Digital Energy Grid (DEG): Built on Unified Energy Interface (UEI)

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Distribution Utility Meet

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Peer-to-Peer (P2P) Trading of Rooftop Solar Energy – Pilots in India

ISGF conducted 3 successful pilot projects of P2P Trading of Rooftop Solar Energy on blockchain platform in India between 2020 and 2022

1. Uttar Pradesh (UP), India:

- Pilot implemented in 2020 under the **regulatory sandbox** approach to test the technical feasibility and customers willingness to participate in P2P trading
- **12 participants** (9 prosumers and 3 consumers) in Lucknow City participated in the pilot project
- **Project Go-Live: Dec 2020**
- Pilot project price discovery was around **INR 5.60/kWh (Win-Win for Prosumers and Consumers**
- **UP Electricity Regulatory Commission (UPERC) issued P2P Guidelines in April 2023**

2. Delhi, India:

- P2P trading of rooftop solar energy with Tata Power Delhi Distribution Ltd (TPDDL) in 2021
- **117 participants** in the pilot project – 2 MW rooftop solar involved
- **Project Go-Live: January 2021**
- Based on the project results, and recommendations to Delhi Electricity Regulatory Commission (DERC) **Peer to Peer Energy Transaction Guidelines, 2024 was issued by DERC in June 2024**

3. Kolkata, India

- Built a P2P trading platform on blockchain for CESC Kolkata in 2022 and run a 6-month pilot with 1002 C&I Customers (26 MW PV installations);
- **Project Go-Live: August 2022**
- Formulated a viable business model for CESC

UPERC Guidelines for P2P Solar Energy on Blockchain Platform

Purpose:
Promote rooftop solar adoption, optimize asset use, and enable blockchain-based P2P energy exchange.

Coverage:
Applies within a Distribution Licensee's service area
P2P Service Providers to be empanelled by the DISCOMs

Metering and Data Handling:
Smart meters mandatory for participation (post paid – being changed to prepaid)
Service Provider accesses meter data via MDM for billing and reconciliation

Scheduling and Pricing:
Day-ahead schedule to be submitted by 1700 hrs on (n–1)th day
Energy priced per mutual agreement between Prosumers and Consumers

Charges and Billing:

- ***Energy Charges: Mutually decided between the Buyer (Prosumer) and Seller (Consumer)***
- ***Open Access/Wheeling Charges at Rs 1.01 per kWh to DISCOM to be paid by the Buyer***
- ***Platform Service Fees: Rs 0.21 per kWh to be paid by both Buyer and Seller to Service Provider separately***

Other Provisions:
RPO benefits from rooftop solar retained by Distribution Licensee

Definitions

Sl. No.	Term	Description
1	Prosumers	Who generates the electricity from rooftop solar
2	Consumers	Who consumers the electricity from rooftop solar
3	BAP (Beckn Application Platform)	Used by consumers to access and transact on the energy network.
4	BPP (Beckn Provider Platform)	Used by prosumers to offer energy on the network.
5	Order Book	A ledger jointly maintained by BAPs and BPPs, recording initial energy transaction contracts.
6	DISCOM	Electricity Distribution Company serving the project area.
7	NPs (Network Participants)	Entities acting as BAPs/BPPs in the transaction layer.
8	Transaction Layer	Digital interface of NPs using Beckn Protocol to facilitate P2P energy transactions.
9	Data Trust Layer	Blockchain-based layer for storing P2P transaction data and fulfillment records from MDMS.
10	MDM (Meter Data Management)	A central system that collects, stores, and validates energy consumption data from smart meters, making it available for billing, forecasting, and analytics.
11	AMISP (Advanced Metering Infrastructure Service Provider)	An entity that installs, operates, and maintains smart meters and the communication system, ensuring reliable meter data transfer to DISCOMs and MDM.

