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ISGF
India Smart Grid Forum

Resilient DISCOMs

A conceptual framework for increasing discom resilience

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Context and Objective

Providing 24x7 reliable & good quality power is the key goal of South Asian governments

DISCOMs face risk from array of threats that can cause power interruption & damage

Proactive planning to safeguard, minimize and mitigate the impact of such threats is critical

- What is resilience
- What are the nature and types of threats DISCOMs face
- How do these threat impact the DISCOMs
- What can DISCOMs do to become resilient to such threats

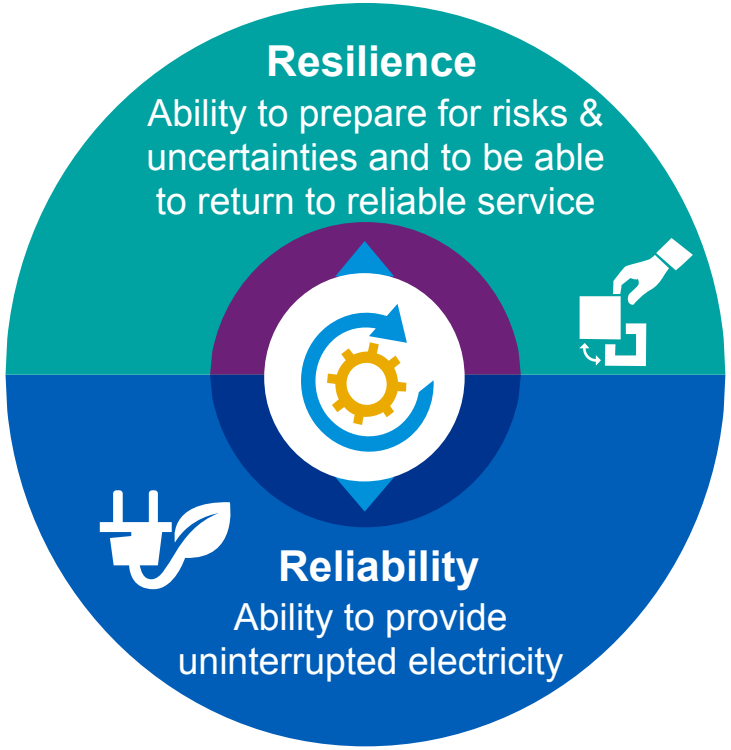
Thought Leadership / White Paper developed under the USAID's SPARC Program was released during the inaugural session of the DUM 2020

Defining Resilience

There is no universally accepted definition of resilience

"Strengthening the ability of a system and its component parts to **anticipate, prepare for, absorb, accommodate, or recover** from the effects of a hazardous event in a **timely and efficient manner**, including through the preservation, restoration, or improvement of its basic structures and functions"

IPCC 2012



"A quality within organizations [that] allows them to **manage crises** and disruption to operations, **resist** sudden shocks and **adapt** to changes"

The Business Continuity Institute

"Ability of an organization to **anticipate**, **prepare** for, and **respond** and **adapt** to incremental change and sudden disruptions in order to survive and prosper."

British Standard

For a DISCOM, resilience measures the ability to quickly anticipate, prepare, and adapt to changing conditions to reduce severity of risks and return to reliable service from events of high impact

Key Threats to DISCOMs

Quality and reliability of electricity services is facing imminent threats from four key spheres

Natural adversities

Cyclones, storms, earthquakes, wildfires, etc.

- No. of annual natural disasters in India ↑ 3 in 1965 to 11 in 2015
- 10 Indian states prone to >3 diff. types of natural adversities (CEA)

Human Induced threats

Cyber attacks, terrorist attacks, riots, etc.

- In 2018, cybercriminals hacked the billing software of a DISCOM in Haryana
- In 2019, a nuclear plant in Tamil Nadu faced a malware attack on one of the plant's computers

Technological threats

Unexpected failure or underperformance of an asset

- In 2012, India suffered 2 severe blackouts lasting ~15 hours - impact on >670 Mn people
- Other countries have also had major blackouts

Health Emergencies

Spread of local/global infectious diseases

- COVID-19 has led to nation-wide lockdown across countries –red. demand from C&I consumers
- Outbreak of Swine Flu in the U.K.(in 2009) led to shortage of staff – Utility O&M impacted

Significant events in recent years

Kerala floods, India

- 22 sub-stations & 1,000 DTs submerged; 30k kms LT line damaged
- Outage affected> **2.6 Mn** customers
- Loss to KSEB > **INR 850 Cr**

