills, Training for non-technical staff, Training in Renewable and Non-Conventional Sources of Energy and Training in Disaster Management.

b. Options for International training

International Associations are quite advanced in carrying out research and development programs on new technological areas. To tap the opportunity, DISCOMs must collaborate with professional international institutes of good repute to provide trainings in areas. The exposure of international associations will help a person to attain not only professional knowledge but also cultural exposure which will assist in overall development of the person. Further, few technologies are relatively new to India however, other countries have already implemented the same and therefore, may have readily available trainers, infrastructure, and training programs for a particular area. Benchmarking the training programs of the distribution utilities against those of international utilities should be continuous process to identify the gaps specific to a DISCOM.

c. Types of training

Apart from the conventional training programs, the DISCOMs may also focus on non-traditional programs and teaching methods such as - Simulator Training, Customer orientation, Attitudinal Changes/ Behavioral Sciences, Training for Contract Labor, Educational Upgradation Plan, Management Development Programs and Exchange program with other DISCOMs.

An indicative training calendar is shown below with standard training themes for a distribution utility

1. The duration of initial training is indicative and shall depend upon the cadre and needs of the employees being trained.
2. Since the employees are not expected to leave the offices for long periods, the days have been kept between 2-5 days.
3. It is suggested to have regular refresher/ periodic training program for all the training themes so that employees are updated, however, the priority must be given to the trainings as mentioned below.
4. The training methodology shall depend upon the availability of infrastructure and expertise with the distribution company. While classroom training are most common, an element of field exposure and on-the-job training must also be added where possible. Alternatively, the distribution companies may also prepare a combination of training manuals, video tutorials and self-study programs for specific themes which shall employees to learn at their own speed and also revise as and when required.
5. It is believed that the specialized training shall depend upon the extend of the adoption/penetration of the specific area in the distribution company and therefore, the duration of the training program must be decided on the basis of the same.

Table 7: Indicative Training calendar

Trainings with broad training topics	Training groups	Initial training	Specialised trainings	Tentative duration of initial training	Training methodology				Periodic training programmes
					Classroom lectures	Field exposure	On the job training	Simulators	
Conventional Trainings									
Network planning and protection									
Distribution Network Planning	A,B	Yes		3-5 days	✓	✓	✓	✓	
Substation Planning & Engineering	A,B	Yes		3-5 days	✓	✓	✓	✓	✓
Implementation of Underground Cable Project	A,B		Yes		✓				
Load flow study with hands on experience on software	A,B		Yes		✓			✓	
Contingency analysis and voltage stability	A,B		Yes		✓				
Short circuit studies	A,B		Yes		✓				
System Operation									
Energy Audit & Loss Reduction	A,B	Yes		3-5 days	✓	✓	✓	✓	
DSM Techniques	A,B	Yes		3-5 days	✓	✓	✓	✓	
Energy Efficiency in power distribution	A,B	Yes		3-5 days	✓	✓	✓	✓	✓
SCADA, DMS and distribution automation									
Basics of SCADA, DMS & DA with Applications	A,B	Yes		3-5 days	✓			✓	
GIS & Integration Of SCADA/DMS/OMS	A,B		Yes		✓			✓	
IT systems									
Application in power distribution	A,B	Yes		2 days	✓	✓	✓		
Integration of billing system with other applications	A,B	Yes		2 days	✓	✓	✓		
ERP and application	A,B	Yes		2 days	✓	✓	✓		

Trainings with broad training topics	Training groups	Initial training	Specialised trainings	Tentative duration of initial training	Training methodology				Periodic training programmes
					Classroom lectures	Field exposure	On the job training	Simulators	
Cyber Security	A,B		Yes		✓				
Applications of Blockchain technology in power distribution	A,B		Yes		✓				
MIS and dashboard	A,B	Yes		2 days	✓	✓	✓		
Artificial Intelligence ,Data Analytics, Machine Learning	A,B		Yes		✓				
O&M									
Modern distribution technologies for O&M	A,B,C,D	Yes		2-5 days	✓	✓	✓		✓
Condition Monitoring of Electrical equipment	A,B,C,D	Yes		2 days	✓	✓	✓		
Cable jointing and working on equipment	A,B,C,D	Yes		2 days	✓	✓	✓		✓
Best Practices in O&M	A,B,C,D	Yes		2 days	✓	✓	✓		
Testing of various S/s equipment's	A,B,C,D	Yes		3-5 days	✓	✓	✓		
Metering & Billing									
Revenue Cycle Management	A,B,C	Yes		2 days	✓	✓	✓		
Commercial Process in Power Distribution	A,B,C	Yes		2-4 days	✓	✓	✓		✓
Latest technology in metering and billing	A,B,C	Yes		1-2 days	✓	✓	✓		✓
Theft detection and data analytics	A,B,C		Yes		✓	✓	✓		
New Trainings									
Disaster Management									
Disaster Planning Management	A,B	Yes		2 days	✓				
Making discoms resilient	A,B	Yes		2 days	✓				
Electrical Vehicles									

Trainings with broad training topics	Training groups	Initial training	Specialised trainings	Tentative duration of initial training	Training methodology				Periodic training programmes
					Classroom lectures	Field exposure	On the job training	Simulators	
Details of Electric Vehicle Charging	A,B	Yes		2 days	✓				
Electric Vehicle Grid Integration	A,B		Yes		✓			✓	
RE integration									
Integration with grid and storage batteries (for various generation)	A,B	Yes	Yes	2 days	✓				
Grid Integration Challenges	A,B	Yes	Yes	2 days	✓				
Operational issues and performance improvement	A,B	Yes	Yes	2 days	✓				
Smart Grid									
Smart Grid Technologies & Applications	A,B	Yes		3-5 days	✓				
Prepaid Meter and Time-Of-Day Metering	A,B	Yes		2 days	✓		✓		
AMI (Smart Meter, HES, MDMS Features)	A,B	Yes		2 days	✓				
Smart Grid Analytics	A,B		Yes		✓				
Safety Training									
Protection in power distribution system	A,B,C,D	Yes		2-4 days	✓				
Modern safety practices in power distribution	C,D	Yes		2 days	✓				
Aspects of fire & electrical safety	C,D	Yes		2 days	✓				
Security of power distribution installations	C,D	Yes		2-4 days	✓				
Safety doing working on Distribution system	C,D	Yes		2-4 days	✓				