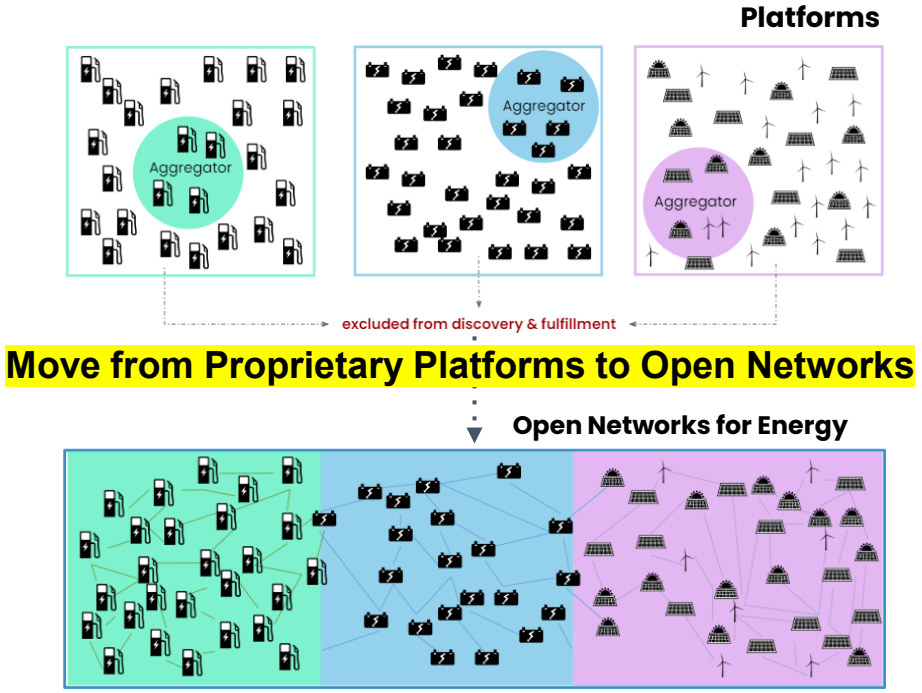
Unified Energy Interface (UEI) - Open Energy Networks

UNIFIED ENERGY INTERFACE

Unified Energy Interface (UEI) is an **open network for energy** to enable transactions between digital energy systems

