



INDIA ENERGY STACK

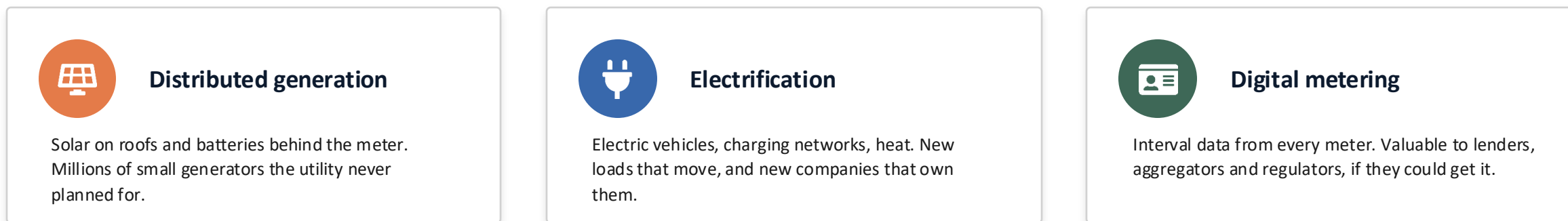
The why, the what, and the how

A shared set of specifications that lets every system in the power sector exchange data, the way UPI lets any bank pay any other.

Ministry of Power Initiative | REC . Nodal Agency | FSR Global · Knowledge Partner

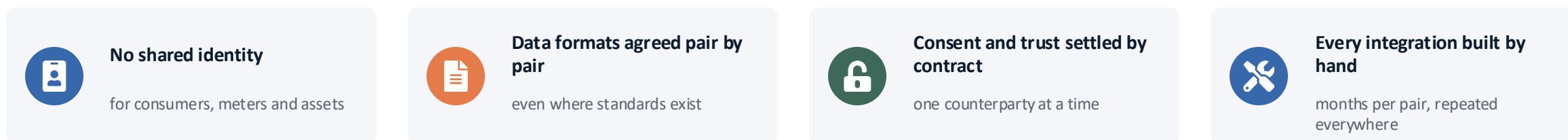
Grids are going digital. The data is not.

Rooftop solar, batteries, electric vehicles and smart meters are arriving in most power systems. Each brings new actors and new systems that designed to talk to each other only with bespoke integrations.



New actors, each with its own system: prosumers, aggregators, charge point operators, lenders, insurers, regulators. Each needs data the others hold.

THE RESULT, IN MOST POWER SYSTEMS



The same problem, at India's scale

India had already bought the systems. They came one at a time, from different vendors, and were never designed to talk to each other.

200+

SCADA systems

across generation, transmission and distribution

52.8 million

smart meters installed

as of December 2025, and rising

200+

interfaces

between utility systems, each built and maintained by hand

One distribution utility often runs several metering systems and spends years making them work together. The same effort is repeated in every State, by every utility, for every new partner. More than 80 distribution utilities, each doing it alone.