6. Training policy

In India, the Central Electricity Authority is mandated to promote skill development measures for persons engaged in the electricity sector. During the past two decades, power distribution system has evolved and there have been drastic shifts in the way operations are carried with continuous infusion of technology. It is crucial that human resources are also upskilled to keep up with the advancements like Electrical Vehicles, Smart grid, Battery storage among others. The emergence of COVID-19 has also forced DISCOMs to depend upon online mode of learning. There is a need to update the national training policy as well which includes training strategy, training curriculum and training modules and takes into consideration the new technology being implemented. The principle that speed of obsolescence overtakes the pace of acquisition of a particular skill should be reversed in this case through timely up-dation of the policy. It is also recommended that the policy framework should be easy to follow and adhere by distribution companies. Regulators may also encourage DISCOMs to adhere to the NTP guidelines by closely reviewing and monitoring the training and development activities during MYT process. The training policy must be prepared and updated every year so that the latest trends are captured in the policy. Further, as a regular practice, training plan must be prepared and communicated to everyone before the start of the financial year.

7. Training Budget

After the finalization of the training policy and plan, funding mechanism for implementation of Training Policy must be earmarked so that the plan may be carried out seamlessly. In this regard, approval by BOD or appropriate committee may be sought at the start of financial year to finalize the source of funds for training.

8. Training Needs Assessment/Job Analysis

Distribution Companies must periodically conduct training Need assessment in different functions such as - Project planning, implementation & monitoring, O&M, Transmission & Distribution, Tariff, Reforms & Restructuring etc. Apart from conventional areas, such assessment may be carried out in upcoming areas like smart meter, data analytics etc.

9. Review/Evaluation of Training Programs

Training evaluation should be carried out in a scientific manner to measure the effectiveness of training by getting feedback on the performance of trained personnel and the training process. It is suggested that proper evaluation methodology be decided for each training program and modification to the training program in terms of content, form and duration be carried out diligently.

Case Study: Correlation of business results with training imparted

The impact of training and capacity building initiatives on business outcomes is often visible as qualitative benefits. However, a large DISCOM in the western part of the country has been able to showcase quantitative benefits from its training and capacity building regimen. The DISCOM has been able to correlate its safety results with regular safety training imparted to its employees.

The company has maintained proper MIS for number of trainings, participation, feedback, etc. on the learning management system. It also maintains MIS of the safety incidents, improvements in AT&C loss, and other business outcomes. This has helped the DISCOM to correlate the impact of its training and capacity building measures with the improvement in business outcomes. Currently, safety results have been successfully monitored and improvement is visible – the DISCOM has been able to reduce fatal accidents by half in a span of two years by increasing the frequency of safety trainings. The DISCOM is now in the process of extending these measurement and monitoring activities to other business outcomes as well, such as AT&C loss reduction, O&M cost reduction and improvement in reliability of power supply.

10. Training Organization Structure

DISCOMs may be encouraged to develop the training function as an independent department headed by a suitable management representative.

Case Study: Infotainment – learning beyond the classroom

Theme

Many companies around the world celebrate the month of November as 'Quality Month'. The main purpose is to raise the level of quality awareness in the company and to recognize the efforts and contributions of quality professionals. A private power distribution company in the northern part of the country has been celebrating Quality month for the past 6 years. This has resulted in enhanced knowledge exchange and quality consciousness paving the way to make the organization process-centric rather than people-centric

Events

The quality month commences with Safety and Quality pledge and flag hoisting at all offices of the company. The flags are de-hoisted at the end of the Quality month. Thereafter, a pre-planned schedule of events and activities is rolled out. Knowledge enhancing events such as Quizzes, Slogans, Pictionary competitions, Debates, Treasure-hunts, Essay competitions, Skit competitions, Model / prototype / Simulator exhibitions are held with spot prizes for the successful teams or individuals. Such events make learning more fun for employees and aids in better retention. For example, the clues used in treasure-hunts are correct answers to cryptic questions on quality; while the models, prototypes and simulators help in learning by visuals and hands-on experience.

Each successful participant is awarded scores for their achievements. The marking system considers both individual and group event scores. These are added within departments to calculate the department-wise scores which determines the best department. This inculcates spirit of teamwork within departments as well as encourages healthy competition between departments. Interdepartmental know-how of each other's best practices also increases as a result.

Reward & recognition

Towards the end of November, the quality month events culminate into a reward and recognition function called "Quality Nite". The DISCOM invites an eminent personality such as CMDs of other DISCOMs, Quality heads of manufacturing companies, etc. as Chief guest for the function. The event begins with inaugural address by the MD, followed by individual award trophies, best department awards, and display of the best simulation models and projects over dinner or hi-tea.

Self - Grading of Distribution Utilities

The following self-assessment framework allows distribution utilities to classify themselves into three grades based on their current maturity level on the training attributes discussed above. The scoring for the attributes is as follows

1. Maturity level 1 score: A distribution utility which falls under maturity level 1 for an attribute would be scored '1' for the same.
2. Maturity level 2 score: A distribution utility which falls under maturity level 2 for an attribute would be scored '2' for the same.
3. Maturity level 3 score: A distribution utility which falls under maturity level 3 for an attribute would be scored '3' for the same.

