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**DISTRIBUTION  
UTILITY MEET  
DUM 2024**

## **Session : RE, EV AND GRID STABILITY AND CHALLENGES OF 10 MILLION ROOFTOP SOLAR PV SYSTEMS**

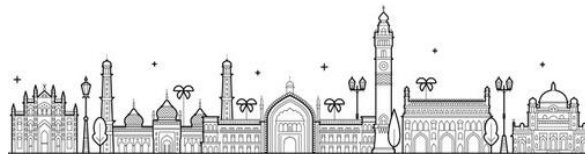
### **ACCELERATING THE RETAIL RENEWABLE ENERGY MARKET IN INDIA THROUGH P2P ENERGY TRADING**

***Presented By***

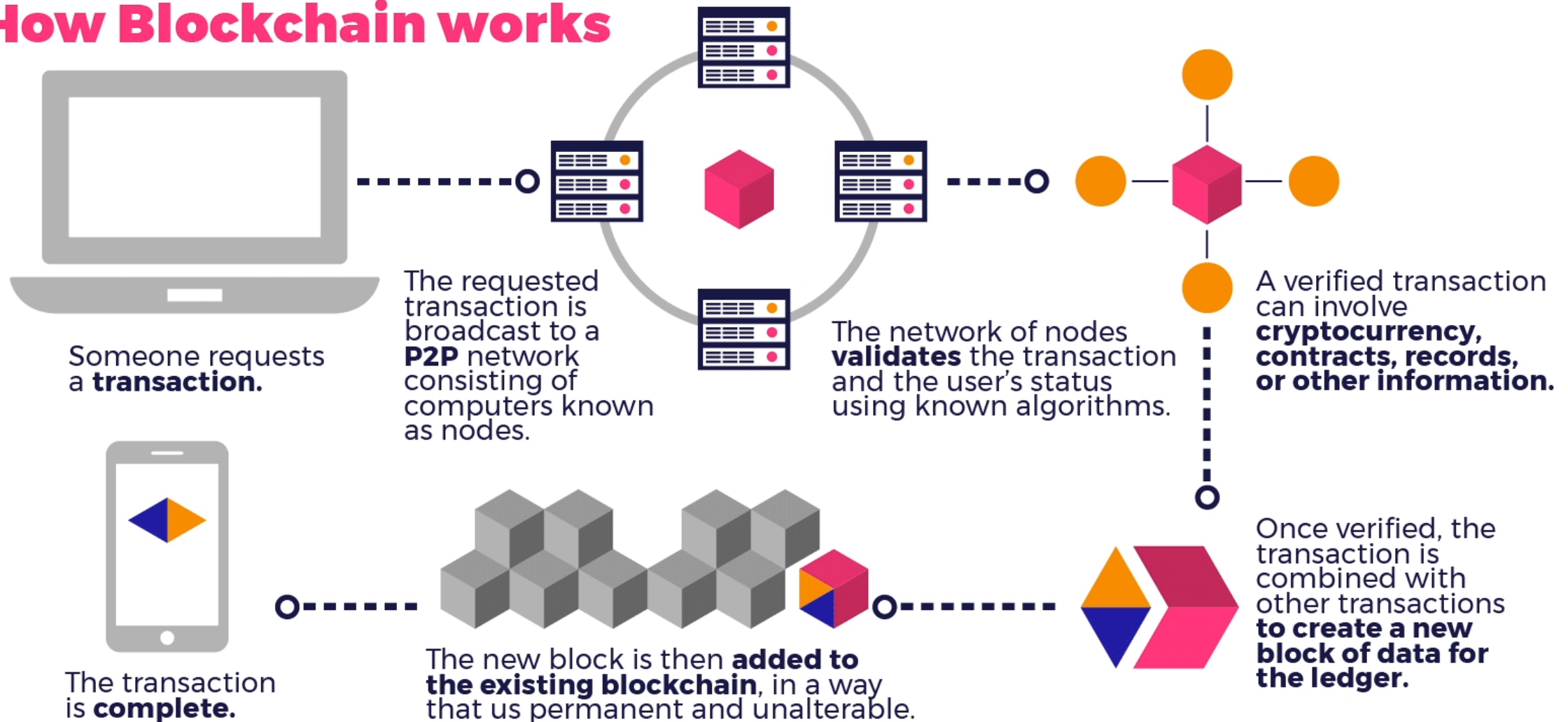
**Reena Suri, Executive Director, ISGF**