From silos to shared information



Interoperability by design



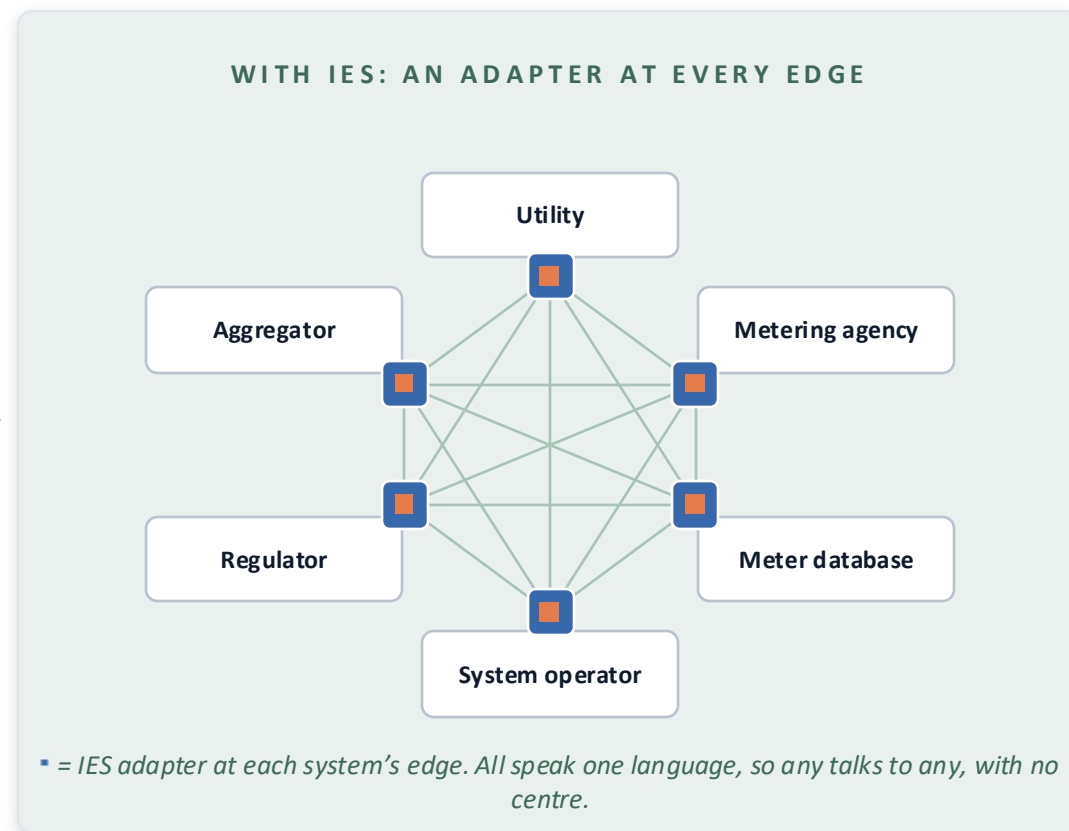
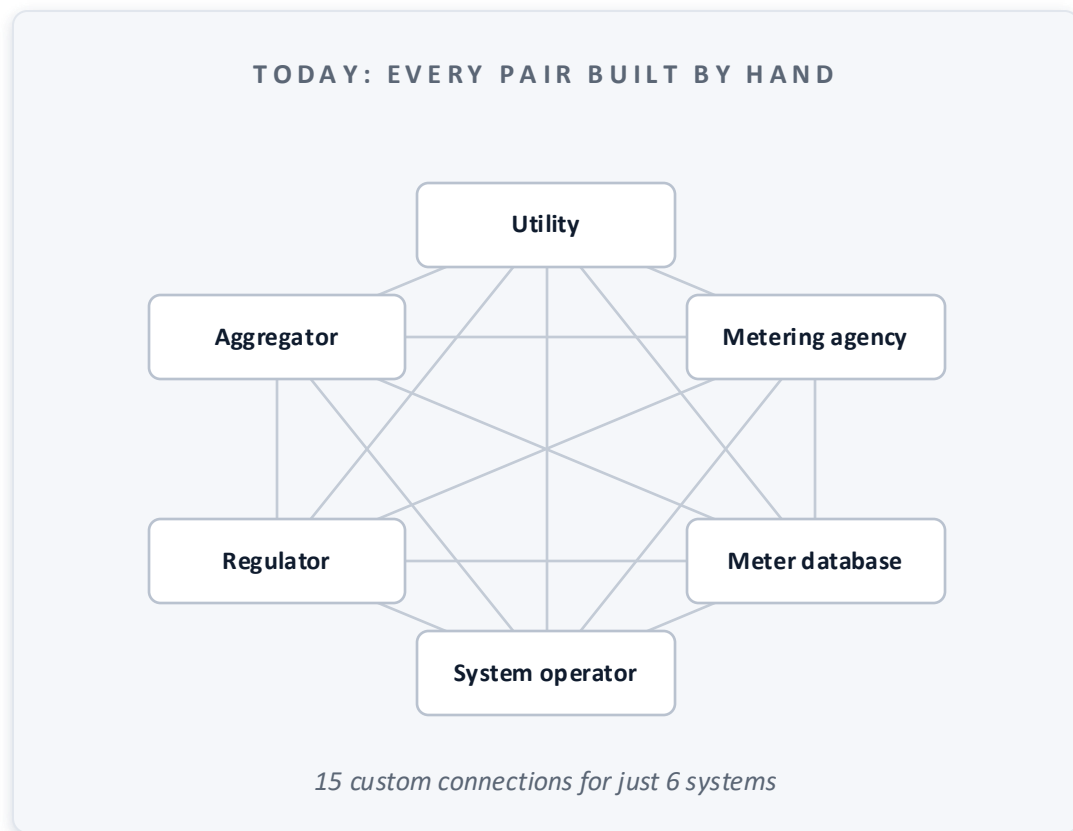
An open innovation ecosystem

What the Ministry of Power set out to add, in three phrases

Useful data, locked inside separate systems

Utilities have added smart meters, rooftop solar, EV charging and demand-side tools. Each produces useful data, but it stays trapped in systems that cannot read each other.

The integration cost is real. One utility often runs several metering systems and spends years making them work together. The same effort is repeated across the country.



India has solved this before

Digital public infrastructure (DPI) is a shared set of rules and registries that everyone builds on and no one owns. Three examples the world knows.



Aadhaar

Identity, 2009

One verified identity, created once and recognised everywhere. Every scheme stopped re-verifying the same person.