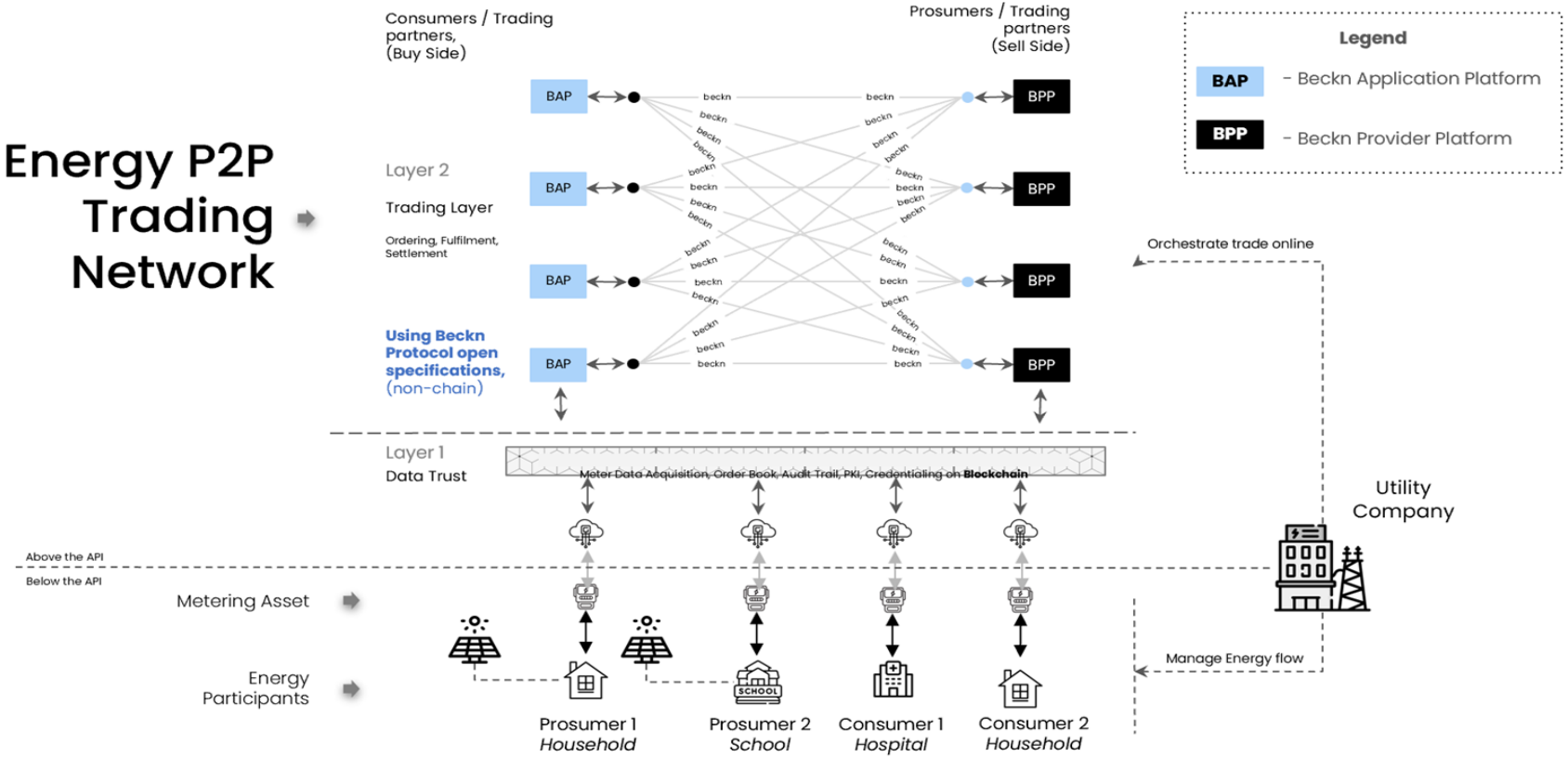
Solves for

Discovery
Ordering
Fulfilment
Post-Fulfilment



Market Expansion | Autonomy at Nodes | Asynchronous & Combinatorial innovation

Energy P2P Trading Network on UEI Architecture



Onboarding Process

ISGF approaches prosumers with rooftop solar and consumers

Users fill an enrollment form with CA number, address, RTS capacity etc.

ISGF submits this filled up Applican Form UPPCL/DISCOM for authentication to join the P2P tarding Platform

If these P2P participants do not have Smart Meters, UPPCL arrange to istall it; and authenticate them to join the P2P platform

After authentication by UPPCL, Prosumers install BPP App and Consumers install BAP App respectively

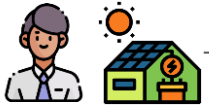
UPPCL flags P2P participants in MDM and RMS systems for billing

UPPCL authorizes the AMISP (eg: IntelliSmart) to share daily meter readings of flagged customers (P2P participants with ISGF's Blockchain Layer

Daily Trading (Day -1 to Day +1)

Day -1

Prosumer declares power (in kWh) to be sold and at what price in BPP App



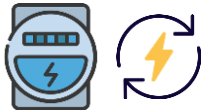
Consumers post their energy needs and buy-prices on BAP App

P2P Platform matches buyers and sellers and creates smart contracts by 5pm

Buyers wallets debited and money held in an payment gateway escrow account. (Bank details of various parties are already linked to the platform)

Trading Day

Energy is delivered through the **local grid** as per contract



Day +1 (Next Day)

DISCOM shares meter data with the Blockchain

The system verifies actual traded quantities

Final billing amounts are calculated and settlement details are send to BAP and BPP

Money from Escrow/payment gateway is distributed to various stakeholders

Monthly Billing and Reconciliation

Blockchain platform maintains all trade records of each P2P Participant

At month end (Month + 1 day), consolidated trade data is sent via SFTP from Blockchian to RMS for adjustments in the billing syatem

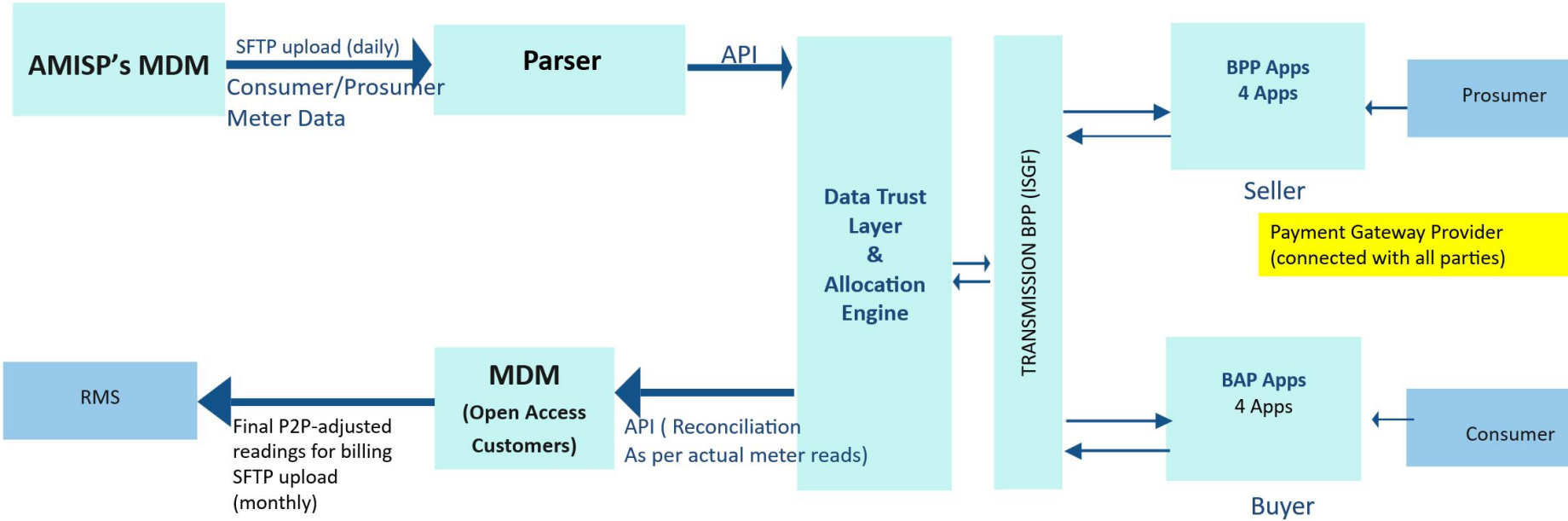
Adjustments are made in bills

Consumers: Energy bought on the P2P is deducted from total usage

Prosumers: Energy sold through P2P is deducted from solar energy exports

Discom monthly electricity bills generated accordingly

UEI System Architecture of UPPCL Demonstration Project



14 different systems interconnected and exchanging data successfully

Thank You

About India Smart Grid Forum (ISGF)

