MINUTES OF SPECIAL MEETING OF THE FORUM OF REGULATORS

DATE : 22nd August 2025

VENUE: Infosys Campus Conference Hall, Benguluru

TIMINGS: 11:00 AM

LIST OF PARTICIPANTS: Appendix I

1. Chairperson, FOR/CERC, welcomed all Members of the Forum and thanked Shri Ravi Kumar, Chairperson of the Karnataka Electricity Regulatory Commission, and Shri Nandan Nilekani, Co-founder & Chairman of the Board, Infosys, for hosting the Special FOR meeting at the Infosys campus in Bangalore. While commending Shri Nilekani on the sprawling state-of-the-art and green campus of Infosys, he informed the Forum that, unlike other FOR meetings wherein several agenda items are discussed, this meeting had only one focus – to understand about the Digital Energy Grid (DEG) and the role of regulators in this regard.

2. He added that the Forum was not new to the concept of the DEG, as the same was also discussed with Dr. R.S. Sharma, Chair of the India Energy Stack, in the previous FOR meeting held in Delhi

3. Thereafter, Shri Nandan Nilekani, Co-founder & Chairman of the Board, Infosys, expressed his gratitude for the opportunity given to host the electricity regulators at the Infosys campus. He apprised the Forum about the India story of Aadhaar and UPI, and acknowledged the collaboration of technology and regulation as key to the success of Aadhaar and UPI. He added that this collaboration ensured that the resultant systems were modern, secure, and compliant with all regulations. He remarked that in countries such as the USA, innovation comes first, followed by regulation; in Europe, regulation precedes innovation. He further added that India has adopted a balanced approach of collaboration between regulation and innovation. He also observed that the electricity industry is quickly evolving. With rooftop solar panels, electric vehicles, and smart appliances, homes are no longer just consumers of power but also producers. This change means that electricity must be traded more frequently , prices will fluctuate according to the time of day, and regulations must

adapt. If India builds strong digital systems for electricity, it could lead the world in this sector.

4. To explain this, Shri Nilekani's team presented the evolution of the energy sector, wherein the 1970s–80s focused on infrastructure and universal access, the 1990s brought liberalisation and unbundling of utilities, the 2000s introduced smart metering and renewables, and the 2010s accelerated digitisation and consumer rights. The 2020s now focus on grid flexibility, resilience to climate change, and equitable access to clean energy.

5. Three major trends were highlighted: decentralisation, digitisation, and decarbonization. The transition from a centralised "big grid" to decentralised systems is clear through rooftop solar, microgrids, demand response, and EV-based storage. It was informed that in California, 40% of capacity is now decentralised, and rooftop solar accounts for up to 25% of peak demand. The UK has legally committed itself to achieving net zero emissions by 2050, with several cities setting earlier goals. Localised strategies are being promoted, as different regions have diverse energy potentials.

6. It was also highlighted that Data management has become a key focus area. The UK Data Act (2025) establishes a framework for secure, consent-based sharing of energy data, inspired by open banking principles. Identifying "data holders", such as aggregators, is essential for accountability. Therefore, proper regulation guarantees privacy, responsibility, and trust in energy markets. Through DEG, electricity services can be integrated into a single platform, making them simple and transparent for both consumers and utilities. The DEG is envisioned as a platform that connects utilities, consumers, regulators, banks, and service providers, much like how UPI has transformed finance. In this matter, Infosys and the Foundation for Interoperability in Digital Economy (FIDE) have collaborated on this idea and co-published a paper with the International Energy Agency (IEA) to showcase its global potential.

7. Thereafter, presentations were made by the Infosys – FIDE team **(Annexure I, II, and III)** wherein several demos were presented. The first focused on demand response, where households can reduce electricity use during peak hours in exchange for payments. The second example demonstrated how rooftop solar adoption can be

simplified by integrating banks, vendors, DISCOMs, and subsidy systems into a unified digital process. The third example discussed EV charging, illustrating how DEG could enable any EV owner to charge at any station using any app, similar to withdrawing cash from any ATM.

8. Examples from other countries were also shared, where utilities and regulators are working on digital systems for energy. The main conclusion was that DEG must be developed in collaboration with regulators. In response to a query from the Forum Members, Shri Nilekani clarified that DEG is not the end product but a process that requires input from both technology experts and policymakers. It was further emphasised that DEG does not dictate how systems need to work, but connects the existing systems. While technology will be the base layer, the governance and policy layer will decide the success of the same. Hence, over the ensuing years, collaboration between policyholders and technical experts will be crucial to ensure that the system is fair, efficient, and beneficial for everyone.

9. Shri Nilekani further emphasised that DEG is purely voluntary, and it does not envisage the replacement of infrastructure but will, in fact, digitise infrastructure. It was unanimously agreed that digital public infrastructure has the potential to transform India's electricity sector. With the right strategy, it can lower costs, boost efficiency, increase transparency, and position India as a global leader in digital energy systems, just as Aadhaar and UPI did in their respective fields. Therefore, regulatory-based innovation (as per international best practices), including enabling rapid decentralisation, decarbonisation, increasing private investment, grid modernisation, and a regulatory sandbox, could be explored

10. In the course of stakeholder consultation conducted by Infosys and FIDE, it was brought to notice that Distribution companies (DISCOMs) had concerns about energy losses caused by static line ratings and requested dynamic, real-time solutions. Further, financial institutions offering ESG-linked loans and green mortgages highlighted the challenge of accessing reliable data to verify energy performance and sustainability claims.

11. A common issue among stakeholders is the lack of a unified, trusted data platform. In this matter, regulatory support, innovation, and collaboration are essential to realise

the full potential of digital energy systems, as strong governance frameworks will help build resilience, flexibility, and security in the evolving grid.

12. The discussion also underlined the increasing importance of demand-side flexibility in tackling India's electricity issues. Examples include electric vehicles, battery storage, and building management systems, which can be grouped and bid into wholesale markets. Unlike older demand response models that required complicated one-to-one connections, the new open network approach enables multiple participants, such as bus depots or appliance suppliers, to connect through a shared interface, making participation simpler and scalable. Since India has limited and costly natural gas supplies, utilising demand-side resources is far more cost-effective for managing peak loads than building new base load power plants. Regulators are already focusing on this matter, with States such as Maharashtra implementing demand flexibility regulations and others considering similar measures. Utilities such as Tata Power, Reliance, and Adani are testing such initiatives, and collaboration with regulators and tech providers is in progress to develop supportive frameworks for digital grids and virtual power plants.

13. The discussion also emphasised the importance of integrating technology, regulation, and local efforts to reach sustainable energy goals. Data continues to be the key driver for decentralisation, decarbonization, and digitisation; hence, cooperation among governments, utilities, businesses, and citizens will shape the success of future energy transitions. Therefore, there is a need for a regulatory sandbox to examine regulatory innovations, which can be initiated by testing new rules in smaller, virtual geographies with interoperability between jurisdictions. Therefore, new regulations could focus on flexible and scheduled RE generation, dynamic interconnection, capacity markets, modified Open access market, and energy asset tenacity.

14. At the conclusion of the meeting, it was agreed that to take the innovative idea of DEG forward, facilitative policy and regulatory interventions would be required. This also requires an appreciation of the DEG vision by the regulators and an understanding of the regulatory framework by the proponents of DEG. Accordingly, it was decided to constitute a Working Group consisting of the following members to examine the contours of DEG, assess the potential of its implementation, and suggest regulatory measures for its roll-out:

a) Chairperson, Uttar Pradesh – Chair of the WG

b) Chairperson, Karnataka ERC- Member

c) Chairperson, Maharashtra ERC – Member

d) Chairperson, Kerala ERC – Member

e) Chairperson, West Bengal ERC – Member

f) Chairperson, Odisha – Member

g) Chairperson, Arunachal Pradesh ERC – Member

h) Chairperson, Tripura ERC – Member

i) Chairperson, Rajasthan ERC – Member

h) Representative(s) of Shri Nandan Nilekani / India Energy Stack Task Force – Special Invitee

15. On conclusion of the meeting, Joint Chief (RA), CERC thanked the Chairperson, FOR/CERC for his continued guidance to the Forum, Chairperson, Karnataka ERC and his team for hosting the FOR in Bangalore, Shri Nandan Nilekani and his team for hosting the Forum on the Infosys campus and for sharing his valuable guidance to make the DEG a reality and to all the Forum members for their active participation in the special FOR meeting as also the FOR Secretariat for their tireless efforts in organising the meeting.