UPI

Payments, 2016

Money stays in the bank. UPI is only the shared rules that let any app pay any account, with no deal between each pair of banks.



DigiLocker

Documents, 2016

A document issued into the locker carries the same standing as the original. Acceptance was settled once, for everyone.



Energy is the last major sector without a digital data backbone. GST, UPI and FASTag data are machine-readable today. Energy data is not. IES applies the same method to the power sector.

What the India Energy Stack is

“A digital public infrastructure to identify and connect stakeholders and assets, thereby facilitating open data exchange and interoperability in the power system through uniform specifications and standards, unlocking transparent, reliable, inclusive, efficient, and affordable access to energy.”

IES Strategy Document

A suite of protocols and specifications

Not a platform, not a product. Common rules any system can implement.

Data stays where it is generated

Each utility keeps its own systems. Nothing moves to a central store.

Standardise the interface, not the systems

The rules cover the exchange between systems, never their internals.

IES is the connective tissue: a shared suite of specifications that enables coordination without centralisation.

IES is a shared common language

IES is a common set of specifications for sharing data across the power sector. It works the way UPI works for banking.



UPI

Money stays in your bank. UPI is only the shared rules that let any bank's app pay any other bank's customer, with no separate deal for each pair.



IES

Energy data stays in the systems that already hold it. IES is only the shared set of specifications that lets any system exchange data with any other, with no separate deal for each pair.

The sector already has rules for what data to report. IES does not replace them. **It makes the same data machine-readable, common, and verifiable, so any two systems can act on it directly.**

What IES is NOT



IES is not

A central platform or database that stores energy data



IES is not

A replacement for any DISCOM, meter-data or consumer system



IES is not

A new regulator or authority that frames energy rules



IES is not

A software product that utilities buy and install



IES is not

A system that controls or monitors the physical grid

Guiding principles

● Transparency & Efficiency

Every transaction verifiable, tamper-evident, machine-readable.

● Data Federation

Data stays where it is generated.

● Interoperability

Join or exit with minimal friction, via open APIs.

● Scalability & Resilience

Decentralised, no bottlenecks; scales to population level.

● Open Innovation

Core data and services open to public and private actors.

● Inclusivity

Shared infrastructure serves smaller stakeholders too.

● Privacy & Trust

Secure exchange, privacy protected, robust compliance.

● Cybersecurity by Design

Authenticated nodes, access controls, continuous monitoring.

● Ecosystem Neutrality

Technology- and vendor-neutral; no lock-in.

● Sovereignty

Aligned with national priorities on data and security.

● Leverage Existing Systems

Build on current infrastructure and standards.

● Minimalism

Only the baseline specifications and registries needed.

● AI Readiness

Data, identifiers and governance AI-consumable by default.



HOW IT WORKS

Register, discover, exchange

Three steps, one adapter, and the schemas underneath. Nothing you run today changes.

It tells any two systems how to share data, in three steps



1

Register

Verifiable digital identity

Every participant gets a digital identity and is listed in a shared directory. Done once.

Uses W3C Decentralised Identifiers



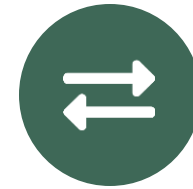
2

Discover

Interaction protocol

Before every exchange, both systems look each other up, confirm the other is genuine, and agree on what is shared and on what terms.

Uses the Beckn protocol



3

Exchange

Schema, taxonomy & verified credentials

Data moves using agreed field names and public domain standards. Where needed, it produces a durable credential the holder keeps in DigiLocker/EntityLocker.

For example: DLMS/COSEM · IEEE 2030.5 · OpenADR etc.

Build to the IES specifications once, and a system connects to any other IES-ready system with no fresh integration work.

Internal systems do not change: Just plug the IES adapter

A small piece of software, the adapter, sits at the edge of each system and connects it to IES. Internal databases, field names and internal software stay exactly as they are.



Part 1: Ready-made

The same for everyone. Handles finding other systems and exchanging messages. This is the Beckn ONIX reference software. You do not build it.



Part 2: Set up once

Specific to the utility: a small mapping that translates between your data format and the IES format. Configured once by the utility.