- ISGF, established as a Public Private Partnership (PPP) initiative of Government of India in 2011, is spearheading the mission to accelerate electric grid modernization, electric mobility and energy transition in India
- The India Smart Grid Forum (ISGF) has evolved as a Think-Tank of global repute on Smart Energy, Electric Mobility and Energy Transition
- 200+ members comprising of ministries, utilities, technology companies, academia and research
- **9 Working Groups:** Grid Modernization & Smart Cities; Smart Metering (AMISPs); IoT, AI & Analytics; Digital Architecture and Cyber Security; Policy, Regulations and Business Models; Renewables & Microgrids; Flexibility & Electric Mobility; Smart Gas; Smart Water
- ISGF has been driving the digitalization of utilities and is actively involved in standards development, technology demonstration pilots; training and capacity building and various advisory and research activities

More about ISGF: www.indiasmartgrid.org

Beckn Protocol

An economic resource discovery and transaction protocol

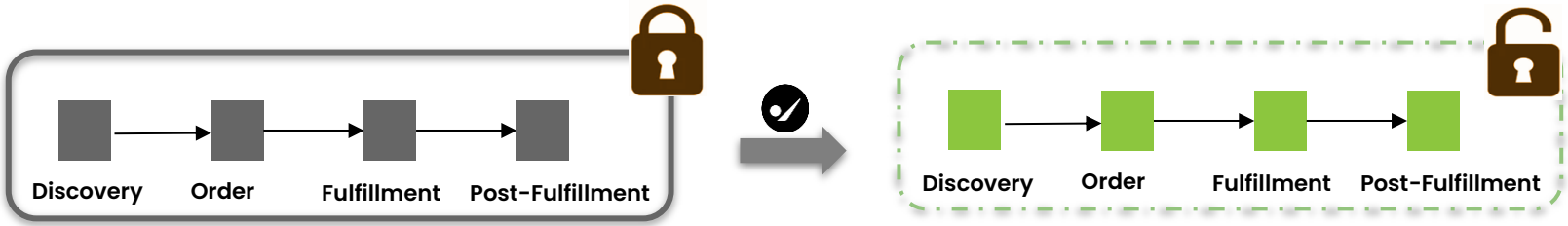
www.fide.org

- ./ Mobility service
- ./ Energy
- ./ Agri producers
- ./ Circular goods & service
- ./ Financial instruments
- ./ Skill ..

- ./ Ordering
- ./ Booking
- ./ Blocking
- ./ Sourcing...

- ./ Decentralised, P2P
- ./ Generic but exhaustive
- ./ Layered
- ./ Transactions as micro-contracts...

Open Source Specifications | **Tech and AI Neutral** | **Open Community**



P2P Trading Process

P2P Participants Onboarding

Consumers and Prosumers fill out a registration form provided by ISGF or its partners. ISGF compiles and submits the participant list to UPPCL/DISCOM for verification. Verified participants are added to a Master List, flagged in the MDM and RMS systems, and linked to digital wallets for future transactions.

Step 01

Day-Ahead Contracting

Each day, prosumers submit their sell offers (units and price) and consumers place their bids through the BPP/BAP apps. The platform facilitates one round of negotiations, matches offers, verifies wallet balances, and generates digitally signed contracts. These contracts are recorded securely on the blockchain.

Step 02

Metering & Data Transfer

On the trading day, energy is delivered through the local grid. Smart meters record the actual energy exchanged. Meter readings are transferred from AMISP's MDM to blockchain layer, then to Inventive Software's MDM, which sends P2P-adjusted readings to RMS for billing purposes.

Step 03

Billing and Settlement

Digital wallets are debited and credited based on energy traded, wheeling charges (₹1.01/kWh), platform fees (₹0.21/kWh each), and deviation settlement charges. RMS uses the adjusted readings to prepare monthly bills for consumers and prosumers after accounting for P2P trades.

Step 04

Final Integration & Monthly Closure

By the end of each month, ISGF shares the final export and import data with Inventive via SFTP. Inventive integrates this into billing systems, ensuring P2P transactions are reflected accurately. From June 2025, the entire billing process for P2P participants will be automated.

Step 05