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## How Blockchain works

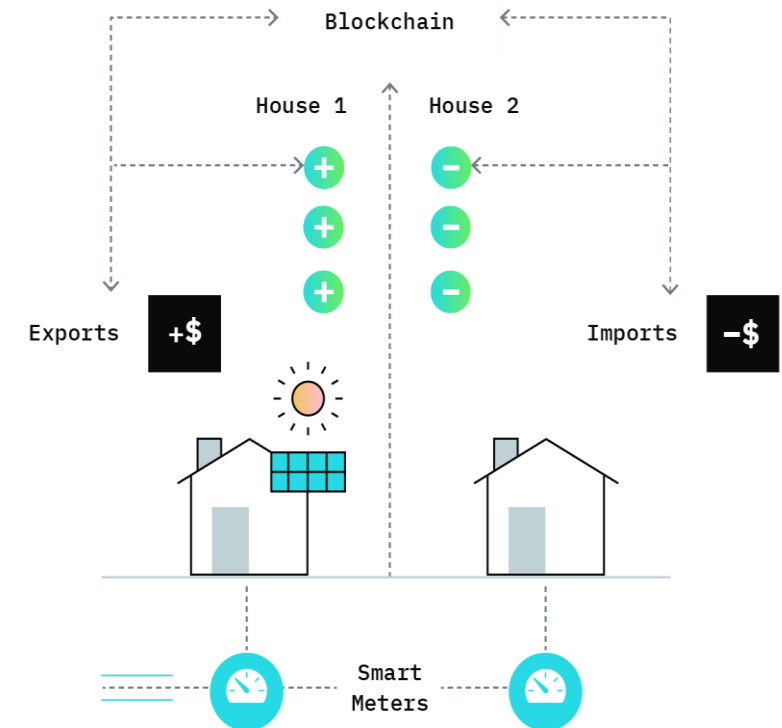


# Blockchain Applications in the Power Sector

Sl No	Domain	Applications
1	Energy Trading	i. Peer to Peer Trading of Green Energy ii. Wholesale Power Market Transactions and Settlements
2	Emission Tracking	i. Renewable Energy Certificates ii. Certificate of Origin for Green Energy Transactions and Green Hydrogen
3	Transactive Energy & Grid Management	i. DER Generation and Service Coordination
4	Customer Empowerment	i. Green Electricity Choice ii. P2P Home EV Charging
5	Energy Metering & Energy Data	i. Measurement, Recording and Verification (MRV) of Energy Data ii. Load Profiling and Demand Estimation
6	Regulatory Compliance	i. Transparent Data for Regulators to Enforce Compliance
7	DER & EV Integration	i. Aggregation and Management of DER as Virtual Power Plants (VPP) on Secured Platform ii. Roaming Solutions for EV charging Anywhere
8	Cyber Security	i. Asset Register for Critical Information Infrastructure (CII) ii. Trustworthy Digital Infrastructure