The cumulative scoring would define the Grade of the DISCOM as follows

1. Cumulative score less or than equal to 24: Grade C
2. Cumulative score between 25 to 39: Grade B
3. Cumulative score of 40 and above: Grade A

Attributes	Description	Maturity level 1	Maturity level 2	Maturity level 3
Training policy				
Preparation of the training policy	Policy document for DISCOM prepared in line with the National Training Policy	DISCOM does not have an existing training policy	Training Policy exists, but adherence is not monitored	Training Policy is aligned to the National training policy and is reviewed every year. Adherence is monitored on regular basis.
Training Budget				
Allocation of funds for training	Allocation of funds for the training needs of the DISCOM	There is no practice of allocating training budget at the beginning of the year	Upto 1.5% of salary budget is allocated and spent for training purposes	1.5 to 5% of salary budget is allocated and spent for training purposes
Training Need Assessment				
Training Needs Assessment/Job Analysis	Assessment process to determine if a training need exists and, if it does, what training is required to fill the gap.	Training Need Assessment is not carried out / carried out on an adhoc basis.	Training Need Assessment is carried out by internal discussions with each head of the department.	Training Need Assessment is carried out in a systematic manner on a periodic basis for each employee / employee group. The DISCOM uses competency mapping and other scientific modes of assessment.
Training Infrastructure				

Attributes	Description	Maturity level 1	Maturity level 2	Maturity level 3
Access to training institutes recognized by CEA for imparting statutory induction training	CEA releases a list of guidelines for recognition of training institutes across the power sector	DISCOM does not have access to CEA certified training institute	DISCOM has access to training infrastructure of other DISCOM or external training institutes	DISCOM has a CEA certified in-house training institute
Class C & D / Lineman Training Institutes	Regional training centres within a state catering to the Class C & D employees of the DISCOM	DISCOM has training centres / lineman training institutes (catering to C & D category employees) at the zonal or circle level	DISCOM has training centres / lineman training institutes (catering to C & D category employees) at the divisional level	DISCOM has training centres / lineman training institutes (catering to C & D category employees) at every sub-division or section
Capacity of Inhouse training centre	The cumulative training capacity of the inhouse Training institutes	Ability to hold trainings for less than 5% of the employee strength in a month	Ability to hold trainings for 5 to 10% of the employee strength in a month	Ability to hold trainings for more than 10% of the employee strength in a month
Hands-on Technical Training infrastructure	Infrastructure /simulators /repair workshops required for providing practical training on Operations, Maintenance & Safety power distribution practices.	No infrastructure to provide hands-on technical training	Some training institutes are equipped with basic hands-on training infrastructure	Simulators, repair workshops, laboratories are accessible to all distribution O&M functions
New technologies Training infrastructure	Infrastructure /simulators /workshops required for providing practical training on new technologies such as Smart grid, Renewable Energy and Grid Integration Technology	DISCOM does not have any access to simulators / laboratories for training on new technologies	DISCOM has MoU / tie-up with reputed training institute(s) which have simulators / laboratories for training on new technologies	DISCOM has in-house simulators / laboratories equipped for training on new technologies
Training Faculty				
Internal Faculty Hiring	Mechanism for hiring of training faculty / Trainers	DISCOM does not hire any dedicated in-house training faculty. There is no mechanism to identify O&M staff who can also conduct in-house trainings	DISCOM does not hire any dedicated in-house training faculty, however, it has identified O&M staff who can also conduct in-house trainings	DISCOM has an identified set of dedicated in-house trainers

Attributes	Description	Maturity level 1	Maturity level 2	Maturity level 3
Training of Trainers and development of inhouse trainers	Periodic training of trainers and development of new training faculty	Training of trainers conducted on an adhoc basis. No future ToT programs or development of new trainers planned. High reliance on external trainers with either no inhouse trainers or very few inhouse trainers	DISCOM plans to put a systematic process in place for conducting training of trainers to enable them to adequately impart training on basic, advanced, and new technologies in distribution O&M.	There exists a structured process for continuously growing and improving the pool of identified in-house trainers who can adequately impart training on basic, advanced, and new technologies in distribution O&M.
Capability of trainers (in-house or outsourced)	Ability of the trainers to conduct technical and non-technical training courses	Ability to impart training on basic O&M practices	Ability to impart training on soft skills, basic O&M practices, and advanced topics such as load flow studies, reliability studies, equipment failure analysis, etc.	Ability to impart training on basic and advanced topics as well as on new technologies such as Smart grid, SCADA, DMS, etc.
Coverage and availability of trainers across the hierarchy	Coverage of the trainers to different classes of employees	Coverage of trainers limited to class C & D (III & IV) employees only	Coverage of trainers extends across all employee classes with limited availability to cover DISCOM's own employees only	Coverage of trainers extends across all employee classes – available to the DISCOM's own employees and for conducting external trainings as well
Training Content				
Content development	Is there a well defined training curriculum - which is regularly reviewed and updated?	DISCOM does not have any fixed training content / curriculum for various functional areas and skill levels	Few in-house trainers have developed fixed training content for their subjects. The same curriculum is imparted to all batches of participants.	All in-house trainers are equipped with fixed training content for their subjects. The curriculum is regularly updated based on changes in technology, DISCOM requirements, etc.

Attributes	Description	Maturity level 1	Maturity level 2	Maturity level 3
Knowledge management	Mechanisms of knowledge sharing within the DISCOM	No structured mechanism for knowledge management	Some departments in the DISCOM have implemented knowledge sharing sessions, peer presentations etc.	There is a structured process for knowledge sharing through Knowledge Management portal which facilitates storage, retrieval and delivery of the knowledge sessions and content
Content delivery mechanisms	How are the training programs imparted? Is the DISCOM prepared for training delivery during crisis situations such as in Covid-19 where in-person training is difficult to conduct?	The DISCOM majorly uses traditional classroom mode of training delivery	The DISCOM uses presentations, webinars, online classrooms, videos, etc. to impart training to its employees besides classroom training.	In addition to conventional classroom learning and webinars, videos etc., the DISCOM deploys innovative methods such as role-playing, debates, quizzes, fun learning initiatives, etc.
Safety training				
Periodicity of Safety training	How frequently are safety trainings conducted in a year and their planned cycle.	Safety training is conducted on adhoc basis without any planned schedule	Safety training is conducted in a systematic manner on a quarterly / monthly basis	Safety training conducted in a systematic manner on a weekly / fortnightly basis - with daily safety briefings.
Coverage of Safety Training	Percentage of O&M employees and field engineers that undergo safety training in a year.	Less than 50% of the O&M employees and field engineers undertake safety training in a year	More than 50% but less than 90% of the O&M employees and field engineers undertake safety training in a year	90% and above of the O&M employees and field engineers undertake safety training in a year
Training Records				
Maintaining proper training records	List of all the training held along with persons who have received training, type of training and faculty. The tentative cost may also be maintained in the list.	No Training records maintained	Training records maintained in Excel, however no training management system or learner management system present	Training records maintained in training management system (TMS) or learner management system (LMS)
Evaluation of Training Programs				