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Appendix – I

LIST OF PARTICIPANTS OF "SPECIAL MEETING OF FORUM OF REGULATORS (FOR)"
HELD ON 22ND AUGUST, 2025
AT BENGALURU (KARNATAKA)

S. No.	NAME	ERC
01.	Shri Jishnu Barua Chairperson	CERC/FOR – in Chair.
02.	Shri R.K. Joshi Chairperson	APSERC
03.	Shri Kumar Sanjay Krishna Chairperson	AERC
04.	Shri Amir Subhani Chairperson	BERC
05.	Shri Hemant Verma Chairperson	CSERC
07.	Shri Alok Tandon Chairperson	JERC for State of Goa & UTs
08.	Shri P. Ravi Kumar Chairperson	KERC
09.	Shri T.K. Jose Chairperson	KSERC
10.	Shri Sanjay Kumar Chairperson	MERC
11.	Shri Chandan Kumar Mondal Chairperson	MSERC
12.	Shri Benjamin L. Tlumtea Chairperson	MzERC
13.	Shri Pradeep Kumar Jena Chairperson	OERC
14.	Shri Viswajeet Khanna Chairperson	PSERC
15.	Dr. Rajesh Sharma Chairperson	RERC
16.	Shri K.B. Kunwar Chairperson	SSERC
17.	Shri R. Manivannan Chairperson	TNERC
18	Justice Devaraju Nagarjun, Chairperson	TSERC-online

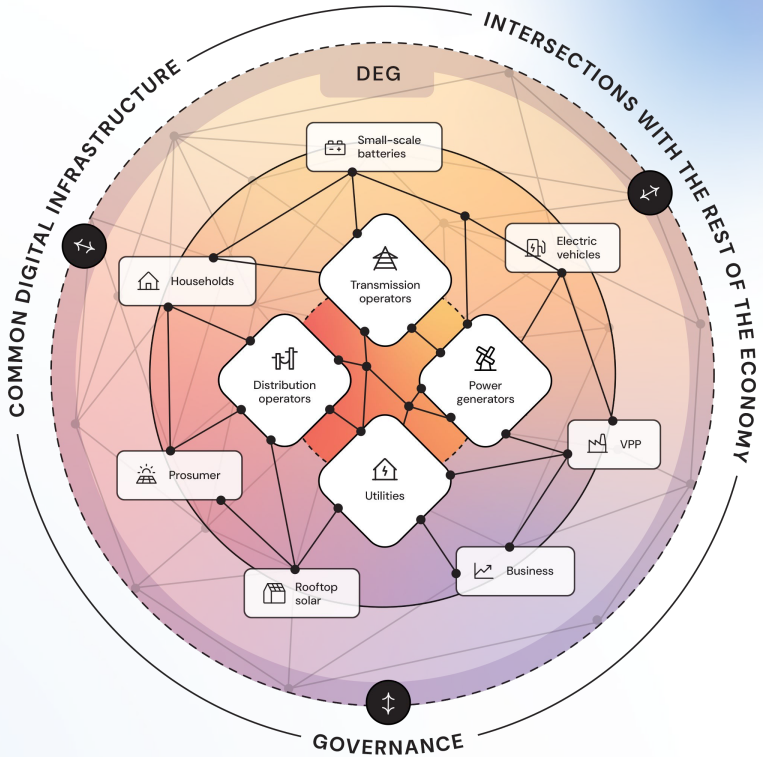
18.	Shri Arvind Kumar Chairperson	UPERC
19.	Shri Madan Lal Prasad Chairperson	UERC
20.	Dr. M.V. Rao Chairperson	WBERC
21.	Shri Mehul M. Gandhi Member (L) & Chairperson I/c.	GERC
22.	Shri Yashwant Singh Chogal Member (Law)-cum-Chairperson	HPERC
23.	Shri Gopal Srivastava Member (L) Acting Chairperson	MPERC
24.	Shri Ram Naresh Singh Member	DERC
25.	Shri Mahendra Prasad Member (L)	JSERC
26.	Shri Harpreet Singh Pruthi Secretary	FOR/CERC
27.	Dr. Sushanta Kumar Chatterjee Chief (Regulatory Affairs)	CERC
SPECIAL INVITEES		
28.	Shri Nandan Nilekani, Co founder & Chairman of Board	Infosys
	Shri Ramesh Babu V Member (T)	CERC
29.	Shri Harish Dudani Member (L)	CERC
30.	Shri Ravinder Singh Dhillon Member (F)	CERC
31.	Shri H.K. Jagadeesh Member (L)	KERC
32.	Shri Jawaid Akhtar Member (F)	KERC
FOR SECRETARIAT		
33.	Ms. Rashmi Somasekharan Nair Joint Chief (RA)	CERC

OTHERS [SPECIAL INVITEES / OBSERVER / GUESTS]		
34.	Shri Siddeshwar N. Secretary	KERC
35.	Dr. Umakanta Panda Secretary	MPERC
36.	Shri Karthik Neelakandan VP & Business Head	Infosys India
37.	Shri Deepak Malhotra Partner	Infosys India
38.	Shri Ashiss Kumar Dash EVP & Global Head Energy, Utilities	Infosys India
39.	Shri Mahesh Patankar Adviser	FIDE (MP EN System)
40.	Shri Sumit Choudhury Global Principal	FIDE
41.	Shri Anirban Sinha Principal, DEG	FIDE
42.	Shri Siddharth Singh Senior Associate	FIDE

FIDE
Foundation for Interoperability in Digital Economy

Digital Energy Grid

FoR x FIDE x Infosys | 22nd August



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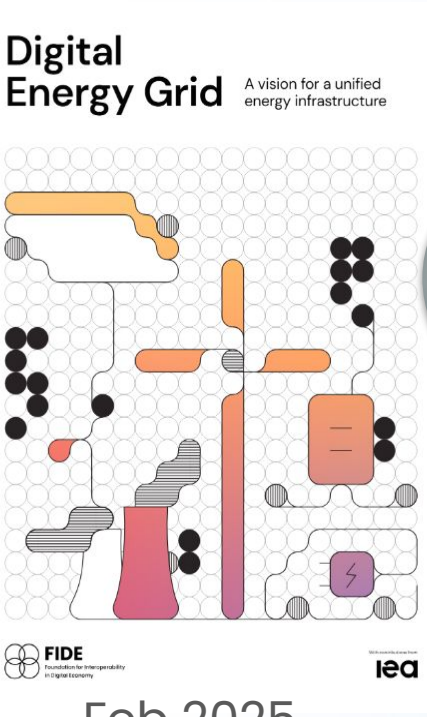
Digital Energy Grid