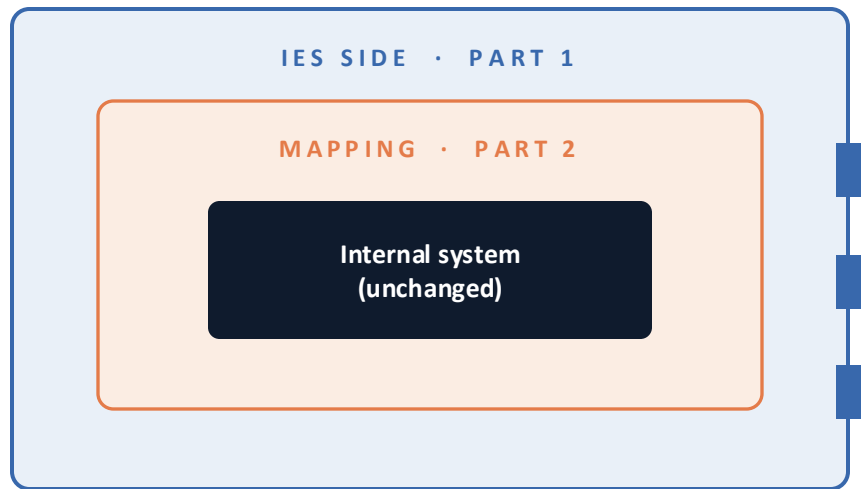
After this, **every new IES-ready partner connects with no further integration work.**

Low risk | Low effort | Low Cost

Two sides to the adapter, one shared language

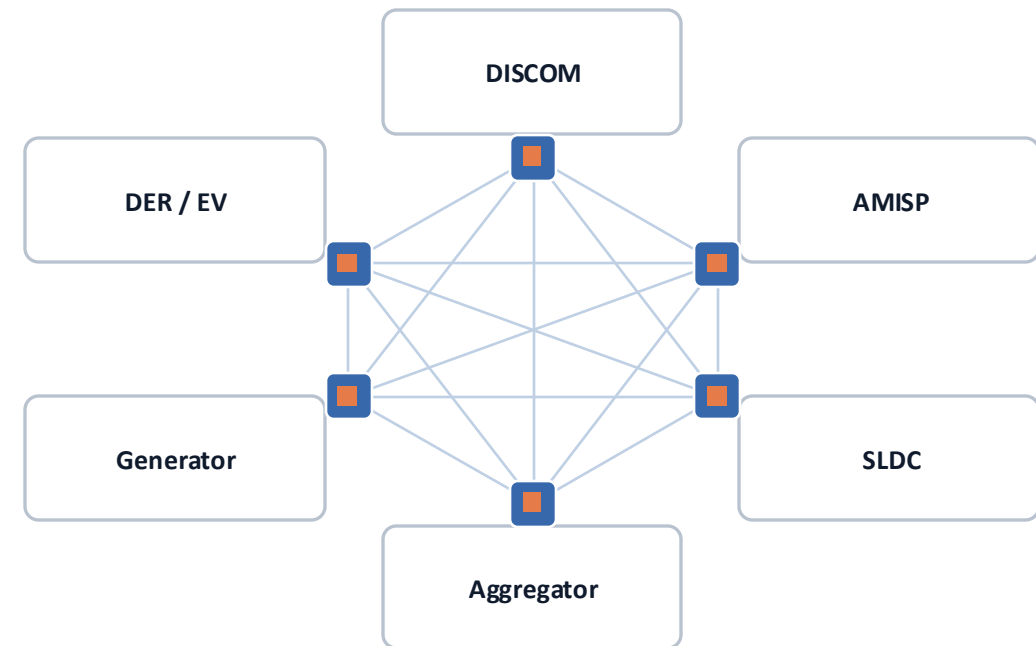
Inside: a one-time mapping to your own formats, which never change. Outside: a ready-made IES-compliant interface. Like a USB-C port, it is standard whatever the device.

One adapter, two sides



- External side (Part 1)**: ready-made, IES-compliant (Beckn ONIX), the same for everyone. Its not build by individual stakeholders.
- Internal side (Part 2)**: a one-time mapping between internal formats and IES, set up once by the stakeholder. In the pilots this was done in a single day.

On the network (e.g.)



■ = the adapter at each system's edge: blue outside (IES interface), orange core (your mapping)

Every system keeps its own internals. All speak one IES language on the outside, so any connects to any, with no bespoke pair.

Register: a verified identity, listed once

Before anything is exchanged, every participant and asset is given a verified digital identity and listed in a shared registry. This is done once, and everything that follows builds on it.

1

Verified identity

Every consumer, meter, asset, DISCOM or service provider gets a digital identity, uniquely and consistently named, so all systems refer to the same thing.

2

Shared registry

The participant is listed in a shared directory, so others can find it and trust that a message genuinely came from it.

3

Done once

Identity is created once. An asset such as a meter, solar unit or EV charger gets its identity the first time a use case needs it, not all on day one.

4

Reused everywhere

Discovery, exchange and credentials all build on the same identity. The first connection takes the most effort; each one after is far easier.

Built on open standards: W3C Decentralised Identifiers for identity, and DeDi for the shared registries.

Discover: find the other party, agree the terms

Before any data moves, the two systems find each other, check each other, and agree what will be shared and how. This is the handshake, and it is the same for every use case.