Cyber Attack, India discom, India

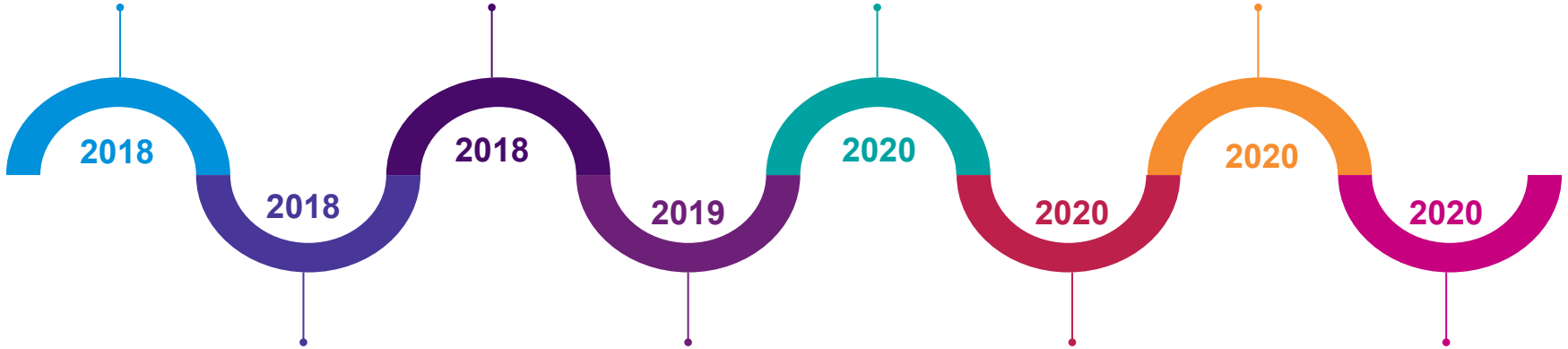
- Commercial billing software hacked & demanded extortion through Bitcoins

Transmission failure, Sri Lanka

- Outage affected > **22 Mn** customers **for 7 hrs**.

COVID-19 Pandemic

- Demand reduction, working capital, lower collection, and ability to pay
- Workforce unavailability impacting business continuity



California Wildfires, U.S.

- 28,000 structures incl. T&D lines and generation equipment destroyed
- Outage affected >**0.4 Mn** customers for **~ 4 weeks**

Cyclone Fani, Odisha, India

- Damaged over 84 k kms LT lines & 11 k DTs
- Outage affected > **0.25 Mn** customers
- Loss to DISCOMs **~INR 250 Cr.**

Cyber Attack Enel, Italy

- Blockage of internal IT network – impacting customer care
- Isolation of ENEL's corporate network

Cyclone Amphan, Odisha & West Bengal, India

- 280+ 33 kV stations and forty 132 kV lines tripped
- Outage affected **15 Mn** customers; 11 deaths due to electrocution

Key Threats to DISCOMs

Cause and Effect

What areas get impacted?

Physical Network and Assets

- Substations, DTs, power lines & poles, meters
- Power plants
- Storage facilities

Business Process

- Planning and O&M activities
- Metering, billing & collection services
- Workforce
- Grid operations and mgt.
- Fuel and power procurement
- Customer services

Information Technology (IT) Infra and systems

- Software & hardware systems
- Control room
- Communication networks
- Supervisory Control and Data Acquisition (SCADA) systems

How do they effect the DISCOM operations?

Business continuity

- Workforce unavailability
- Service disruption

Outages

- Disruption in fuel supply
- Unavailability of workforce
- Asset break-down
- Customer inconvenience

Low Revenue

- Reduction in demand or supply
- Inability to meter readings

Low Collection

- Limited accessibility of collection centers
- Manpower shortage causing delay in bill delivery

Frozen Assets/Tools

- Loss of customer and DISCOM data
- Damaged devices

What can DISCOMs do?

Key attributes of a resilient DISCOM

Organizational	Technological	Financial	Planning	Workforce and customer
Monitor readiness, agility and effectiveness at the corporate and business unit levels	*Deploy digitally enabled systems and focus on upgradation of existing infrastructure*	*Create mechanisms for liquidity management and financial recovery*	*Understand the operational risk at various levels to develop supply chain mitigations*	*Implement crisis management best practices to ensure health and safety of employees and customers*

What can DISCOMs do?

Organization

- **Embedding resilience in key organizational and investment decision** - evaluate investments considering its operational, societal and environmental impacts along with aspects of safety & security
- Prepare **disaster and emergency response plan** to effectively withstand extreme events and update it with new techniques regularly
- Develop **formal governance structures** e.g. reporting lines, titles & role descriptions, decision rights, along with committees specifically charged with implementing resiliency strategies

Leading practices

- ✔ US regulators projected loss avoidance ~ USD 135bn in the gulf coast region (Texas, Louisiana, Florida etc. imp. area for international energy supplies) investments of USD 50 bn over 20 yrs for adaption methods incl catastrophe modelling and climate risk assessment for investment prioritization)
- ✔ Energy department (Odisha) releases disaster mgt. plan since 2015 - areas prone to threats, interventions across the value chain during crisis; CDRI (Coalition of Disaster Resilient Infra) also working
- ✔ During COVID-19, utilities around the global have segregated workforce and established specific sub-teams focused on critical operations & workforce reinstatement

What can DISCOMs do?