FIDE's joint vision with IEA
https://energy.becknprotocol.io



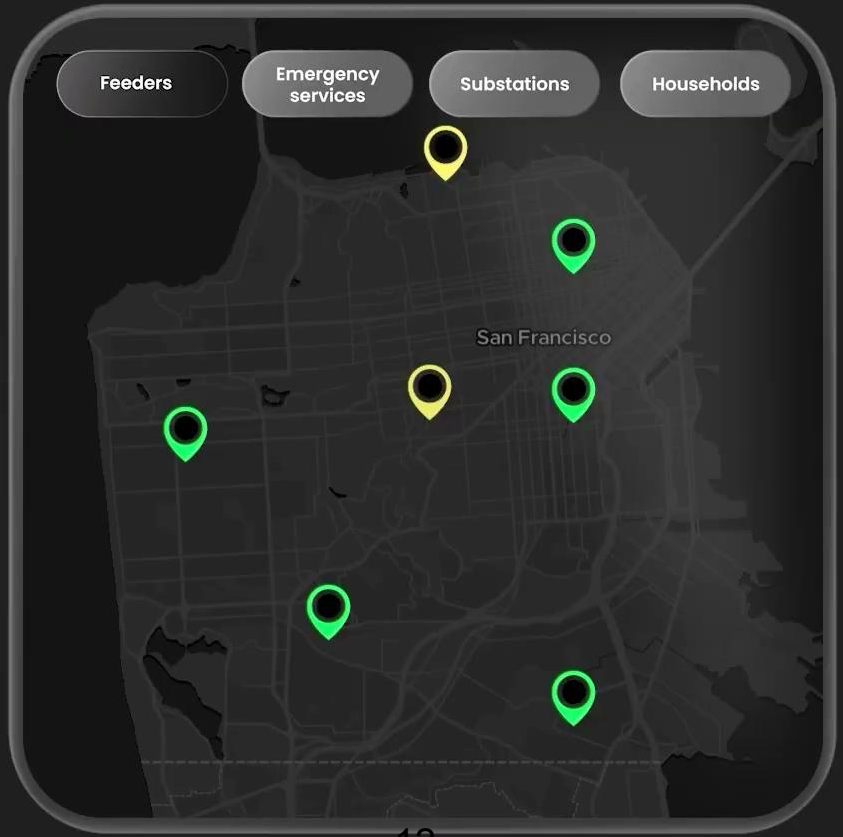
Feb 2025

DEG in action

Utility Administration Portal

Agent Gridly ● Online

Type a Message



Feeder Summary | Audit Trail

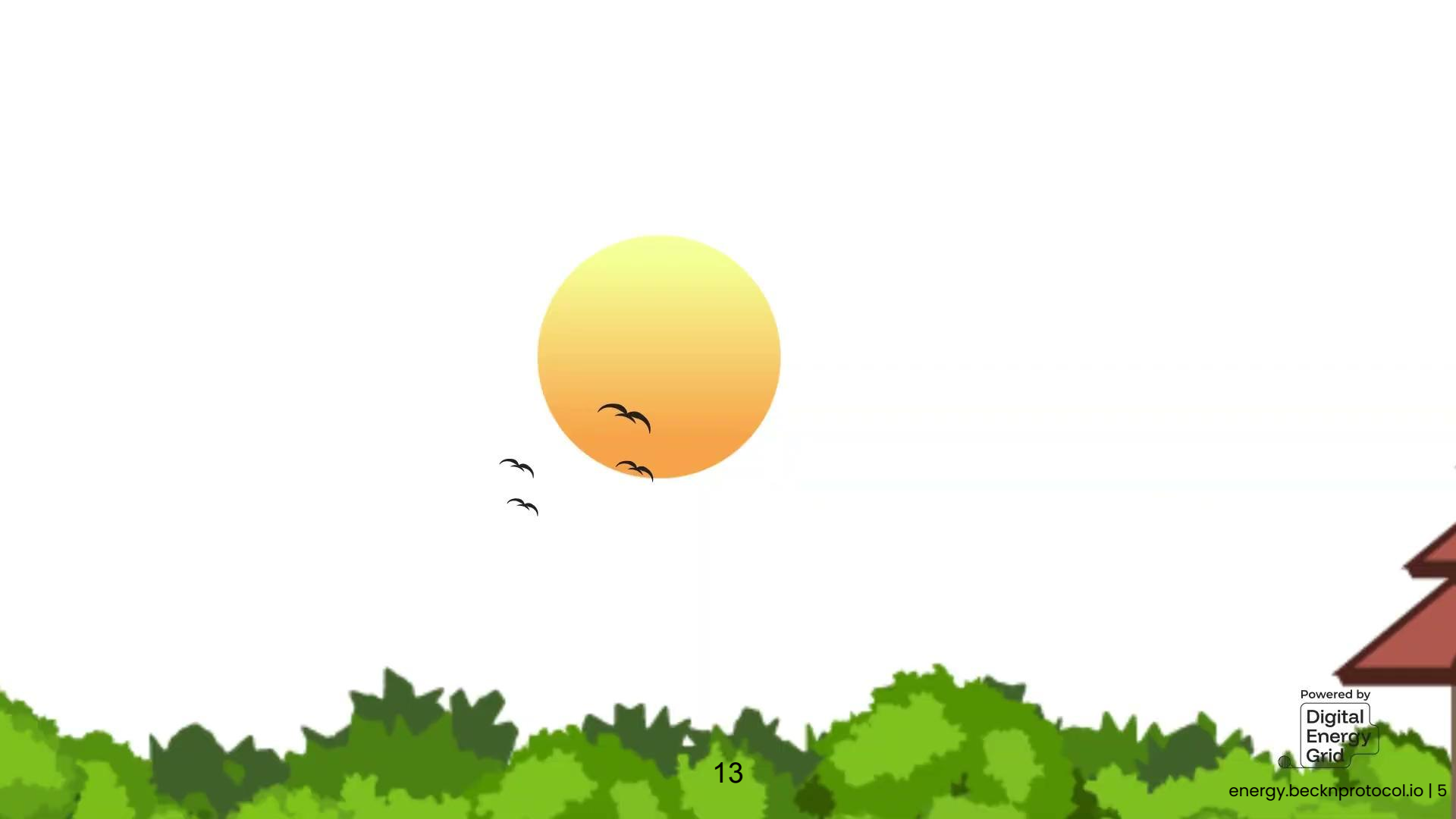
Central Feeder Hub — Normal
Region : NORTH 17%
Margin : 49% 860 kW

SoMa District Feeder — Normal
Region : NORTH 17%
Margin : 49% 860 kW

Mission District Feeder — Normal
Region : NORTH 17%
Margin : 49% 860 kW

Marina District Feeder — Normal
Region : NORTH 17%
Margin : 49% 860 kW

Sunset District Feeder — Normal
Region : NORTH 17%
Margin : 49% 860 kW



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Digital Energy Grid
Demonstrations

Participating Startups

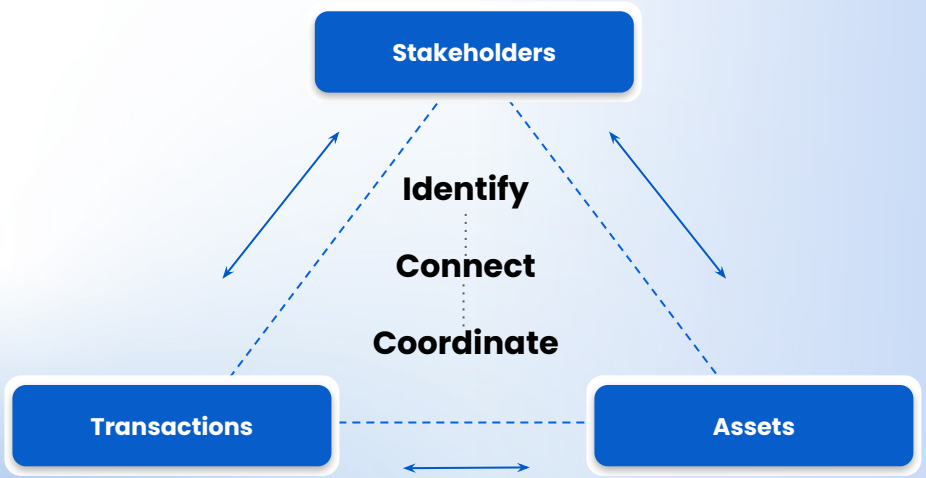
Pulse Energy

trillectric

TruePower by JioThings

vikramsolar

DEG → IES: Translating Vision into India's Energy future



Reliable

Inclusive

Efficient

Transparent

Affordable

Energy System

Challenges of the new grid's regulators

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- Rising edge renewable assets create entropy for planning mechanisms
- Harder diurnal demand prediction causing resource adequacy issues
- Frequent reinvention of the solution stack driving higher capex burden
- Distributed demand-side assets (EVs, BESS) idle; untapped for grid support
- Newer actors, markets and evolving roles add competition and new rules

Regulation in the world of new grid

Fixed parameters, periodic reporting, and rigid rulebooks	→	**Dynamic conditions, continuous monitoring, adaptive frameworks**
Planned capex, aggregated data, latency, missing pipelines	→	**Real-time capex signals, granular data, high-frequency streams, connected pipelines**
Annual/quarterly reports, lagging indicators	→	**Live dashboards, IoT sensors, transaction-level visibility requirements**
Opaque billing, contract disputes, undetected theft	→	**Traceable billing, smart contracts, fraud analytics, consumer trust**

What gaps are these shifts leading to?

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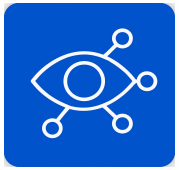

Visibility and addressability of assets

Universal discovery and contracting mechanisms

Controlled and consented sharing of data

Better policy enforcement and monitoring

Seamless information flow

Real time analytics and decision making

What capabilities can bridge these glaring gaps?

- Lack of asset visibility, addressability
- Absence of universal discovery and transactions
- No common data pipeline
- Lack of real time analytics and decision making from seamless information flow
- Effective regulatory impact

What capabilities can bridge these glaring gaps?

Lack of asset visibility, addressability

Absence of universal discovery and transactions

No common data pipeline

Lack of real time analytics and decision making from seamless information flow

Effective regulatory impact

Can be solved through

A universal digital representation of energy

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Energy Resources

Information Flows

Transactions

Contracts

Policies

Credentials

Universal Identity

Machine Readable Data

Verifiability and Portability

The three foundational building blocks of solution

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Universal Identity

- Zip Codes
- Country Codes
- IP Addresses

Machine Readable Data

- Electronic Health Record
- Tax Invoices
- Billing Databases
- Electronic Passport