1 Find

Look up the other party in the shared registry: a utility, a metering agency, an app. No prior relationship and no separate agreement needed.

2 Check

Both sides verify each other automatically: who you are, and what you are allowed to ask for. Nothing moves until both checks pass.

3 Agree

Settle what will be shared, for what purpose, and on whose consent. The agreement is signed and carries one reference number, so every exchange can be audited later.

4 Choose how the data travels

Small data travels inside the message itself. Large or continuous data goes over the channel you already run: an API, a file transfer, a data stream. Chosen once, when you agree.

The handshake is standard for everyone. The channel, the interface and your own systems stay exactly as they are.

Exchange: what is sent, not just how

The data-exchange slide showed how the bytes move. This is what travels inside the message: the specifications that make the data mean the same thing to everyone.

1

Taxonomy

A shared vocabulary for billing terms, outage types and meter categories, so the same word means the same thing in every system.

2

Schema

Exact field names, formats and validation rules, so every message is structured the same way and can be read on the first try.

3

API spec

The agreed interface for requesting and returning the data, so any two systems exchange it the same way, with no bespoke arrangement.

4

Verifiable credential

Where a durable record is needed, the exchange issues one: a Consumer Energy Passport or a Consumer Meter Digest, held in DigiLocker.

Each exchange follows the public standard for its domain e.g. DLMS/COSEM for meter data, IEEE 2030.5 for solar and storage, OpenADR for demand response.

IES schemas, for example



ElectricityCredential

W3C verifiable credential issued per meter by DISCOMs. Carries customer identity, DER details and tariff profile.



MeterData

Contains core meter data format covering profile shapes such as customer profile, interval profile, daily profile, etc. .



MeterDataCredential

Wraps MeterData in a W3C VC. Attests to produced the readings, where and how a reading was captured.



MeterDataRequest

Query schema for requesting meter data: capabilities, authorisation and the request itself.



MeterDataRequestCredential

Wraps MeterDataRequest in a W3C VC. Proves the seeker is authorised to ask.



ArrFiling

Schema for DISCOM regulatory ARR filings, built from ArrFiling, ArrFiscalYear and ArrLineItem.

Use cases, specified end to end

Each use case follows the same path: Register, Discover, Exchange



Smart Meter Data Exchange

A standard, audit-trailed way to share smart-meter data between metering agencies, utilities, regulators and consented third parties.



Consumer Meter Digest

A consumer pulls their own meter readings on demand, as a signed credential, and shares them with whoever they choose.



Consumer Energy Passport

A wallet-held credential binding a consumer to their connection, meter, sanctioned load and DER assets. Issued by the utility, verifiable everywhere.



Utility Regulatory Filing

Revenue and compliance filings reach the regulator as structured, signed, machine-verifiable objects instead of PDFs.



Tariff Intelligence

Tariff orders and data-exchange rules published as policy-as-code that billing systems, apps and meters consume directly.