Technology

- **Enhance network visibility and remote-control** capabilities – AMI, IT-OT solutions, higher level of digitalization
- **Fast-track adoption of digital infrastructure for organizational working -** approval processes, workforce mgt., electronic document management, digitize workflow systems, etc.
- **Implement digital solutions** incl. drones/UAVs for asset monitoring, DMS/OMS, & prioritize use of sensors & analytics to monitor and optimize network performance; and also customer side interventions

Leading practices

- ✔ U.S. Govt. invested ~**USD 4.5 Bn** to implement **utility & grid modernization projects** post 2008 fin. crisis ~**USD 7 Bn** economic output, **47,000 jobs**, and **> USD 1 Bn** tax rev (under American Recovery and Reinvestment Act 2009)
- ✔ Washington Utilities and Transportation Commission organized **online public meetings, hearings and workshops** during COVID-19
- ✔ ENEL - Stress testing and back-up of operating center – **100% IT applications on cloud – 55% employees** work remotely

What can DISCOMs do?

Financing

- Set up **disaster resilience and response fund** for timely recovery of the power system in an event of a threat, through surcharge, additional levies or grants
- Design **innovative insurance products** in collaboration with govt., MDBs, & FIs to cover risks associated with natural disasters.
- Given the pre-determined trigger point, these instruments can be mobilized faster than many other traditional funding avenues.
- Improve **online payment mechanisms & remote collection efforts** to enhance revenue collection (in absence of collection centers during crisis)

Leading practices

- ✔ The **Crisis & Disaster Management Plan** for power sector released by CEA proposes disaster management fund **eq. 1% of the annual revenue of the utility/power station**
- ✔ Govt. of Uruguay invested in **insurance products (~ USD 450 million)** to protect its hydro plants during drought
- ✔ Several Indian states incl. Rajasthan, Karnataka etc. **exempted processing fees** on digital payment (COVID-19)
- ✔ **BSES and TPDDL** initiated range of online payment options e.g. bills on whatsapp,

What can DISCOMs do?

Planning

- Assess local requirements and technical feasibility **for implementation of system hardening measures** incl. dynamic circuit reconfiguration; increasing **underground cables** in more susceptible areas; PMUs; network islanding; among others.
- **Greater use of DER** incl. Plug-in Electric Vehicle (PEV), Solar Rooftops, Microgrids to ensure continuous supply in the aftermath of an extreme event
- Develop a **vulnerability testing mechanism** incl. simulation-based cyber-attacks and technical failures on critical grid infrastructure.

Leading practices

- ✔ KSEB installed flood prediction system & climate proof DTs post 2018 floods
- ✔ Post 2011 earthquake and tsunami the Japanese Govt. enhanced focus on RE and micro grid –investments ~USD 21 million for microgrid pilots
- ✔ NERC (North American Electric Reliability Corporation) organizes a regular grid security & emergency response exercise -stakeholders to respond to cyber-attack in simulated environment

What can DISCOMs do?

Workforce and customer

- Define **customer and employee safety guidelines** during extreme events incl. directions on de-prioritization of non-essential and risk prone functions, avenues for complaint resolution & staff safety. **Training for employees** on emergency response plan needed to improve preparedness
- Ensure **deep customer engagement** during extreme events - set-up hotline channels, institutionalize presence on social media, and mechanisms to proactively provide updates on vital information
- **Regular Safety audits** through independent bodies to assess vulnerability of existing workforce & customers - options to min. impact of extreme events

Leading practices

- ✔ Ofgem, issued guidelines related to customer convenience and employee safety ensuring business continuity during COVID; set up 24X7 control rooms
- ✔ During cyclone Amphan in 2020, Odisha DISCOMs ensured wide dissemination of trajectory of the cyclone & timing of the landfall amongst customers
- ✔ Regulatory agency in California (CPUC) conducted a safety audit for PG&E , post wildfires in California during 2018

Summary – Ready Reckoner

Nature and types of threats

Natural Adversities
- Weather events such as floods, cyclones, drought, etc.
- Wildfires

Human-induced
- War, Riots
- Terror Attacks
- Cyber Attacks
- Bomb Threats, Strikes

Technology
- System Irregularities
- Design failure
- Structural defects

Health Emergencies
- Epidemic and Pandemic such as Coronavirus disease (COVID-19), Influenza, flu, etc.

Areas of impact

Physical Network and Assets
- Substations, Distribution Transformers (DTs), lines and poles, meters, etc.
- Power plants
- Storage facilities

Business Process
- Planning and O&M activities
- Metering, billing & collection services
- Workforce
- Grid operations and management
- Fuel and power procurement
- Customer services

Information Technology (IT) Infrastructure and systems
- Software & hardware systems
- Control room
- Communication networks

Outcomes on DISCOM operations

Business continuity
- Workforce unavailability
- Service disruption

Outages
- Disruption in fuel supply
- Unavailability of workforce
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- Customer inconvenience

Low Revenue
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Frozen Assets/Tools
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- Damaged devices

Way forward

Organizational
- Resilience as a criterion during investment planning
- Disaster response plan
- Formal governance structures

Technological
- Deployment of AMI infrastructure and advanced IT-OT solutions
- DISCOM e-governance
- Digitization of operations

Financial
- Digital payments
- Disaster resilience funds
- Innovative insurance products

Planning
- System strengthening and hardening measures
- DER solutions
- Vulnerability testing exercises

Workforce and customer
- Customer and employee safety guidelines
- Robust customer engagement plan
- Safety audits

Thank You

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