Verifiability and Portability

- UPI
- QR code
- API token

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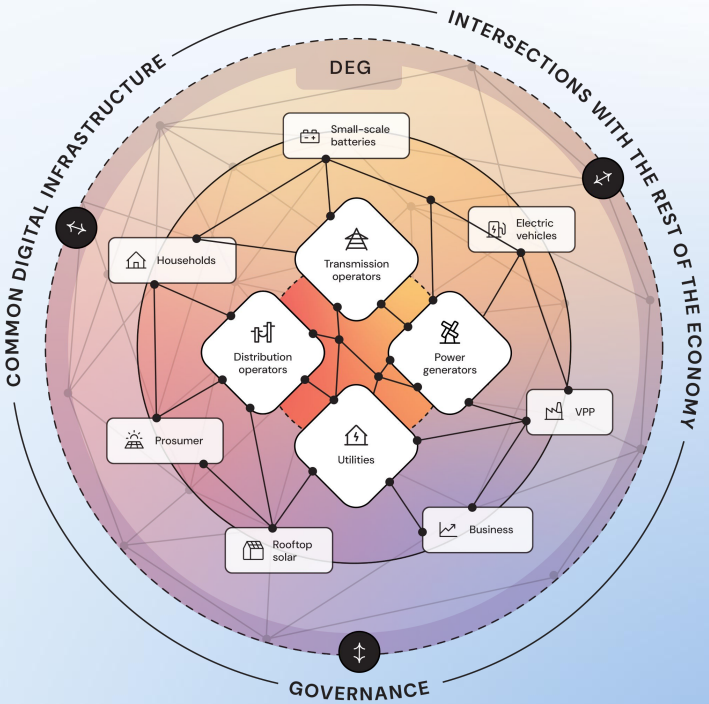
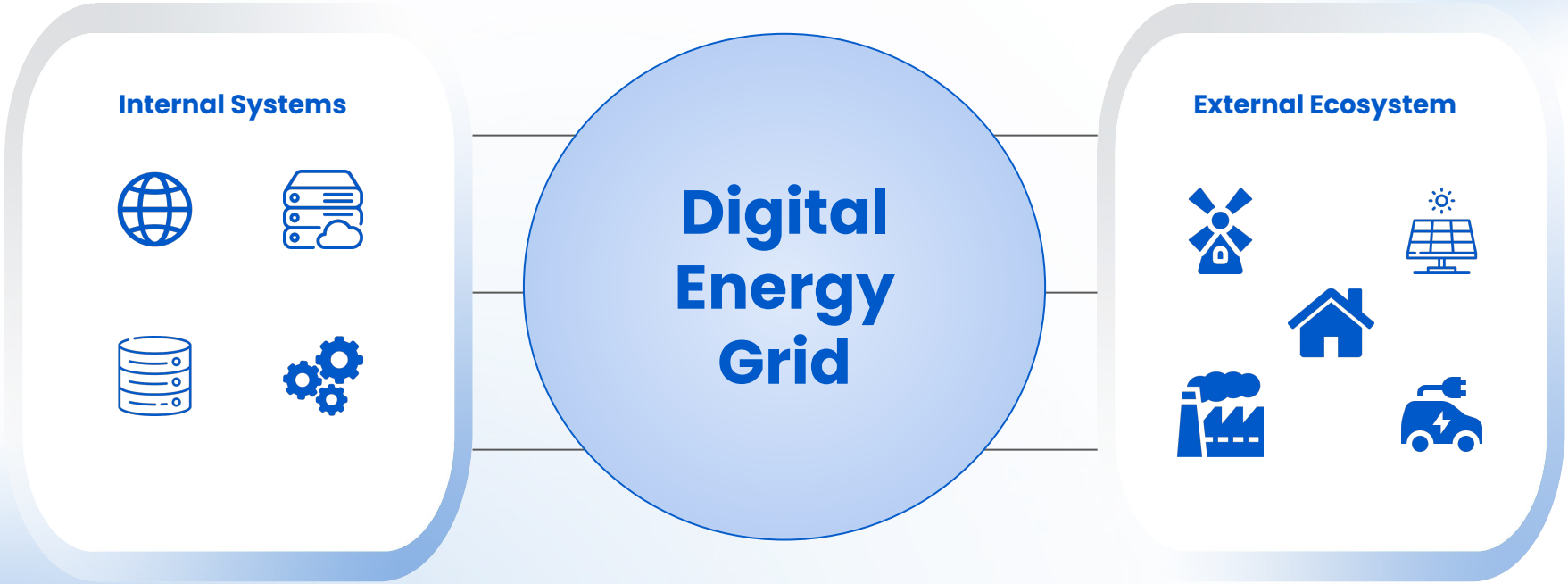
Like roads, or like the internet **Digital Energy Grid (DEG)** proposes a common infrastructure that enables the aforementioned digital needs



DEG is not an internal IT system (nor APDRP +)

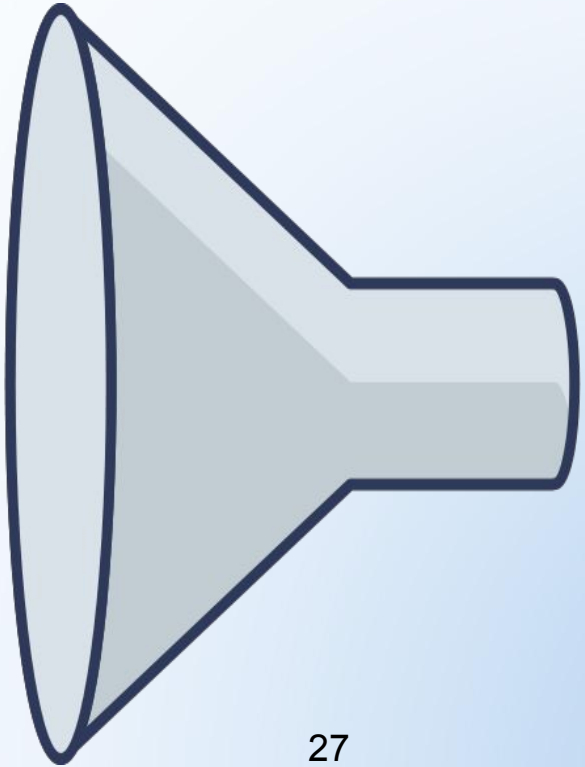


DEG is not an internal IT system, it is an **infrastructure** of interacting with the ecosystem

DEG is not a software platform or ERP system but it builds on your ERP Investments

DEG is not:

- A point-solution
- A software platform
- An ERP system
- A visibility tool
- A dashboard
- A collection of ideas
- A vision just on paper



DEG is:

- An enabler to solve problems at scale and efficiency
- A provider of a backbone to create a visibility tool

DEG is not only about tech or open architecture, it lies at the trinity of

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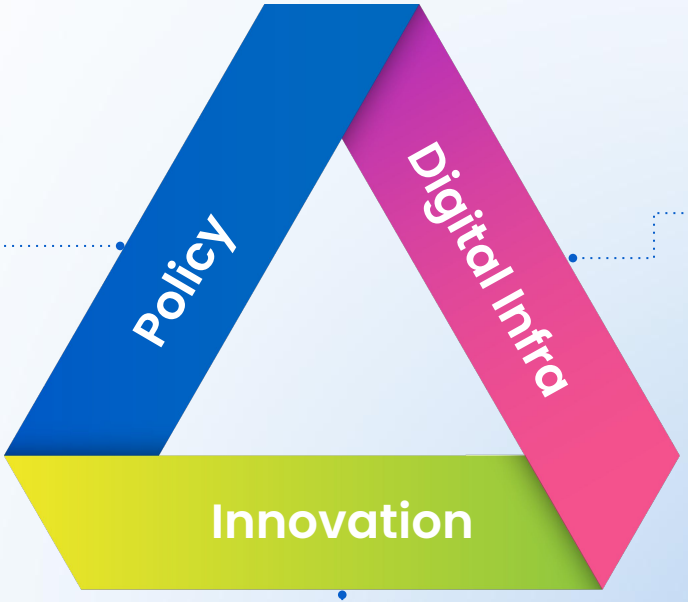
Align policy with DEG & DEG enables policy for future of the grid



DEG that amplifies the physical and the economic grid

Ecosystem of public and private innovation

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Current regulations, prospects to intervene

Digital Energy Grid

Digital energy grid meets regulatory action

Accelerate enforcement of the existing rules

Speed up compliance and monitoring by embedding rules into the digital layer

Regulatory innovations

Layer new regulatory tools on existing frameworks to improve efficiency

Create new regulations for digital grid era

Interoperable, data-rich, decentralized energy ecosystem integration

Structural interventions across the energy value chain

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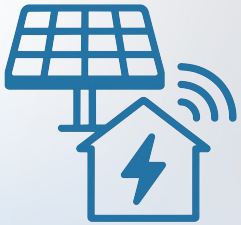
	Generation	Transmission	Distribution	Power Markets
Accelerate existing Regulations	Decentralised and distributed oversight	Real time congestion monitoring and ancillary service pricing	Service level compliance (quality metrics)	Evidence-based policy making
Regulatory Innovations	Fast tracking RE capacity	Green Certificate Issuance and Verifiability	Demand Flexibility	P2P Trading and OTC markets
New Regulations for Digital Era	Flexible and scheduled RE generation	Dynamic Interconnection Management	Energy asset leasing and capacity market creation	Modified Open Access Markets