Attributes	Description	Maturity level 1	Maturity level 2	Maturity level 3
Mechanism of evaluation	Mechanism for evaluation of the effectiveness of training program.	No feedback mechanism for evaluation of training programs	Participant feedback forms are used for evaluation of training programs.	Besides participant feedback, superior feedback regarding impact on the participants' skill level is also noted.
Record of Evaluation process	Maintenance of records of training effectiveness evaluation and subsequent analysis.	No feedback taken or feedback from participants is neither recorded nor analysed	Record of feedback received from participants is kept, but there is no mechanism for systematic analysis	Feedback from participants and superiors is recorded and analysed. The results from the analysis are used to improve training content and delivery

Prescriptive Actions for Distribution utility

1. Action plan for Grade C DISCOMs

Attributes	Short term plan (0 - 2 years)	Medium term plan (2 - 4 years)	Long term plan (4 - 8 years)
Training policy			
Preparation of the training policy	Implement training policy within the guiding framework of the national training policy	Implement suitable matrics to monitor implementation of the training policy	Review and improve training policy by setting suitable performance targets on training policy matrics.
Training Budget			
Allocation of funds for training	Earmark training budget during budgetary approvals for the year.	Ensure 100 % utilization of training budget.	Determine training budget requirement based on TNA, analysis of infrastructure required, number of employees to be trained, etc.
Training Need Assessment			

Attributes	Short term plan (0 - 2 years)	Medium term plan (2 - 4 years)	Long term plan (4 - 8 years)
Training Needs Assessment/Job Analysis	Hire external support for Training Need Analysis for O&M functions such as Complaint management, Breakdown maintenance, Metering and Billing departments on priority.	Implement in-house Training Need Assessment to cover all O&M functions.	Implement in-house Training Need Assessment to cover all employees of the DISCOM.
Training Infrastructure			
Access to training institutes recognized by CEA for imparting statutory induction training	Identify and liason with other DISCOMs in the region which have a CEA certified training facility	Explore options for tie-ups with external CEA recognized institutes and possibility of establishing such institute by state government or regional cooperation of state governments	Allocate budget / explore external funding options for setting up in-house training facility based on CEA guidelines
Class C & D / Lineman Training Institutes	Develop a model lineman training institute from the existing ones	Standardize the facilities available at linemen training institutes at least in urban divisions / sub-divisions	Enhance the reach and coverage of linemen training institutes to cover all rural sub-divisions / sections
Capacity of Inhouse training centre	Evaluate in-house training options to choose the best option from - establishing new in-house training centre vs augmentation of existing centres vs 100% external training. Obtain management approval for the chosen option.	Explore options for capacity expansion to cover at least 10% employee strength in a month	Explore options for capacity expansion to cover 15% employee strength in a month
Hands-on Technical Training infrastructure	Identify basic need for hands-on training infrastructure based on results of training need analysis	Identify and obtain approvals for required resources - procurement / in-house construction of simulators / models etc.	Prioritize and equip training classrooms / labs of O&M functions with maximum revenue / customer satisfaction impact - such as Metering & Billing

Attributes	Short term plan (0 - 2 years)	Medium term plan (2 - 4 years)	Long term plan (4 - 8 years)
New technologies Training infrastructure	Organize participation of employees in free MOOCs (Mass Open Online Classrooms) which provide free online programs on new technologies like smart grids, smart metering, etc.	Organize visits to other DISCOMs / institutes where infrastructure on new technology is available	Prioritize and develop plan for spending on new technologies training infrastructure
<td colspan="4" align="center">Training Faculty</td>			
Internal Faculty Hiring	Invite recommendations from department heads to nominate potential trainers. Conduct mock sessions and surveys to evaluate trainer capability. Finalize list of employees to be developed as in-house trainers.	Develop mechanism for hiring of dedicated training staff for O&M functions.	Review other O&M functional responsibilities of in-house trainers. Restructure the organization to gradually shift to full-time training roles for the in-house trainers.
Training of Trainers and development of inhouse trainers	Assess skill gaps of the identified employees to be developed as in-house trainers.	Conduct priority ToT programs based on identified skill gaps for development of in-house trainers. Develop skill gap identification as a regular, annual process.	Conduct ToT programs based on identified skill gaps as well as training needs of the organization.
Capability of trainers (in-house or outsourced)	Organize training sessions with newly identified in-house trainers who have least skill gaps. Start with sessions on basic level training such as basic O&M practices.	Widen the scope of in-house trainers to cover advanced topics such as load flow studies, reliability studies, equipment failure analysis, etc.	Widen the scope of in-house trainers to cover basic and advanced topics as well as on new technologies such as Smart grid, SCADA, DMS, etc.
Coverage and availability of trainers across the hierarchy	Basic training sessions to gradually cover all C&D category employees	Inclusion of B category employees in in-house training sessions. Focus on development of A and B category in-house trainers	Inclusion of A category employees in in-house training sessions
<td colspan="4" align="center">Training Content</td>			