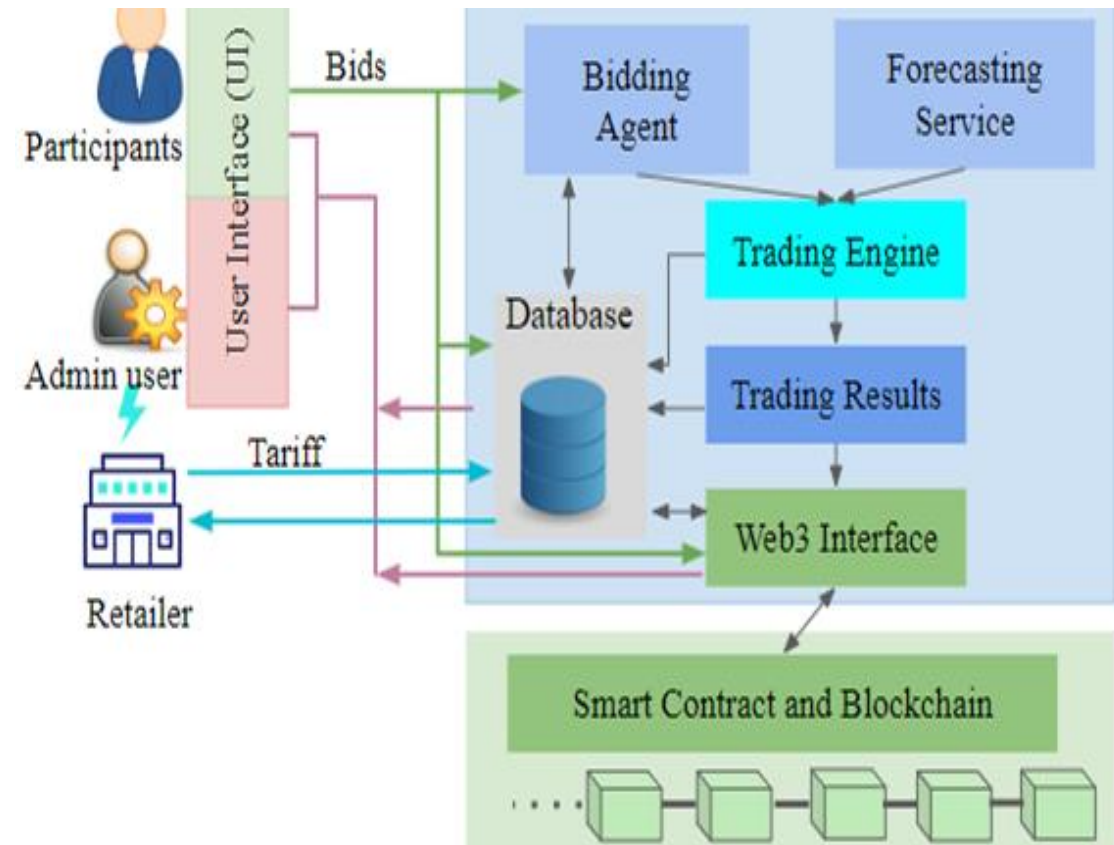
# What is P2P ENERGY TRADING?

- P2P energy trading is a decentralized approach to buying and selling electricity where individuals and businesses trade excess energy directly with each other via blockchain technology
- Blockchain technology can create this decentralized retail market for P2P energy trading as it can handle transactions and payments on both sides of the meter, in real time, at a lower cost to all involved
- This model allows producers of renewable energy, such as households with solar panels, to sell their surplus electricity directly to neighbors or other consumers
- P2P energy trading promotes more efficient use of renewable resources, reduces transmission losses, and can lower energy costs; and create clean energy communities



# Decentralized Retail Renewable Energy Market Concept

- P2P trading enables direct electricity transactions connecting consumers and prosumers and facilitates the transition to a decentralized retail renewable energy market
- The retail RE market incentivises and automates the balancing of electricity supply and demand in close proximity by providing price signals connected to available surplus solar energy
- This provides alternatives for conventional Net Metering (NM) and Gross Metering (GM) subsidies; and offers higher ROI for rooftop solar (RTS) and battery owners incentivizing them to invest in a market-based approach