Visibility of grid connected generation assets

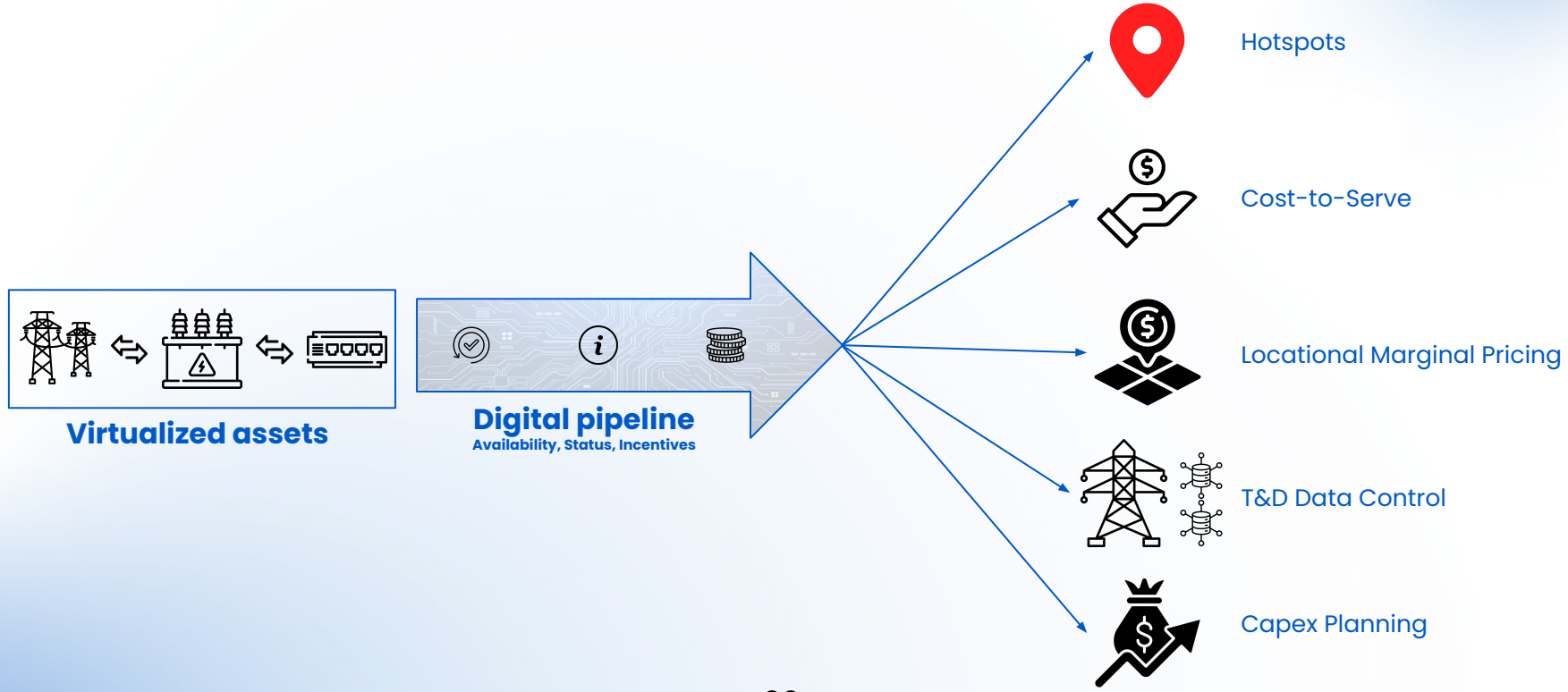


Utility / grid-connected generators visibility

Demand forecasting, scheduling and grid management

Virtualisation of generation assets

Distribution and sub-distribution assets visibility



Solar assets buying made easy and network-wide visibility

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Ecosystem Unlock

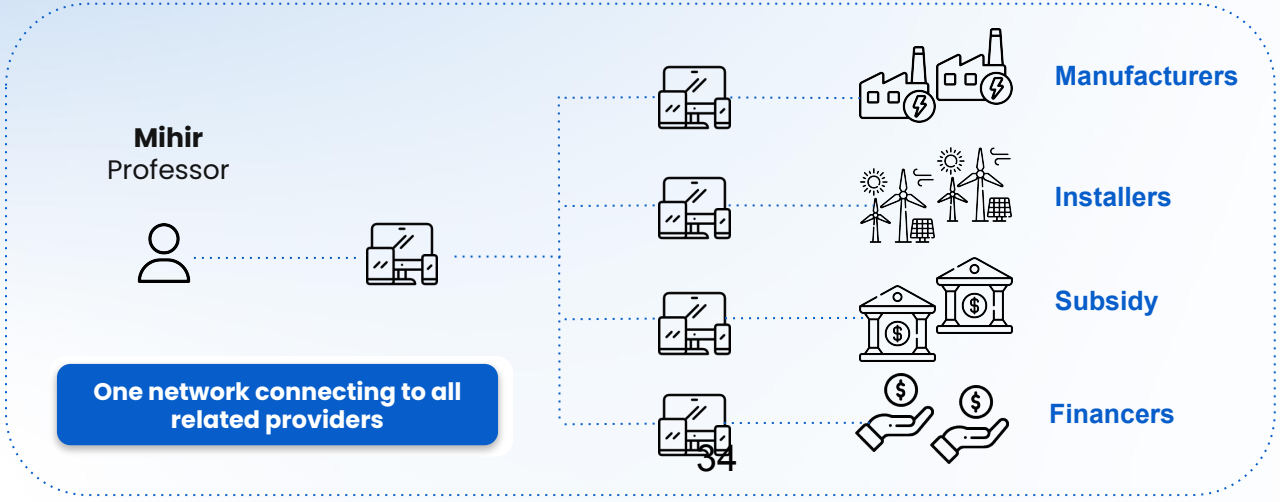
Simplifies the entire solar adoption journey.
One stop shop for **:**

- Panel discovery
- Certified installer booking
- Financing options & subsidies
- DISCOM approvals
- Certified installer booking

Market unlock for Businesses

Starting with solar installation, a **lifelong engagement opportunity** with the customer

Extend value added services: Smart inverter, trading agent, RTC green power, VPP membership



Flexible demand unlocking unprecedented relief for the grid

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Opportunity

~25% of building and passenger EV &
~40% of industry and green hydrogen
electricity demand in 2050 could be flexible

Beyond the obvious

Innovation lever:
New aggregator layer on top of the regulatory & economic grid

Market lever:
Like open banking created fintech innovations, new market-structures will be created at the edges

Social lever:
Effortless yet effective transition for consumers to be active participants

Bulk commercial load

Data Centres

Cold storage

Water Pumping Stations

Distributed and individual loads

EV Charging Station

Refrigerators

HVACs

New type: **District Cooling**

District Cooling

Thermal Batteries

Smart Meters powering smarter energy use with DEG

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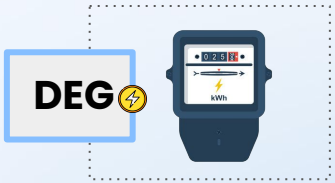
What it is today

Monitor consumption & Support dynamic billing

What can DEG Unlock



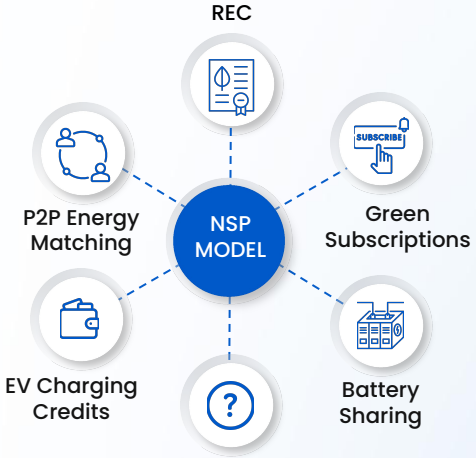
- PDP Compliant
- Multi-layer Security
- Privacy-Preserving

- Lower trust costs by providing signed, trusted messages
- Enhance grid planning and flexibility through observability
- Participate in flexibility markets through connected-DER control

- Facilitate trust govt subsidy & regulatory compliance
- Monitor consumption & support dynamic billing

From a billing tool to an energy intelligence layer enabled by DEG

Utilities evolving beyond traditional roles : Network Service Provider model with DEG

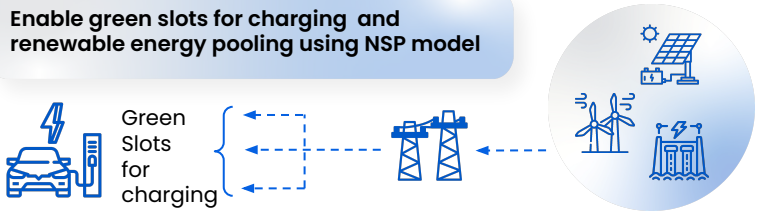


A Network Service Provider *Like*

VISA & stripe

Example Use Case:

Enable green slots for charging and renewable energy pooling using NSP model



Intervention need for advocacy on recognition of digital energy exchanges

Allow 2-3 more parties

This is India’s opportunity to pioneer the global landscape of the future of grid management

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Thank you
Q&A

Collaboration opportunities

Challenges of the new grid's regulators

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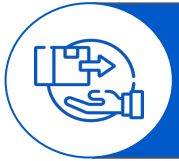
Higher number of renewable assets around the edges creating entropy for the planning mechanisms



More difficult prediction of future diurnal demand leading to resource adequacy problems

The solution stack is getting reinvented multiple times increasing capex burden on the system

Distributed demand-side assets (EVs, BESS) available as potential grid support systems is lying idle and underutilized

Newer actors, markets and evolution of traditional roles creating new competition and therefore new rules

Higher number of renewable assets around the edges creating entropy for the planning mechanisms