DER Visibility

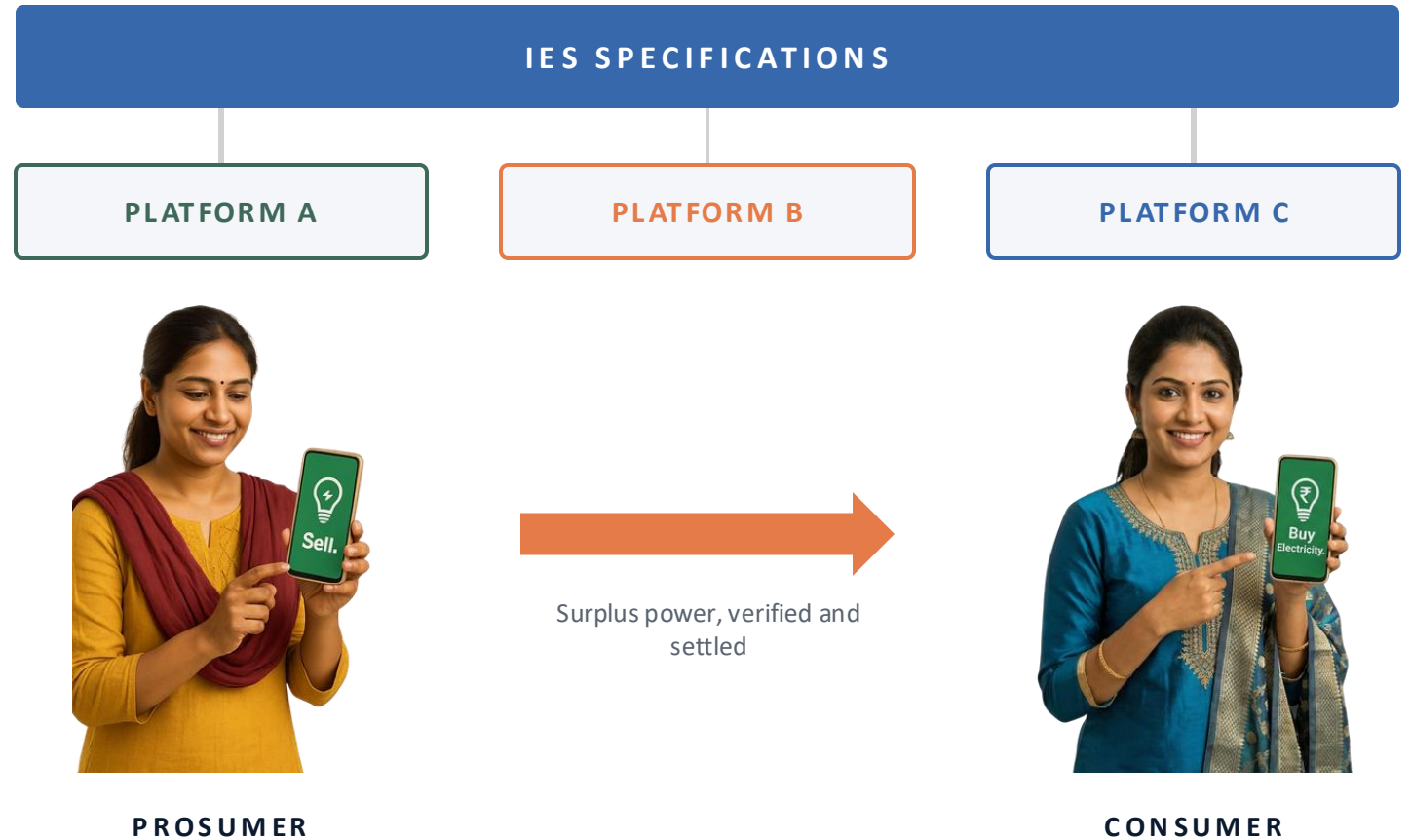
Every rooftop solar unit and battery registered with a verified identity, giving operators reliable visibility of distributed assets.

From one household to another

A prosumer on one platform sells surplus power to a consumer on another. Neither platform is built for the other.

HOW A TRADE SETTLES

- 1 The prosumer lists surplus power on Platform A.
- 2 Platform C shows the offer to a consumer. Both platforms speak IES, so the offer is understood as sent.
- 3 The trade is verified against registered identities and settled. Each platform keeps its own systems.



Surplus solar, sold to the tailor next door

A farmer with rooftop solar sells surplus power to a tailor next door, directly and digitally. Each side gains something it cannot get today.



For consumers and prosumers

- Rooftop solar owners earn from the surplus they generate.
- Neighbours buy cheaper, greener power.
- No paperwork with the utility for each trade.



For the distribution utility

- Lower peak load and better demand management.
- Set-off against renewable purchase obligations.
- Lower liability for paying out exported power.



For the State

- Faster rooftop solar adoption under the national scheme (PM Surya Ghar).
- Local energy livelihoods in villages and towns.
- A market that runs on rules, not on bilateral deals.

Peer-to-peer trading, in the field

Ghar se ghar tak, apni bijli apnon ke liye: from one home to another, our power for our own. Click the frame to play.



WHAT TO WATCH FOR

A rural household with solar becomes a prosumer: someone who can buy, store and sell energy, and earn from the surplus.