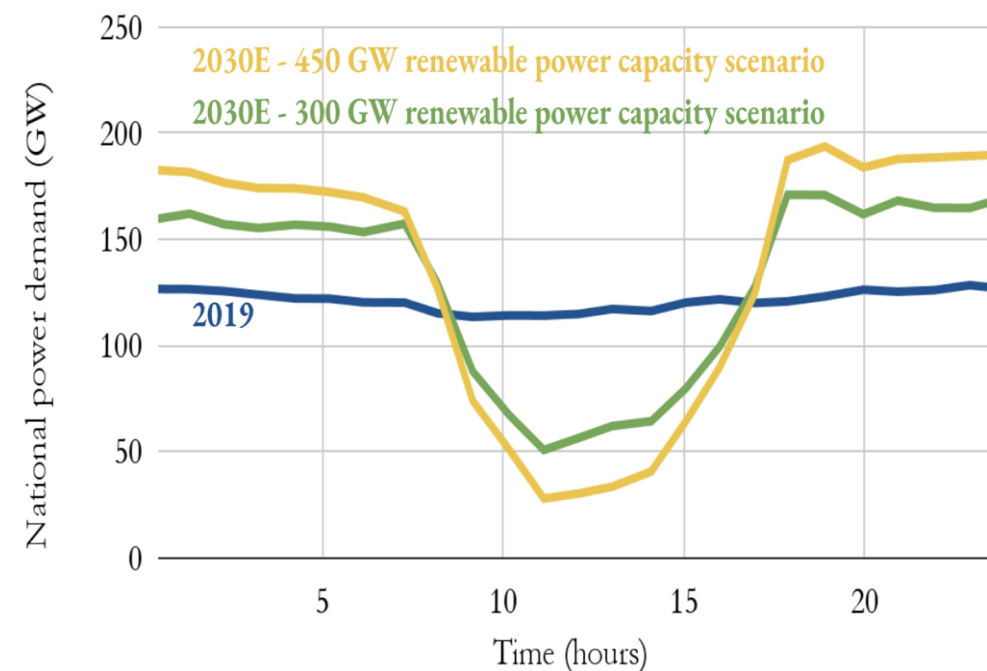
P2P Trading Platform Layout



# What Is The Need For A Retail Market In The Power Sector?

**Status Quo:** The Indian power sector is dominated by centralised thermal power plants. Renewables, initially promoted through subsidies has now achieved grid parity, but grid integration is still a challenge – subsidized transmission access and energy storage systems – still lack the abilities of conventional dispatchable power sources they replace

- Huge increase in solar generation during the day will lead to **‘duck curve’** load profile posing a challenge for cost-efficient grid management and design
- The **‘space and time problem’** of distributed solar and wind can be better addressed by P2P energy trading, facilitating the transition to a distributed retail RE market
- P2P trading incentivises and automates the balancing of supply and demand in close proximity by providing price signals connected to available surplus energy within the community



Indian national power grid demand projection  
(with increased solar penetration and without)

# What Challenges Will A Retail Market Solve?

01

Phasing out subsidies

The retail market supported by P2P provides a market-based alternative for conventional Net Metering (NM) or Gross Metering (GM) subsidies

02

Accelerating RTS adoption

P2P provides increased returns for RTS and battery owners hence incentivising more end-customers to install RTS and batteries

03

Reducing grid reliance

The Distributed Retail RE Market reduces the reliance on the backup grid by balancing surplus RE and demand within the trading group on a local/regional level

04

Reducing electricity cost

End customers engage in direct trading, diminishing the need for upstream grid services, consequently decreasing the prices in P2P transactions and postponing investments in grid infrastructure

05

Empowering end-customers

The Distributed RE Market enables end-customers to take active roles in the energy transition increasing awareness and acceptance

The above challenges present a selection of all benefits through the adoption of Decentralised Retail Renewable Markets  
The full value proposition is discussed on subsequent slides

# Decentralized Retail Renewable Energy Market Value Proposition : Stakeholders and Benefits

The Decentralized Retail Renewable Energy Markets offers a beneficial proposition for the various stakeholders in the Indian Energy Markets on the transition to 50 % non-fossil electricity generation by 2030.