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Causes

Low visibility of utility-scale assets connected centrally and at the state-level

Low visibility of decentralised renewable assets (granularity of data capture low - needs to get to 5 minutes interval

Co-created Solutioning

Interoperable and standardized way of communicating generation to Central and State-level grid operator (input to the IES ~ manifestation of DEG in India)

Transactions supported (including P2P) at central and state grid operators with better informed decisions in scheduling (includes ancillary services called as grid stabilization strategies)

Collaborations

Create safe place to create thousands of transactions ~ digital twin within RE-rich and low-RE states to ascertain system benefits

Develop contours of new MOP Rules or FOR Model Regulations supporting market deepening

The solution stack (investments in the distribution and transmission assets) are getting reinvented multiple times increasing capex burden on the system

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Causes

Lack of distribution infrastructure mapping

Inadequate assessments of projected CAPEX requirements

Co-created Solutioning

Leveraging existing and prospective investments in the sub-distribution grids, create dynamic and digitized tool to better predict the CAPEX needs

Multiple transactions and approval processes at SERCs supported through a well-informed distribution sector assessments

Collaborations

Create digital twin of transmission and distribution networks mandated through a regulatory process

Inform new MOP guidelines or CAPEX related regulations for investments in transmission and distribution infrastructure

Distributed demand-side assets (EVs, BESS) available as potential grid support systems is lying idle and underutilized

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Causes

New EVs, BESS and demand-side (buildings, industrial processes) coming-up on the network

Demand-side assets remain outside of balancing needs of the grid

Co-created Solutioning

Facilitate millions of transactions to ramp-up or ramp-down end-use consumption to meet load shape objectives

Leverage existing Resource Adequacy and emerging Demand Flexibility regulations

Collaborations

Create digital twin of end-use level infrastructure as available assets in the system

Facilitate demand flexibility implementation in chosen networks and create millions of transactions including those in the tertiary ancillary services

FORUM OF REGULATORS ROUND-TABLE

GLOBAL REGULATORY TRENDS

Ashiss Kumar Dash
Deepak Malhotra

August 22, 2025

Infosys®
Navigate your next

TODAY'S TOPICS

1. Introductions
2. The Emerging Landscape for Electricity
3. Regulatory Enablers for Decarbonization: Leading International Practices
4. What's Next for India

THE EMERGING LANDSCAPE FOR ELECTRICITY

INFOSYS IS A RECOGNIZED LEADER WITH 3 DECADES OF EXPERIENCE WORKING WITH UTILITIES AROUND THE WORLD

We are a global leader with an impeccable track record of empowering clients to navigate technology and drive business transformation

14,000+ Utilities Practice

145+ Clients

6 of Top 10 Utilities globally

30 Years of experience

14 of Top **20** NA Utilities

20 + Development centers

Electric | Water | Gas

ACADEMIA COLLABORATION

Stanford ENERGY
Bits & Watts Initiative

Stanford Bits & Watts, CA, USA, Advisory Member for Energy Transition

THE ENERGY CONSORTIUM
IIT MADRAS

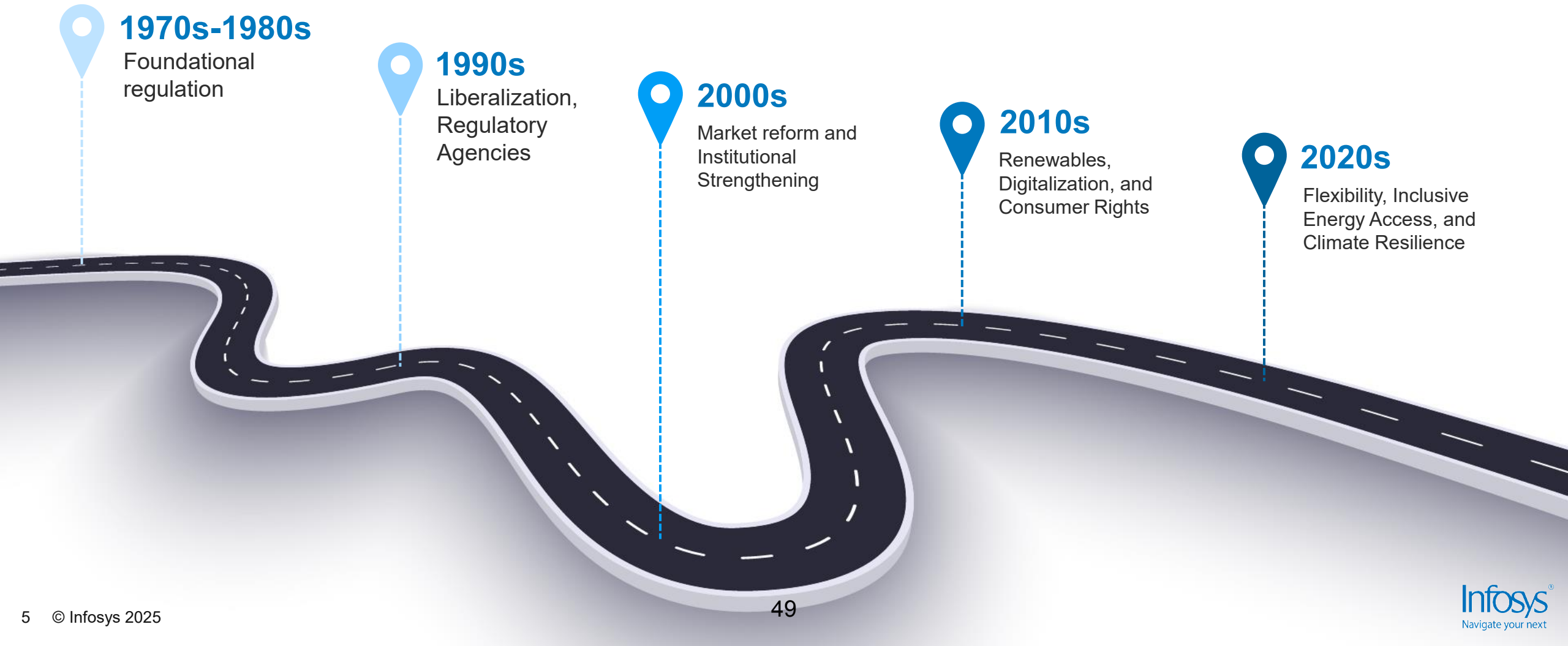
IIT Madras, Chennai, India, Energy Consortium