Attributes	Short term plan (0 - 2 years)	Medium term plan (2 - 4 years)	Long term plan (4 - 8 years)
Content development	Hire external support the new trainers on content development of basic O&M training	Evaluate and improve content on basic O&M training. Gradually increase scope of content creation to advanced topics.	Evaluate and improve content on basic O&M and advanced level training. Gradually increase scope of content creation to topics covering new technologies.
Knowledge management	Develop mechanism for regular (preferably weekly or fortnightly) knowledge sharing sessions - either in-person presentations or webinars.	Develop mechanism for recording of knowledge pieces and presentations. Develop a reward and recognition scheme for best knowledge sessions - evaluated by superiors.	Develop mechanism for easy access and retrieval of knowledge sharing sessions / presentations / videos of webinars, etc.
Content delivery mechanisms	Encourage employees to attend webinars and MOOCs. Hire external support for training on presentation skills for key in-house trainers.	Encourage trainers to facilitate out-of-class training at site / field offices.	Create a structured process to conduct field training, video recording, capturing snapshots of key moments, etc. Use these in future training sessions to improve the learning experience.
Safety training			
Periodicity of Safety training	Assign KPI for conducting regular safety training to the concerned department head. Conduct regular safety training and monitor participation	Encourage safety pep talks before carrying out scheduled maintenance work	Develop weekly safety update / safety bulletin. Identify safety champions in each department / O&M section / sub-division who shall coordinate safety training

Attributes	Short term plan (0 - 2 years)	Medium term plan (2 - 4 years)	Long term plan (4 - 8 years)
Coverage of Safety Training	Increase coverage for safety training to 90% and above for O&M employees and field engineers.	Improve participation by ensuring safety messages by top management during safety meets / drills	Improve participation by structuring a reward and recognition mechanism.
Training Records			
Maintaining proper training records	Maintain training records in Excel	Develop mechanism to provide useful analysis from training records	Implement training management system (TMS) or learner management system (LMS)
Evaluation of Training Programs			
Mechanism of evaluation	Implement basic participant feedback forms / simple 5-star rating mechanism on paper.	Improve participant feedback form to cover more attributes of training feedback.	Use participant feedback as well as superior feedback regarding impact on the participants' skill level for evaluation
Record of evaluation process	Collate and record responses of participant feedback in excel	Use basic analysis to find opportunities in content / trainer improvement	Configure LMS /TMS to record the feedback from participants and superiors.

2. Action plan for Grade B DISCOMs

Attributes	Short term plan (0 - 2 years)	Medium term plan (2 - 4 years)	Long term plan (4 - 8 years)
Training policy			
Preparation of the training policy	Modify existing training policy to conform to the framework requirements of the national training policy	Implement suitable matrics to monitor implementation of the new training policy	Review and improve training policy by setting suitable performance targets on training policy matrics.
Training Budget			
Allocation of funds for training	Ensure 100 % utilization of training budget.	Increase training budget beyond 1.5% of employee salary budget	Increase training budget to 5% of employee salary budget
Training Need Assessment			

Attributes	Short term plan (0 - 2 years)	Medium term plan (2 - 4 years)	Long term plan (4 - 8 years)
Training Needs Assessment/Job Analysis	Carry out in-house Training Need Assessment to cover all O&M functions.	Implement in-house Training Need Assessment to cover all employees of the DISCOM.	Integration of Institutional goals with training need assessment.
Training Infrastructure			
Access to training institutes recognized by CEA for imparting statutory induction training	Explore options for tie-ups with external CEA recognized institutes and possibility of establishing such institute by state government or regional cooperation of state governments	Allocate budget / explore external funding options for setting up in-house training facility based on CEA guidelines	Develop in-house training institute - emphasise online teaching modes vs classroom in-person training
Class C & D / Lineman Training Institutes	Develop a model lineman training institute from the existing ones	Standardize the facilities available at linemen training institutes at least in urban divisions / sub-divisions	Enhance the reach and coverage of linemen training institutes to cover all rural sub-divisions / sections
Capacity of Inhouse training centre	Evaluate in-house training options to choose the best option from - establishing new in-house training centre vs augmentation of existing centres vs 100% external training. Obtain management approval for the chosen option.	Explore options for capacity expansion to cover at least 12% employee strength in a month	Explore options for capacity expansion to cover 15% employee strength in a month
Hands-on Technical Training infrastructure	Identify basic need for hands-on training infrastructure based on results of training need analysis	Identify and obtain approvals for required resources - procurement / in-house construction of simulators / models etc.	Prioritize and equip training classrooms / labs of O&M functions with maximum revenue / customer satisfaction impact - such as Metering & Billing

Attributes	Short term plan (0 - 2 years)	Medium term plan (2 - 4 years)	Long term plan (4 - 8 years)
New technologies Training infrastructure	Organize participation of employees in free MOOCs (Mass Open Online Classrooms) which provide free online programs on new technologies like smart grids, smart metering, etc.	Organize visits to other DISCOMs / institutes where infrastructure on new technology is available. Leverage MoUs / tie-ups	Prioritize and develop plan for spending on new technologies training infrastructure
Training Faculty			
Internal Faculty Hiring	Develop mechanism for hiring of dedicated training staff for O&M functions.	Review other O&M functional responsibilities of in-house trainers. Restructure the organization to gradually shift to full-time training roles for the in-house trainers.	Develop a mechanism of identification and onboarding of back-up in-house trainers
Training of Trainers and development of inhouse trainers	Assess skill gaps of the identified employees to be developed as in-house trainers.	Conduct priority ToT programs based on identified skill gaps for development of in-house trainers. Develop skill gap identification as a regular, annual process.	Conduct ToT programs based on identified skill gaps as well as training needs of the organization - special emphasis on advanced level and new technology training.
Capability of trainers (in-house or outsourced)	Widen the scope of in-house trainers to cover basic and advanced topics as well as on new technologies such as Smart grid, SCADA, DMS, etc.	Encourage in-house trainers to take up external trainings as guest faculty. Identify a pool of suitable external trainers	Introduce reward and recognition schemes to promote best performing in-house trainers
Coverage and availability of trainers across the hierarchy	DISCOM may explore opportunities in providing external training to other DISCOMs	Strengthen the pool of trainers to cater to external clients.	MoU / business relationship with at least 2 other DISCOMs for providing external training.
Training Content			