The benefits have been demonstrated by various Indian and global projects and case studies, which are described in subsequent slides

Specific initiatives in the European Union are in a transitional phase from pilot projects to commercial projects with thousand of participants demonstrating the concept of P2P energy trading on an extended scale

STAKEHOLDER	BENEFITS
<b>Participants</b>	Receive electricity cost reductions Access to clean energy locally Incentive to invest in DERs with higher ROI Active participation in energy transition
<b>DISCOMs</b>	Contribution to Renewable Purchase Obligation (RPOs) Cost benefit in comparison to Net Metering (NM) subsidies Insights into customer behaviour/digitization of energy flows Customer retention/acquisition in contestable markets (near future) Deferral of investment in grid upgradation New revenue opportunities
<b>Government/ Regulators</b>	Removal of costly Net Metering(NM) subsidies Market-based incentive for DER adoption Orderly integration of variable RE generation Inclusion of customers in energy transition



Beyond the Indian projects, Powerledger operates a variety of projects globally:

Project	Project Brief	Participant Benefits	Energy Supplier/DSO Benefits	Other Benefits
<b>CMU in Thailand, 2022 - 2024 (Live)</b>	95 meters of Chiang Mai University sharing solar surplus from a total of 15 MW of solar creating a smart campus	Financial benefit: P2P trading price is 25.5 % discounted from ToU rate (FiT rate is zero): savings amount to ~16,980 INR/month per meter	Local balancing of supply and demand	Enabling specific sites to become net-zero Creating an energy sharing community
<b>ekWateur in France, 2019 - 2024 (Live)</b>	5,500 customers of ekWateur are choosing their preferred energy source from a list of renewable generators (exact generator capacity not disclosed)	Selection of specific energy sources Visualization of green energy consumption by source	Acquisition/retention of customers through new product offering. Visualization of energy flows.	Demonstration of application of high-performance blockchain in large-scale P2P environment
<b>Energie Steiermark in Austria, 2021 - 2024 (Live)</b>	Creation of a Smart Community in the district of Graz currently that aims to cover residential and B2B P2P (the project was commercially launched in mid 2023 and currently being advertised) (exact generator capacity not disclosed).	Financial benefit: Around ~256 to ~330 INR/month per meter	Loss from income through energy provision can be compensated through customer acquisition and reduced network fee payment per kWh traded P2P	Demonstrating energy communities as implemented by the Clean Energy Package

# Peer To Peer (P2P) Trading - Indian Demonstrations

Powerledger and ISGF have jointly operated a variety of P2P projects in India:

Project	Project Brief	Participant Benefits	DISCOM Benefits	Gov Benefits
<b>CESC Ltd in West Bengal, 2022</b>	1,001 participants of a diverse mixture of customers (domestic, C&I, social institutions, ...) with ~8.1 MW of solar capacity over a 6 months time frame in Kolkata	Financial benefit of i. Prosumers: a. ~919 INR/month (vs GM) b. ~632 INR/month (vs NM) <sup>1</sup> ii. Consumers: ~41 INR/month	i. Creating new revenue opportunities.  i. Financial earnings <sup>2</sup> of: a. 9.72 INR Lacs per month vs NM b. 0.33 INR Lacs per month vs GM	i. Reduction in subsidies (saving taxpayer money) ii. Incentive for commercial customers to invest in DERs increasing RTS adoption iii. Customer empowerment
<b>TPDDL in New Delhi, 2021</b>	117 participants split in domestic and commercial with a total of 2 MW of solar capacity over a 10 months time frame in North Delhi.	Financial benefit of i. Prosumers: ~371 to ~1039 INR/month ii. Consumers: ~112 INR/month (Domestic)/Loss of ~81 INR/month (C&I) <sup>3</sup>	i. Visibility over price signals in the distribution network ii. Digitization of energy flows iii. Competitive advantage for customer retention/acquisition (near future) iv. Reduction of NM purchase requirements	i. Local power trading reducing network losses ii. Enabling orderly scaling of renewables in the grid iii. Accelerated adoption of smart meters
<b>UPPCL in Uttar Pradesh, 2020 - 2021</b>	Twelve domestic and commercial participants over 4-5 months time frame in Lucknow, Uttar Pradesh (~ 7.7 MWh exported).	Financial benefit of i. Prosumers: ~551 INR/month ii. Consumers: ~237 INR/month	i. Contribution to meeting RPO targets ii. Revenue reduction can be recovered through P2P network access charge (eg 10% of P2P price difference)	i. Understanding consumer behaviour and preferences. ii. Reduction of average energy costs (7.27 INR/kWh for grid purchases vs 5.74 INR/kWh for P2P trades)