Massachusetts Institute of Technology

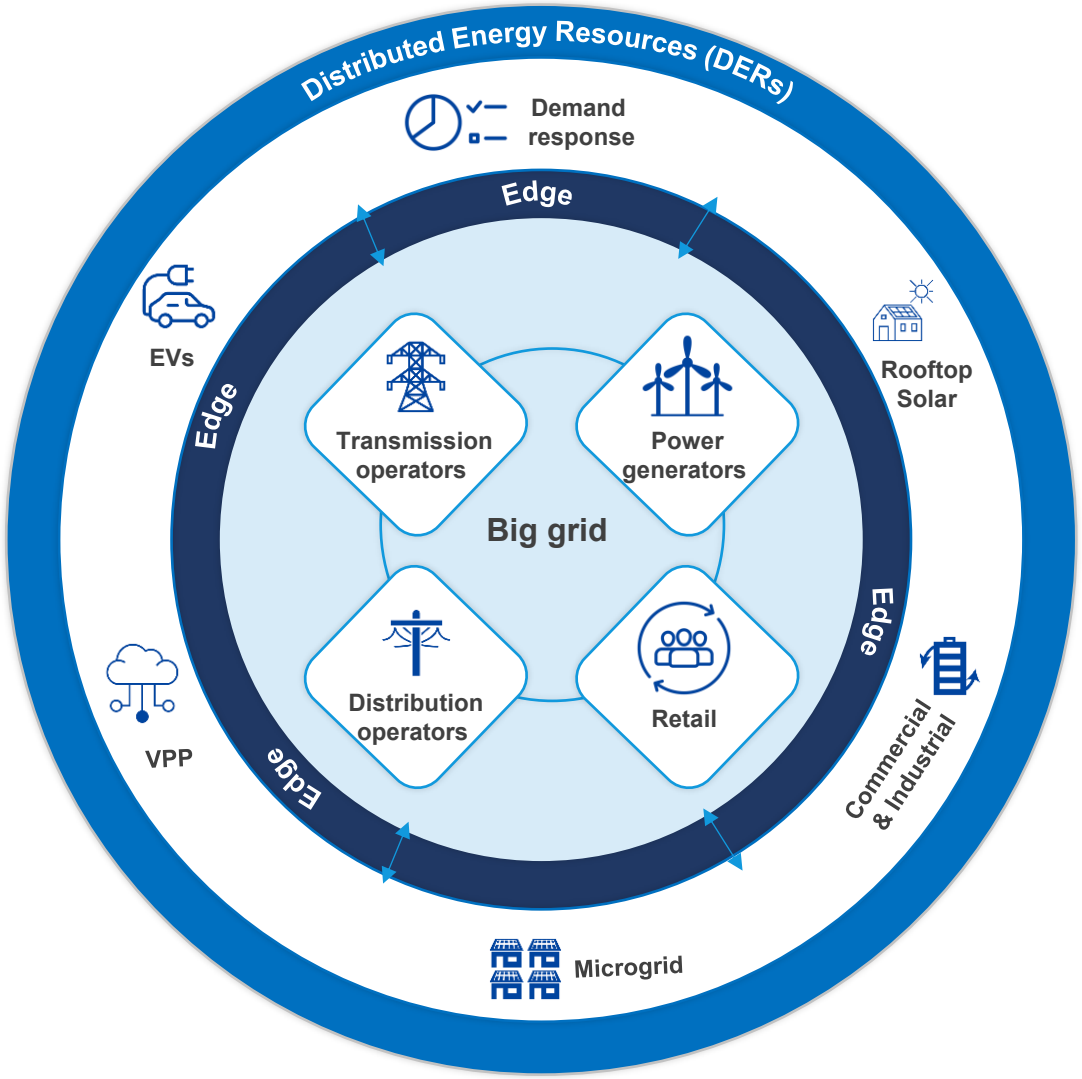
PURDUE UNIVERSITY

Infosys
Navigate your next

FROM ELECTRICITY ACCESS TO EMPOWERMENT: THE REGULATION JOURNEY



DECENTRALIZATION IS SHIFTING CRITICAL MASS TO THE EDGE OF ENERGY SYSTEMS



40% Global Power capacity represented by **decentralized energy systems** by 2030

6x Energy capacity of EVs as compared to Grid batteries

51 days Clean energy exceeded electricity demand in CAISO grid in California in 2024

13GW Solar ≈ 25% Peak Demand of CAISO Grid Rooftop solar in California contributes ~13 GW of capacity, meeting ~25% of peak electricity demand on the CAISO grid

UK - INTEGRATED ENERGY SYSTEMS AT CITY / REGIONAL LEVEL ESSENTIAL FOR ENERGY TRANSITION

Energy integration links data and control systems across electricity, heat, buildings, and electric vehicles, transforming millions of signals from meters and sensors into **coordinated, real-time operational decisions**.

Optimising supply and demand across the regions and country builds **resilience, supports participation in energy flexibility markets, and accelerates progress towards Net Zero.**

UK's legally binding **Net Zero by 2050** target, with many cities aiming for 2030–2040

Rapid increase in AI and Data Centers will result in **localised spikes in energy demand growth**

VPPs coordinating EVs/appliances to balance grid are expanding in the UK market

The **UK Data Act** is setting a framework for **data sharing, interoperability, and governance**

Up to £16.7 billion per year could be saved by 2050 in the UK through integrated, flexible energy systems[1]

[1] **Carbon Trust.** (2021). *Flexibility in Great Britain: The value of flexibility in a decarbonised grid and system* (Final report)

MAIN PARTICIPANTS IN THE ENERGY TRANSITION

LARGE ENERGY USERS	SERVICE PROVIDERS	REGIONAL AUTHORITIES	ENERGY CORE SECTOR	FINANCIAL SERVICES
Industrial, commercial, data centres, public buildings, agriculture	Urban and regional transport authorities, electric mobility providers, waste, water and sanitation services, district heat/cooling networks	Regional planning and development authorities, State Electricity Regulatory Commissions, State Nodal Agencies, State Pollution Control Boards, Municipalities	Distribution Companies, renewable energy developers, transmission and distribution infrastructure providers, grid operators and system integrators	Commercial banks, mortgage lenders, asset managers, insurers, development banks, green finance institutions and ESG investors
"Return on investment is always a tricky one... How am I saving on my energy? When you scrape data from all different places, there are so many caveats, it's so difficult."	***"We don't have access to granular energy and emissions data, but given our sustainability targets, it would be interesting to apply that to our route planning algorithm."***	***"At the moment there's no data platform where you've got everything you need. Energy usage and fuel usage come from totally different systems"***	***"Cable ratings are excessive; most things are over engineered. You can't challenge engineering specifications without granular performance data."***	***"Real estate portfolio energy data is extremely difficult to get hold of - we're always having to come up with proxies and estimates."***
Need for **trusted, granular, real-time energy data** to make WHAT operational and investment decisions.	Frustration with **data silos, slow access, and inconsistent quality** blocking efficiency and ESG reporting.	Appetite for **actionable insights**, not just raw data, to unlock cost savings, revenue (e.g. flexibility markets), and compliance ease.	Willingness to explore **standardised, city-level data access layers** to reduce integration burden.	

TECHNOLOGIES MAKING A DIFFERENCE

The technologies, tools, and datasets driving the energy transition today span several layers, from physical infrastructure and IoT sensors to advanced analytics, AI, and shared open data platforms

The physical assets and devices…

- Wind
- Solar
- EVs
- EV charge points
- Batteries
- Smart meters and sub-meter
- HVAC sensors
- Grid transformers
- Building Energy Management Systems (BEMS)
- BEMS
- Home Energy Management Systems (HEMS

…supported by platforms and tools…

Energy optimisation platforms
e.g., *AutoGrid, GridX, Kaluza*

Digital twin environments
e.g., *Bentley iTwin, Siemens Twin*

Carbon accounting tools
e.g., *Persefoni, Normative*

Scenario modelling tools
e.g., *PLEXOS, HOMER, EnergyPLAN*

Flexibility platforms
e.g., *KrakenFlex, EcoStruxure, GE DERMs*

…with the relevant datasets...

- Asset operational data
- Telemetry streams fom sensors
- Network performance data
- Carbon footprint reports
- Consumption data
- Event logs from devices
- Simulation datasets
- Socio-economic & denographic overlays
- Environmental data
- Edge-processed summeries
- Investment case data
- Market price & flexibility signals
- Retrofit opportunuity mapping
- Investment case data
- Harmonised assetregistry
- Carbon emissions invetories

…and the latest innovation

AI/ML for predictive maintenance and demand forecasting

Blockchain for energy transactions and traceability

Cybersecurity for grid and device protection

Edge computing for real-time analytics and control

BARRIERS TO ENERGY TRANSITION GLOBALLY

DIGITAL LAGGARDS

Only **20%** of utility companies have completed their digital transformation

REGULATORY BASED INNOVATION

72% of utility leaders state innovation is driven by regulatory & compliance requirements

POLICY SUPPORT

Regulatory framework lags emerging needs of the utility landscape

SKILLED WORKFORCE

4x growth of workers to develop, construct & operate wind and solar projects

NIMBY SYNDROME

Not In My Backyard

In **UK > 58%** of power infrastructure decisions taken to court

SUPPLY CHAIN BOTTLENECKS

120 weeks, to 210 weeks – avg. lead time for large transformers due to shortage

PERMITTING & REGULATIONS

Building offshore wind in China **3x cheaper compared to EU** due to efficient permitting process

AGING GRID INFRASTRUCTURE

> 70% of infrastructure is more than **25 years old**

REGULATORY ENABLERS FOR DECARBONIZATION – LEADING INTERNATIONAL PRACTICES

REGULATORY ENABLERS FOR DECARBONIZATION – INTERNATIONAL PRACTICES

Enabling **decentralized energy systems** by promoting **flexible grid operations** and supporting the growth of local energy markets.

Accelerating **decarbonization** in industry and transport through stricter emissions targets, electrification incentives, and clean fuel mandates

Accelerating private **investment** in renewable generation through improved revenue predictability

Prioritizing **grid modernization** to enhance resilience, integrate renewables, and support a more dynamic, digital energy system

TREND #1: DECENTRALIZE ENERGY SYSTEMS

Key learnings from global best practices in operating an Open Local Energy Market

MULTI-NODE AGGREGATION

- Allow for aggregator-level telemetry
- FERC 2222 – Enable DERs to participate in wholesale markets

CONSUMER DATA PORTABILITY & CONSENT

- Enact CDR-style data sharing via standard APIs

LOCAL SERVICES PEAK SHAVING, VOLTAGE SUPPORT

OPEN LOCAL ENERGY MARKET

INNOVATION, CUSTOMER CONSENT MANAGEMENT

HALF-HOURLY SETTLEMENT

- UK MHHS Program Go Live 2nd July 2027
- Local services: peak shaving, voltage support
- Faster cashflow (4-month settlement)

REGULATORY SANDBOX

- Test new tech and approaches
- Example – Distributed storage at substation to deliver autonomous peak shaving (EPIC program CA)

TREND #2: ACCELERATE DECARBONIZATION

Regulations to incentivize the End User Sector

CARBON PRICING

Best Practices:

- **Carbon Border Adjustment Mechanisms (CBAMs):** Level the playing field for domestic industries.
- **Voluntary Carbon Credits integration:** e.g. Singapore, Japan
- **Tiered Pricing Models:** Recommend different rates for developed and developing countries

EU: Emissions Trading System + CBAM; revenue reinvestment in green infrastructure and social programs.