Attributes	Short term plan (0 - 2 years)	Medium term plan (2 - 4 years)	Long term plan (4 - 8 years)
Content development	Hire external support the new trainers on content development of basic O&M training	Evaluate and improve content on basic O&M training. Gradually increase scope of content creation to advanced topics.	Evaluate and improve content on basic O&M and advanced level training. Gradually increase scope of content creation to topics covering new technologies.
Knowledge management	Develop mechanism for regular (preferably weekly or fortnightly) knowledge sharing sessions - either in-person presentations or webinars.	Develop mechanism for recording of knowledge pieces and presentations. Develop a reward and recognition scheme for best knowledge sessions - evaluated by superiors.	Develop mechanism for easy access and retrieval of knowledge sharing sessions / presentations / videos of webinars, etc.
Content delivery mechanisms	Encourage employees to attend webinars and MOOCs. Encourage trainers to facilitate out-of-class training at site / field offices.	Create a structured process to conduct field training, video recording, capturing snapshots of key moments, etc. Use these in future training sessions to improve the learning experience.	Deploy innovative methods such as role-playing, debates, quizzes, fun learning initiatives, etc.
Safety training			
Periodicity of Safety training	Assign KPI for conducting fortnightly safety training to the concerned department head. Conduct regular safety training and monitor participation	Encourage safety pep talks before carrying out scheduled maintenance work	Develop weekly safety update / safety bulletin. Identify safety champions in each department / O&M section / sub-division who shall coordinate safety training

Attributes	Short term plan (0 - 2 years)	Medium term plan (2 - 4 years)	Long term plan (4 - 8 years)
Coverage of Safety Training	Increase coverage for safety training to 90% and above for O&M employees and field engineers.	Improve participation by ensuring safety messages by top management during safety meets / drills	Improve participation by structuring a reward and recognition mechanism.
Training Records			
Maintaining proper training records	Develop mechanism to provide useful analysis from training records	Implement training management system (TMS) or learner management system (LMS)	Improve analytics and implement changes based on results of insights from the LMS / TMS
Evaluation of Training Programs			
Mechanism of evaluation	Use participant feedback as well as superior feedback regarding impact on the participants' skill level for evaluation. Perform basic analysis.	Improve participant feedback form to cover more attributes of training feedback. Improve	Provide insights to other departments for improvement based on analysis and actions taken in O&M
Record of evaluation process	Collate and record responses of participant feedback in excel	Use basic analysis in excel to find opportunities in content / trainer improvement in O&M training	Configure LMS /TMS to record the feedback from participants and superiors.

3. Action plan for Grade A DISCOMs

Attributes	Short term plan (0 - 2 years)	Medium term plan (2 - 4 years)	Long term plan (4 - 8 years)
Training policy			
Preparation of the training policy	Review and improve training policy by setting suitable performance targets on training policy matrics.	Review and improve by gradually targeting higher performance scores on training policy matrices	Benchmark with international DISCOMs
Training Budget			
Allocation of funds for training	Ensure 100 % utilization of training budget.	Increase training budget to target 5% of employee salary budget	Evaluate and optimize training expenses to cover more training gaps within the approved budget boundaries.
Training Need Assessment			

Attributes	Short term plan (0 - 2 years)	Medium term plan (2 - 4 years)	Long term plan (4 - 8 years)
Training Needs Assessment/Job Analysis	Integration of Institutional goals with training need assessment.	Competency Mapping of resources to the institutional targets and project. Identification of shortfall in skilled resources and planning (recruitment /upscaling) for the same.	Carrying out a yearly study /report on need assessment and workforce renewal. Integration of competency mapping and institutional targets of the organisation.
Training Infrastructure			
Capacity of Inhouse training centre	Explore options for capacity expansion to cover at least 12% employee strength in a month	Explore options for capacity expansion to cover 15% employee strength in a month	Explore options for capacity expansion to cover 20% employee strength in a month
Training Faculty			
Internal Faculty Hiring	Develop a mechanism of identification and onboarding of back-up in-house trainers	Develop mechanism for hiring of dedicated training staff for O&M functions.	Develop workplans for all trainers based on the TNA and subsequent training calendar.
Capability of trainers (in-house or outsourced)	Widen the scope of in-house trainers to cover basic and advanced topics as well as on new technologies such as Smart grid, SCADA, DMS, etc.	Encourage in-house trainers to take up external trainings as guest faculty. Identify a pool of suitable external trainers	Introduce reward and recognition schemes to promote best performing in-house trainers
Coverage and availability of trainers across the hierarchy	DISCOM may explore opportunities in providing external training to other DISCOMs	Strengthen the pool of trainers to cater to external clients.	MoU / business relationship with at least 2 other DISCOMs for providing external training.
Training Content			
Knowledge management	Develop mechanism for regular (preferably weekly or fortnightly) knowledge sharing sessions - either in-person presentations or webinars. Update records on the knowledge management portal	Develop a reward and recognition scheme for best knowledge sessions - evaluated by superiors.	Strengthen the knowledge management portal to support easy access and retrieval of knowledge sharing sessions / presentations / videos of webinars, etc.
Safety training			

Attributes	Short term plan (0 - 2 years)	Medium term plan (2 - 4 years)	Long term plan (4 - 8 years)
Periodicity of Safety training	Encourage safety pep talks before carrying out scheduled maintenance work	Develop weekly safety update / safety bulletin. Identify safety champions in each department / O&M section / sub-division who shall coordinate safety training	Publish results of safety training and safety accidents on notice board, internal circulations, knowledge portal and website
Coverage of Safety Training	Improve participation by ensuring safety messages by top management during safety meets / drills	Improve participation by structuring a reward and recognition mechanism.	Conduct safety events such as quiz, slogan, skit competition etc.
Training Records			
Maintaining proper training records	Improve analytic7s and implement changes based on results of insights from the LMS / TMS	Develop a process for getting weekly / monthly insights from LMS / TMS. Action plan may be prepared by trainers based on the insights	Record action taken and impact assessment of changes in curriculum / faculty / training method.
Evaluation of Training Programs			
Mechanism of evaluation	Perform basic / advanced analysis on training feedback.	Improve participant feedback form to cover more attributes of training feedback.	Provide insights to other departments for improvement based on analysis and actions taken in O&M
Record of evaluation process	Configure LMS /TMS to record the feedback from participants and superiors.	Find opportunities in content / trainer improvement in O&M training	Use feedback scores to improve the inhouse training faculty.