## UPERC - 2023

The UPERC Regulation of April 2023 promotes RTS through P2P energy trading using technologies like blockchain. It defines roles for P2P Prosumers, Consumers, and Service Providers, outlining the registration and eligibility process, including smart meter requirements. The regulation specifies the mechanics of scheduling and recording energy transactions, with prices mutually agreed upon by participants and additional charges for Service Providers; and wheeling charges for the DISCOM. Billing aligns with UPPCL cycles, based on actual meter readings and transaction prices. The regulation ensures compliance with existing laws and includes provisions for dispute resolution and guideline amendments.

## DERC - 2024

The DERC has issued guidelines for P2P energy trading, emphasising the use of blockchain and other technologies for decentralised transaction recording. The guidelines offer flexibility for prosumers and consumers to trade renewable energy via the distribution network, with billing managed by the distribution licensee. Delhi DISCOMs can petition for transaction charges, and prosumers may install renewable energy systems up to 500% of their sanctioned load. Metering options include virtual net metering, group net metering, and peer-to-peer metering.

## KERC - 2024

The Karnataka Electricity Regulatory Vcommission (KERC) has issued regulations in August 2024 for P2P trading of solar energy featuring blockchain-based platforms to enhance decentralisation and efficiency. The regulations empower prosumers, allowing those with rooftop solar units to sell power to Escoms or directly to other consumers at a tariff agreed upon within the regulatory framework. Sellers and buyers have flexibility in pricing, and participants are required to have net or gross metering arrangements. The integration with jurisdictional DISCOMs or their authorised firms will support the facilitation of energy transactions.

The toolkit complements **USAID's SAREP Whitepaper "Accelerating the Retail Renewable Energy Market in India through Blockchain-Based P2P Energy Trading"** by providing practical tools and recommendations

## **Challenges with the Traditional Approach**

- Ongoing programs have led to building large solar and wind farms far away from load centres
- Government subsidies could not achieve the 40 GW RTS target by 2022
- India's RE targets require new innovative, scalable approaches

## **Harnessing the Distributed Retail Renewable Energy Market**

- The toolkit outlines strategies for P2P retail RE markets using blockchain
- Addresses challenges of centralised renewables and inefficient traditional tariff structures
- Stakeholders are equipped with guidelines (business and technology tools) for effective implementation of commercial P2P projects
- The strategies are based on learnings from Indian and Global pilot initiatives

## **Benefits of Local Energy Markets (LEMs)**

- Benefits include faster energy transition, cost savings, and enhanced grid stability
- It promotes equitable, market-based approaches to meet national renewable targets efficiently

## Business Tools



### Active Customer Participation

Empowering customers to participate in decentralised energy systems addresses challenges like intermittency, congestion, and costly network upgrades by promoting self-sufficiency and reducing grid congestion. P2P energy trading incentivises local RE assets, reducing network costs and enhancing grid stability, while making RE more accessible and equitable for all



### Achieving National Goals w/o Subsidies & Creating a Win-Win for all Stakeholders

P2P energy trading can achieve RE targets without subsidies, saving taxpayer money. It allows domestic NM prosumers to sell energy at higher prices and C&I consumers to buy at lower costs. DISCOMs benefit by purchasing excess solar cheaply, meeting RPOs, reducing network costs, and charging fees per unit traded. This model incentivises renewable energy, reduces subsidy reliance, and creates significant cost savings