Mexico: Carbon tax + pilot ETS; revenue for public transport and energy efficiency.

ENERGY EFFICIENCY STANDARDS

Best Practices:

- **Public-private financing** (e.g., green bonds, tax incentives).
- Household **appliance standards and retrofit subsidies.**
- **National plans** with independent reviews.

Germany: Loans, tax credits, building standards, industry tax breaks.

UK: R&D investment, energy labelling

Japan: Mandatory savings plans, appliance upgrade incentives.

FUEL STANDARDS

Best Practices:

- **Mandatory standards**
- **Harmonized testing procedures.**
- **Fuel and vehicle taxes**

Brazil: Weight-based standards; incentives for ethanol/flex-fuel vehicles.

EU: CO_2 limits, incentives for low-emission vehicles, consumer labeling.

ELECTRIC VEHICLES

Best Practices:

- **Standardized chargers for all EVs.**
- **Urban planning to prioritize charger placement.**
- **Public-private partnerships using data to guide investment.**

Norway: Tax breaks, fast chargers, lower EV ownership costs.

China: High charger density, government incentives, private charger support.

TREND #3: ACCELERATE INVESTMENTS IN RENEWABLE GENERATION

FINANCIAL INCENTIVES AND SUBSIDIES

US: Investment Tax Credit (ITC): a federal incentive for renewable energy investments

FEED-IN TARIFFS (FIT) AND POWER PURCHASE AGREEMENTS (PPA)

UK: Contracts for Difference (CfD) Scheme guarantees renewable producers a fixed price for electricity, via a government-backed contract.

Germany: FIT guarantees fixed payments to renewable energy producers for each unit of electricity fed into the grid

China: FIT ensures long-term price certainty to renewable developers, supporting rapid scale-up of solar and wind.

RENEWABLE ENERGY TARGETS AND COMMITMENTS

EU: Renewable Energy Directive (EU Green Deal)

State of California, US: Renewable Portfolio Standard

KEY CONSIDERATIONS

- Policy certainty and consistency
- Impact on market operation
- Incentivize hybrid (generation + storage) projects
- Cater to a wide spectrum of project types
- Enforce forecast obligation on generators

TREND #4: FAST-TRACK INVESTMENT THROUGH ORCHESTRATION ACROSS DIVERSE STAKEHOLDERS

INTEGRATED ENERGY PLANNING

Australia and EU: Publish rolling **Renewable Energy Zones** with clear cost-sharing and annual capex targets.

US: Reform **Transmission Utility queues**: use maturity gates, milestone deposits, and dashboards.

US: **Prioritise corridors** with highest curtailment/ utilisation gaps; align with storage zones.

PERMITTING & PRO-BUILD REGULATION

EU: Declare Renewable & Grid **Acceleration Areas with single-window clearance** and standard biodiversity and land norms.

EU: Statutory approval timelines (**≤12 months onshore**) with defined milestones; quarterly public status **dashboards**.

THE WORLD BANK

Standard contracts / checklists for Special Economic Zones. Create **escalation and ombudsman pathways**.

FIXING SUPPLY-CHAIN BOTTLENECKS

UK: Aggregate demand and pre-book: National Grid £59 billion HVDC supply chain framework, focusing on long-lead items like HVDC cables and converter systems to support major projects

US: Temporary **duty relief on critical bottleneck** components

India: BIS **tightens quality norms and selectively reduces duties** on critical components

TREND #5: MODERNIZE GRID AND BUILD RESILIENCE

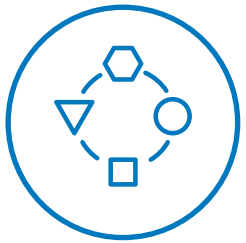
POLICIES AND REGULATIONS				Interventions that regulatory policies should encourage / enable
Smart grid technology	✓	✓	✓	• Accelerate smart meter rollout, grid automation (for fault detection and load balancing) and enable dynamic pricing
Advanced metering infrastructure deployment	✓	✓	✓	• Accelerate nationwide AMI rollout and enable real-time data access for consumers and aggregators. • Support disaggregation of behind-the-meter (BTM) loads.
Demand Side Management	✓	✓	✓	• Use dynamic pricing (e.g., time-of-day EV tariffs), run regular flexibility tenders for peak shaving and voltage control. • Incentivize load shifting and energy efficiency programs.
Market Reforms and Power Trading			✓	• Open markets to DERs (e.g. regional) and standardise measurement and verification (M&V) protocols. • Increase transparency in market operations and settlement.
Grid Infrastructure Upgrades	✓	✓	✓	• Expand substation and transmission capacity and prioritize upgrades in high-curtailment corridors. • Fund HVDC/UHVAC corridors linking REZs to demand centers.
Energy storage deployment mandates and incentives	✓		✓	• Incentivise distributed and co-located storage to support grid flexibility (e.g. with renewables). • Support storage participation in ancillary services markets.
Microgrid development	✓			• Promote renewable-powered microgrids and hybrid systems (generation + storage + load) for resilience and industrial use. • Streamline permitting and interconnection processes.
Distribution system planning		✓		• Mandate data-driven planning (e.g. load forecasts, DER growth, grid constraints) non-wires alternatives (e.g. storage, demand response, and energy efficiency) and transparent grid maps

Best practices

Decentralized, Market-Driven Approach | Central-Local Regulatory Collaboration | Transparency and Accountability | Clear Penalties and Guidelines | Support for Innovation and Economic Development

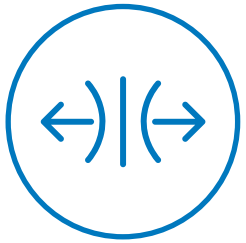
WHAT'S NEXT FOR INDIA

WHAT'S NEXT FOR INDIA IN ENERGY TRANSITION

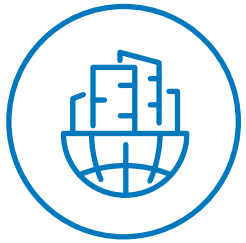


Decentralized systems need smart, **adaptive regulation**

Strain from **AI / Data Center demand growth** will push regulatory boundaries



Fast change demands **flexible policy** responses



India can lead by **utilizing global practices** and building on its **digital public infrastructure**

Digital is the backbone—companies must be pushed to innovate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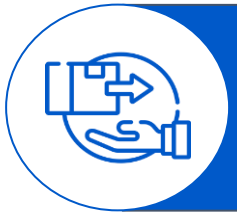
Slides for facilitated discussion

Challenges/Opportunities of the new grid's regulators ~ (from the morning discussion)

Digital Energy Grid

beckn

Higher number of renewable assets around the edges creating entropy for the planning mechanisms



More difficult prediction of future diurnal demand leading to resource adequacy problems

The solution stack is getting reinvented multiple times increasing capex burden on the system

Distributed demand-side assets (EVs, BESS) available as potential grid support systems is lying idle and underutilized

Newer actors, markets and evolution of traditional roles creating new competition and therefore new rules

1. Higher number of renewable assets around the edges creating entropy for the planning mechanisms

- Causes leading the effect:
  - Low visibility of utility-scale assets connected centrally and at the state-level
  - Low visibility of decentralized renewable assets (granularity of data capture low – needs to get to 5 minutes interval)

- Co-created solutioning:
  - Interoperable and standardized way of communicating generation to Central and State-level grid operator (input to the IES ~ manifestation of DEG in India)
  - Transactions supported (including P2P) at central and state grid operators with better informed decisions in scheduling (includes ancillary services called as grid stabilization strategies)

- Collaborations:
  - Create safe place to create thousands of transactions ~ digital twin within RE-rich and low-RE states to ascertain system benefits
  - Develop contours of new MOP Rules or FOR Model Regulations supporting market deepening

2. The solution stack (investments in the distribution and transmission assets) are getting reinvented multiple times increasing capex burden on the system

- Causes leading the effect:
  - Lack of distribution infrastructure mapping
  - Inadequate assessments of projected CAPEX requirements

- Co-created solutioning:
  - Leveraging existing and prospective investments in the sub-distribution grids, create dynamic and digitalized tool to better predict the CAPEX needs
  - Multiple transactions and approval processes at SERCs supported through a well-informed distribution sector assessments

- Collaborations:
  - Create digital twin of transmission and distribution networks mandated through a regulatory process
  - Inform new MOP guidelines or CAPEX related regulations for investments in transmission and distribution infrastructure

3. Distributed demand-side assets (EVs, BESS) available as potential grid support systems is lying idle and underutilized

- Causes leading the effect:
  - New EVs, BESS and demand-side (buildings, industrial processes) coming-up on the network
  - Demand-side assets remain outside of balancing needs of the grid

- Co-created solutioning:
  - Facilitate millions of transactions to ramp-up or ramp-down end-use consumption to meet load shape objectives
  - Leverage existing Resource Adequacy and emerging Demand Flexibility regulations

- Collaborations:
  - Create digital twin of end-use level infrastructure as available assets in the system
  - Facilitate demand flexibility implementation in chosen networks and create millions of transactions including those in the tertiary ancillary services