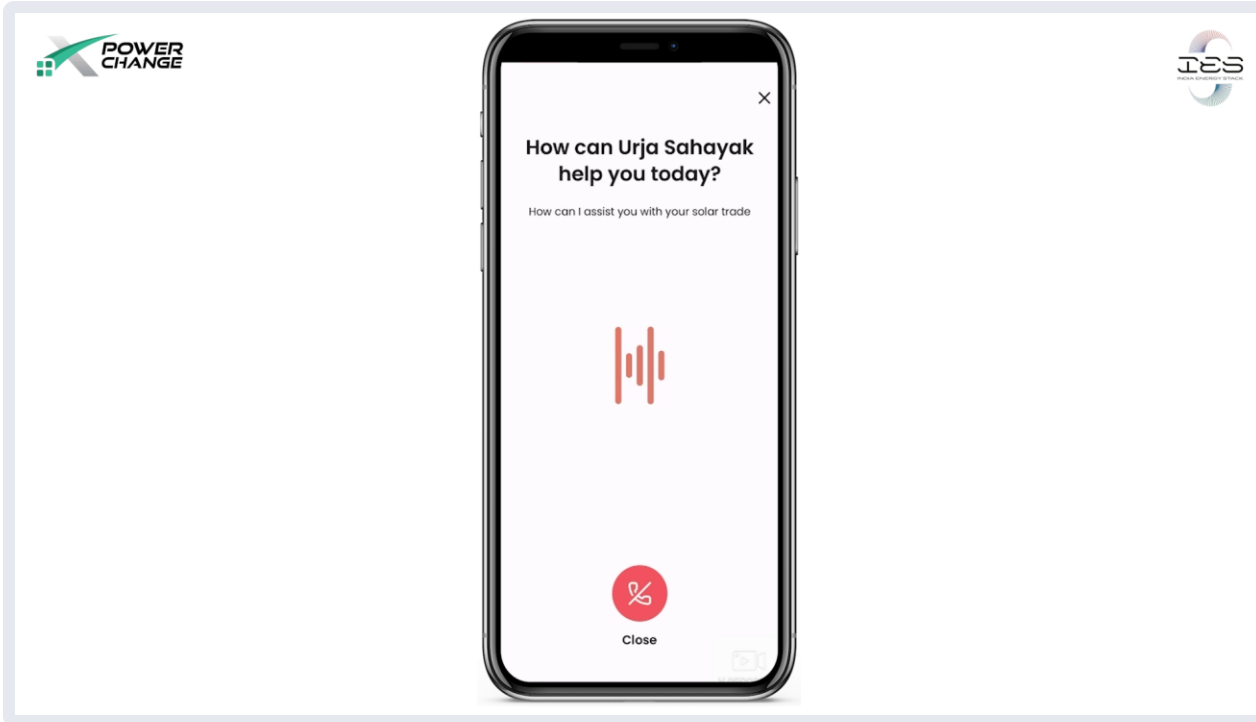
The buyer and seller do not need to be on the same platform or the same utility. IES specifications carry the offer, the identity check and the settlement.

In Hindi with English subtitles.

India Energy Stack: Peer-to-Peer Energy Trading · 4:19 · Embedded, plays offline

How the two trading platforms were built

Two platforms, PowerXchange and Pulse, built to the same published specifications. Click the frame to play.



PowerXchange and Pulse · 2:34 · Embedded, plays offline

WHAT TO WATCH FOR

Two independent platforms, each built by its own team, reading the same IES specifications.

Urja Sahayak, the in-app assistant, takes a solar trade request in plain language. Orders are placed, tracked and settled from the phone.

Because both platforms speak IES, a prosumer on one can trade with a consumer on the other. No integration between the two was built.

A copy of the full video is also on Google Drive, linked below.

One consumer's journey: proof in seconds, not weeks



A small-business owner in Visakhapatnam wants a green loan. The bank asks for proof of her connection and her 5 kW rooftop system. Today that means a manual letter from the DISCOM, repeated KYC and weeks of back and forth.



STEP 1

Issue

Her DISCOM checks its records and issues the Passport as a signed certificate. An installer can also issue asset credentials.



STEP 2

Hold

It lands in her DigiLocker wallet. It belongs to her, like a document, not a login.



STEP 3

Share

She shares only the fields the bank needs: sanctioned load and solar capacity. Nothing more.



STEP 4

Verify

The bank checks the DISCOM's seal on its own, in seconds. No call to the DISCOM. No paper.

Outcome: the loan is assessed on verified data, the same day. The certificate is reusable: for a subsidy claim, a service sign-up, or a new DISCOM after moving cities.

Full specification: india-energy-stack.gitbook.io/docs → Use Cases → Consumer Energy Passport

The Meter Digest: consumption you can prove

The Passport proves who you are. The Digest proves how much you use, month by month, signed by your utility.



Consumer Meter Digest: monthly kWh by appliance, Feb 2025 to Jan 2026

WHAT IT IS FOR

A consumer can show a bank, a scheme or a solar installer a year of verified consumption without visiting the utility or handing over bills.

Reusable across utilities and States: the record travels with the consumer, not with the connection.

Machine-verifiable, so a lender, a subsidy administrator or an energy-efficiency service can act on it without a manual check.

Issued as a W3C verifiable credential carrying the utility's own signature, revocable by the utility alone.



Where it stands: issuance is proven in the pilots. Acceptance by banks and scheme administrators is the next step, and it is a demand problem, not a technology one.

The IES AAA: Architecture, Accelerator, Adoption

Three parallel tracks. They are not sequential phases; they run concurrently and reinforce each other.



Architecture

The technical blueprint: shared data models, identifiers, APIs, registries and assurance requirements. It defines the rules for exchange between federated systems.



Accelerator

The practical enablers that speed up adoption: sandbox environments, testing tools, conformance kits, reference implementations, training and a developer ecosystem.



Adoption

The institutional conditions for national scale: certification to verify readiness, incentives to motivate participation, data policy and success metrics.

The Accelerator is not a phase. It is a permanent function that evolves as IES matures, from hands-on support for early adopters to a self-service ecosystem at scale.