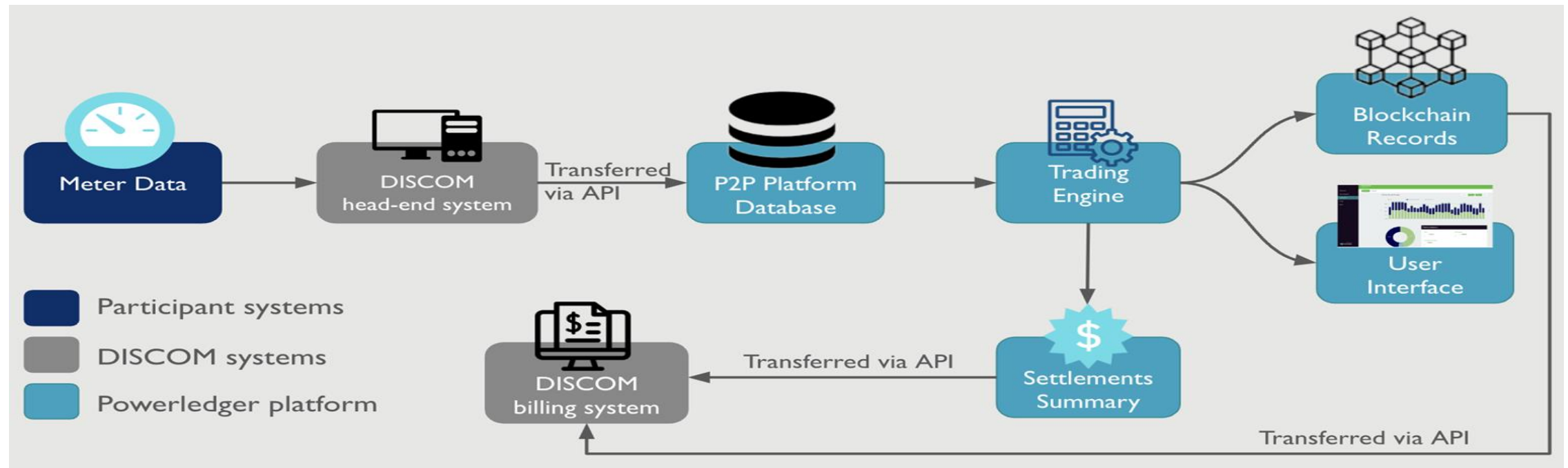


### The Ask for Ensuring Trust and Transparency

The more active participation of end-customers in today's world as well as demands for provenance tracking of their electricity require increased management of resources and data. Without adequate tools, meeting these demands can become burdensome and time-consuming. Streamlining this process requires the tools outlined in the Toolkit



The data flow between different entities during the implementation of a P2P trading solution is based on the following sequence: Smart metering and DER energy management systems ensure the collection of meter readings, which are collected by the DISCOM. The DISCOM transfers meter readings via a secure Application Programming Interface (API) to the Powerledger blockchain platform, which utilises the readings for further processing and calculation of transactions. Final transactions are stored in the blockchain and transaction outcomes displayed via a User Interface. Additionally, all required information is transferred to the DISCOM via API for billing purposes.



# How Will The Toolkit Be Applied Effectively?

## Regulators

Regulators need to adopt regulations recognising P2P as a market activity supported by blockchain technology. Key actions include developing a clear regulatory framework, revising subsidy schemes, promoting necessary technological infrastructure

## DISCOMs

DISCOMs should adopt measures to accelerate P2P projects by developing incentive programs for participants and implementing infrastructure. They need to work on regulatory compliance, provide technical support, adopt efficient data transfer methodologies

## Applying the Toolkit

## Customers

Participants should register with their utility to engage on the P2P platform, actively participate in real-time trading, and ensure accurate billing and settlement. Proactive engagement with utilities can encourage the development of retail renewable energy markets.

## Technology Providers

Technology providers need to develop the necessary infrastructure, including data management systems and energy management software. They should design robust trading platforms, implement Gen3 blockchain for secure transactions..

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# THANK YOU

*For discussions/suggestions/queries email: [dum@indiasmartgrid.org](mailto:dum@indiasmartgrid.org)*

*[www.dumindia.in](http://www.dumindia.in)*

*[Links/References \(If any\)](#)*

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