Conclusion

Power is a concurrent subject in India. While the central government forms the overarching policies and guidelines for the power sector; the management of operations, regulations, tariffs, and other aspects including capacity building are taken up at the state / DISCOM level. Therefore, DISCOMs hitherto formed policies relating to training & capacity building differently with varying degrees of success in implementation.

Role of stakeholders

Multiple stakeholders need to come together in tandem to prepare the required infrastructure in place along with requisite skills. The main onus lies with Ministry of Power/ CEA and State Regulators for policy formulation and policy implementation. The key is to have a feasible plan/policy and an implementation framework, therefore, role of Ministry of Power as well Regulator is crucial.
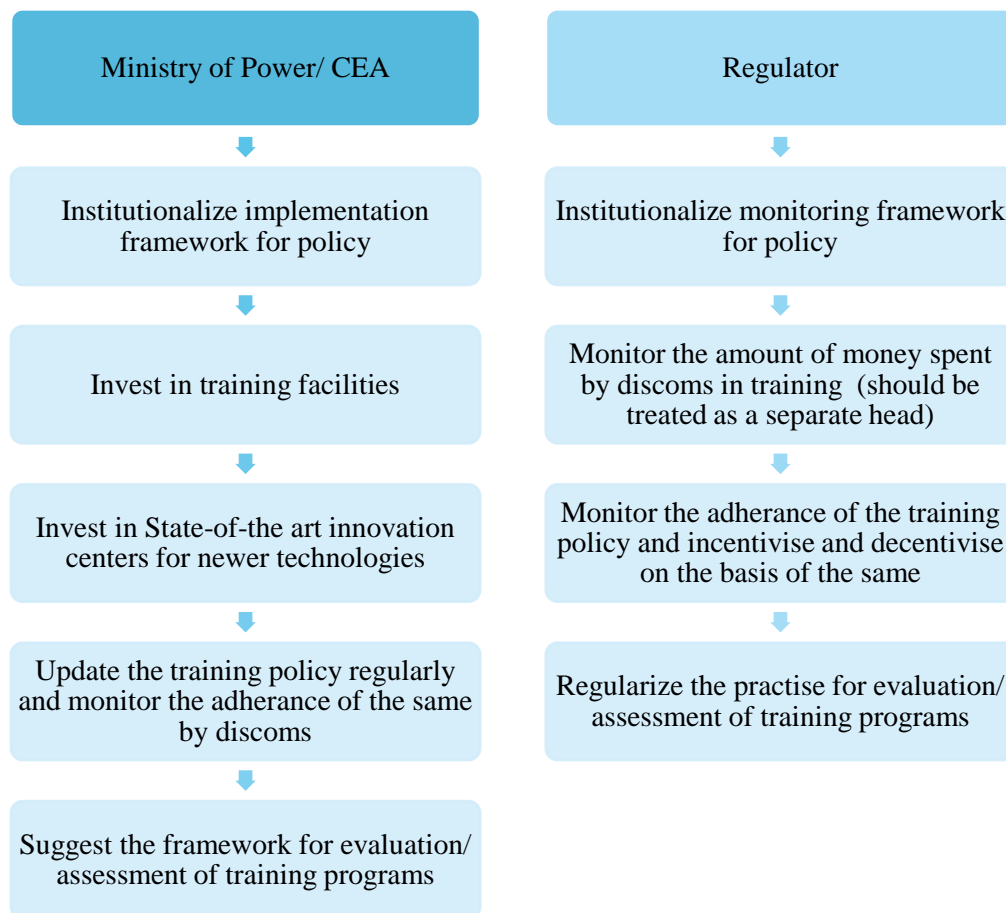
Ministry of Power/ CEA	Regulator
Institutionalize implementation framework for policy	Institutionalize monitoring framework for policy
Invest in training facilities	Monitor the amount of money spent by discoms in training (should be treated as a separate head)
Invest in State-of-the art innovation centers for newer technologies	Monitor the adherance of the training policy and incentivise and decentivise on the basis of the same
Update the training policy regularly and monitor the adherance of the same by discoms	Regularize the practise for evaluation/ assessment of training programs
Suggest the framework for evaluation/ assessment of training programs	

Figure 4: Role of Stakeholders

Role of Central Govt. Institutes

For effective reforms in the sector, the central government notifies different power sector schemes from time to time. These schemes are usually aimed at infrastructure upgradation, infusion of technology, increase in supply coverage, financial restructuring, etc.

In recent times however, the central government is increasing focus on training & capacity building of DISCOMs. For example, the National Training Program is a capacity building initiative under Deen Dayal Upadhyaya Gram