What IES changes for the sector



Integration cost falls

One published standard replaces bespoke point-to-point work. New integrations take days, not months.



No vendor lock-in

Conformance is written into procurement. Vendors build to a published standard; the utility is not tied to one supplier.



Each capability costs less

The identity and trust foundation is reused, so new use cases build on what is already in place.



New services become viable

Banks, financiers and aggregators can build on verified energy data, creating demand that flows back to the DISCOM.



Existing data does more

The same data a DISCOM already holds becomes usable for forecasting, loss reduction and consented services.

Real gains for four groups



For consumers

Your energy history becomes portable and verifiable. Use it for a green loan, a subsidy or a new service, without repeated paperwork or calls to the DISCOM.



For the grid

Every rooftop solar unit or small battery gets a verified identity when first connected. Operators gain reliable visibility, and resources connect across DISCOMs and aggregators.



For regulation

Filings reach the regulator already signed and in one consistent format. Tariff orders become computable. Regulators move from reading PDFs to monitoring data.

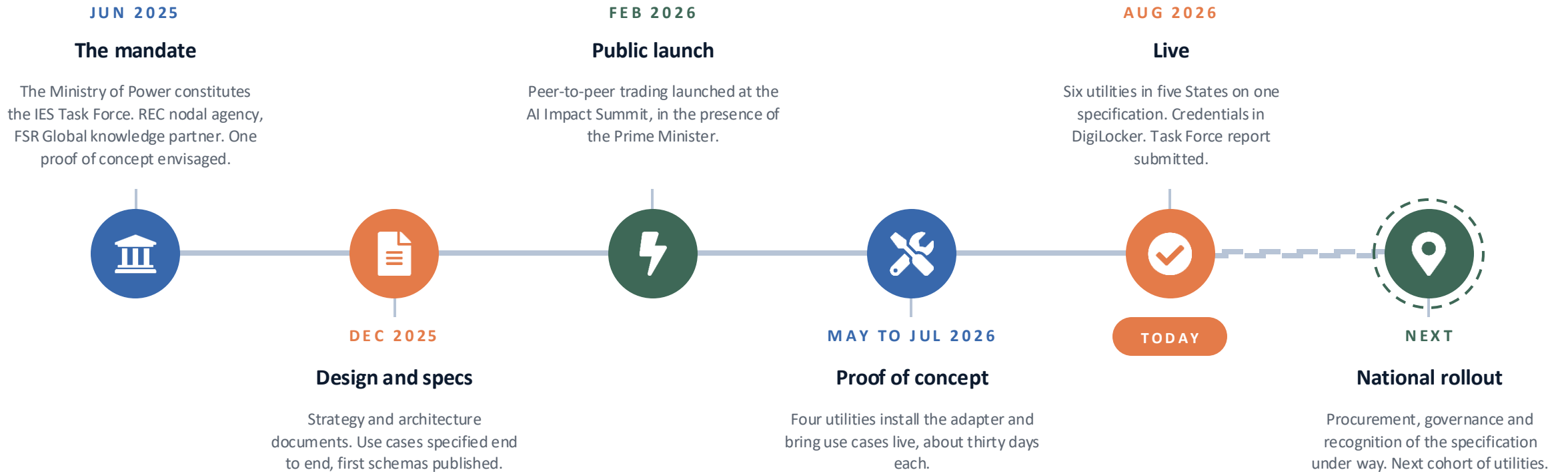


For markets

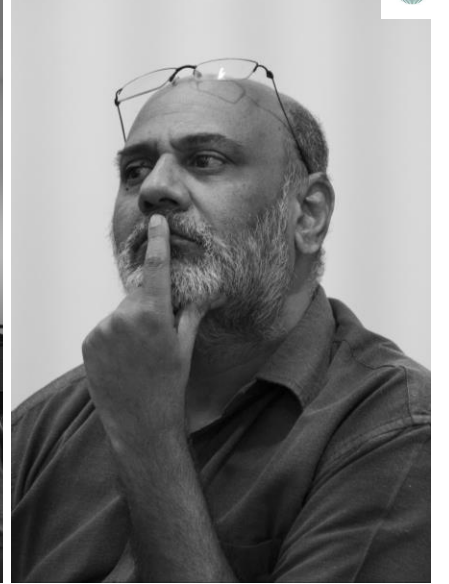
Demand flexibility, peer-to-peer energy exchange and open access become workable in practice, without a separate agreement between every pair of participants.

From a mandate to six live utilities

The order of June 2025 envisaged one proof of concept. This is what happened, and what comes next.



Fourteen months from set-up to first live use. Aadhaar took twenty, ONDC ten, the Account Aggregator sixty.



One Nation, One Frequency, and now One Digital Grid

BUILT IN INDIA, FOR THE WORLD

THANK YOU

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