Jyothi Yojana (DDUGJY) project to provide need-based skill development training to 40,000 C&D category employees across the country in FY 21. REC Institute of Power Management & Training (RECIPMT) (Formerly known as Central Institute for Rural Electrification (CIRE)) of REC has been steering its implementation.
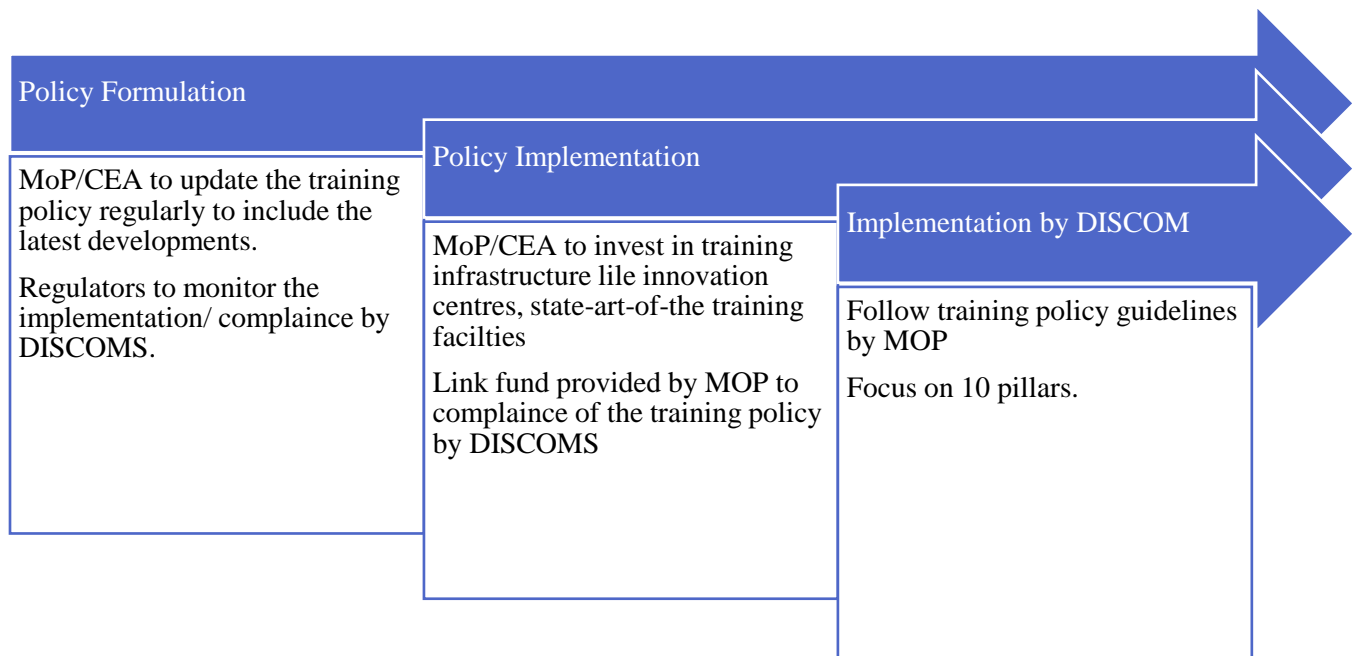
Policy Formulation

MoP/CEA to update the training policy regularly to include the latest developments.

Regulators to monitor the implementation/ complaince by DISCOMS.

Policy Implementation

MoP/CEA to invest in training infrastructure lile innovation centres, state-art-of-the training facilties

Link fund provided by MOP to complaince of the training policy by DISCOMS

Implementation by DISCOM

Follow training policy guidelines by MOP

Focus on 10 pillars.

Figure 5: Role of Central institutes

Another scheme, recently approved by Govt. of India is 'Revamped Distribution Sector Scheme (RDSS)' to help DISCOMs improve their operational efficiencies and financial sustainability by providing result-linked financial assistance to DISCOMs to strengthen supply infrastructure based on meeting pre-qualifying criteria and achieving basic minimum benchmarks. The scheme has an outlay of Rs 3,03,758 Crore over 5 years i.e. FY 2021-22 to FY 2025-26. The outlay includes an estimated Government Budgetary Support (GBS) of Rs 97,631 Crore. REC and PFC have been nominated as nodal agencies for facilitating the implementation of the scheme.

The Scheme has the following components:

- **Part A** – Financial support for Prepaid Smart Metering & System Metering and up-gradation of the Distribution Infrastructure.

- **Part B** – Training & Capacity Building and other Enabling & Supporting Activities.

Part B focuses on the up-gradation of human skills; process improvements; enabling components of MoP (communication plan, publicity, consumer survey, consumer awareness and other associated measures such as third-party evaluation etc), augmentation of Smart Grid Knowledge Centre including AI, training and capacity building for personnel involved in execution of the Scheme at field level, awards and recognitions etc.

Role of Regulator

There is a need for regulatory oversight on DISCOM expenditure on training and capacity building. Currently, SERC review is limited to employee expenses which froms a part of the DISCOM's tariff filing. Training and

capacity building is often subsumed within the employee expenses. The consultants recommend that Training and capacity building should form a separate expense head under the O&M budget during ARR / MYT filing by the DISCOM. This shall ensure systematic review and improvement in the DISCOM's effort towards training and capacity building through regulatory oversight.

Prescriptive Action Plan for DISCOM

DISCOMs are required to grade their training and capacity building activities based on the proposed roadmap in Chapter 5. The focal points of grading are called the 'pillars of training Roadmap'. Based on the self – grading, DISCOMs may be categorized as Grade A, Grade B or Grade C.

A summary of the prescriptive actions for each of the grade is given below:

Grade	Summary of prescriptive action
A	DISCOM should benchmark itself with international distribution utilities.
	Use of LMS /TMS for record maintenance
	Development of a Knowledge management portal to support easy access and retrieval of knowledge sharing sessions
	Establish Co-relation of Safety training with safety related incidents and publish the same on internal circulations /website etc.
	Improve participant feedback form to cover more attributes of training feedback. Implementation of a closed loop system based on the feedback received.
	Yearly need assessment study /report to map the competencies of current manpower against institutional target
B	DISCOM should benchmark itself with Grade A distribution utilities.
	Allocate budget for setting up in-house training facility based on CEA guidelines and over a long-term duration develop an in-house training institute for training needs of DISCOM staff.
	Prioritize and develop plan for spending on new technologies training infrastructure
	Carry out assessment of the Training Programs
	Conduct ToT programs to develop inhouse trainers
	Improve participant feedback form to cover more attributes of training feedback.
	In-house Training Need Assessment to cover all employees of the DISCOM.
	Assign KPI for conducting fortnightly safety training
C	Make optimal use of the national training programs for Class C and D employees
	Conduct ToT programs to develop inhouse trainers
	Enhance the reach and coverage of linemen training institutes to cover all rural sub-divisions / sections
	Assign KPI for conducting monthly safety training
	Use of basic feedback forms for participants
	Implement Training Need Assessment to cover all O&M functions.
	Carry out assessment of the Training Programs

Budgetary Allocation and minimum person days for each employee

Although the structure and demographics of each distribution utility is different, defined by their policy and target, but there is a need for every distribution utility to allocate minimum training days and estimate the training costs and budget at the start of every year. It was observed that one of the comparator utilities carries out a similar study to understand the workforce renewal needed, where the need for assessment of the training workforce is carried out and a similar recruitment / training policy is prepared. A similar approach may be adopted as a target for utilities.