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India’s Energy Internet Revolution

Intelligence as Infrastructure

Presenter: **Manoj Muthyala & Vishakha Chavan**

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What If Energy Flowed Like Information Online?

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In 2025, the world debates energy transition — India is building it.

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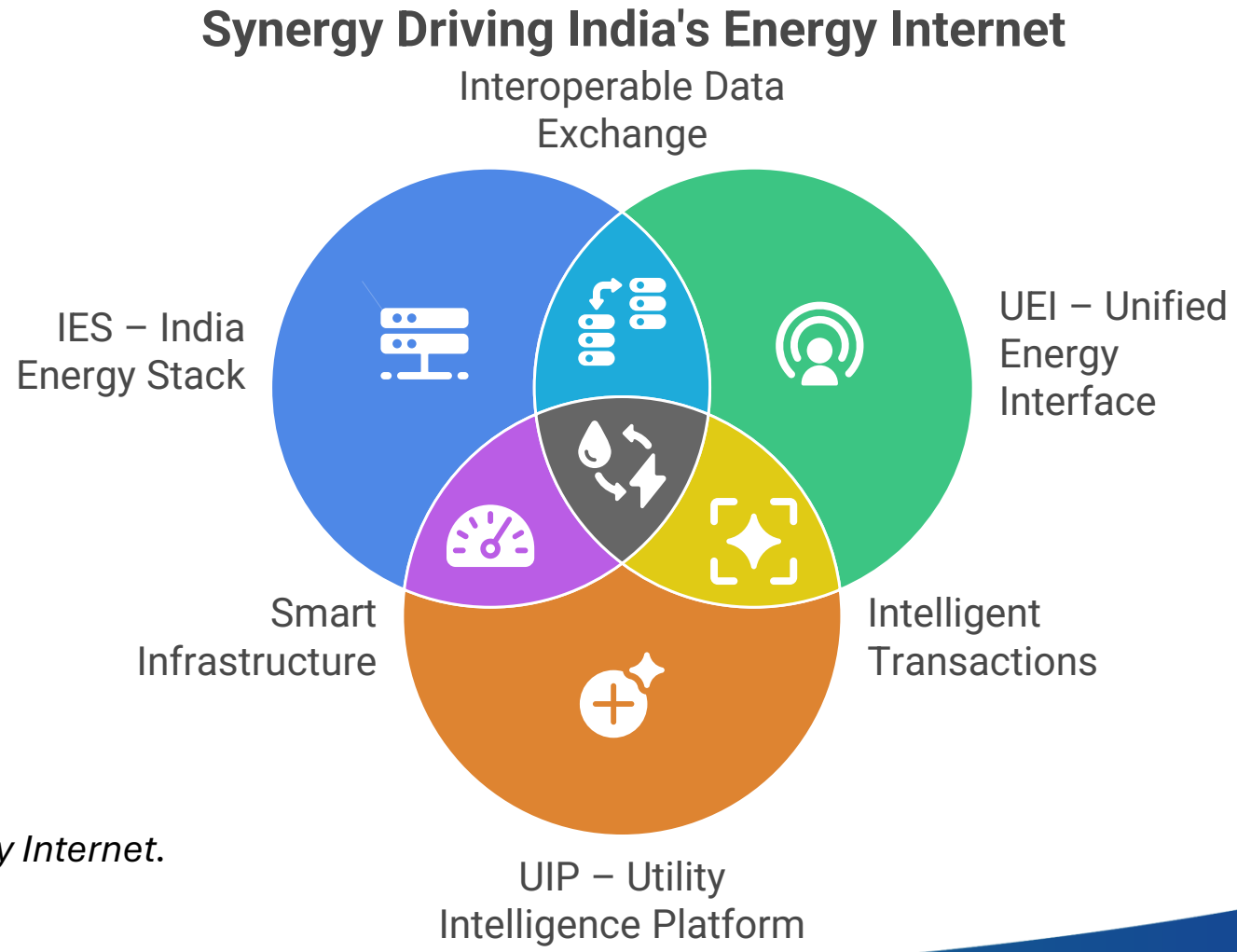
What if Energy Flowed Like Information Online?

In 2025, the world debates energy transition — India is building it.

- ✓ **India Energy Stack (IES)** – a national-scale data backbone enabling trusted, secure energy data exchange across utilities, markets, and prosumers.
- ✓ **Unified Energy Interface (UEI)** – the transaction layer that standardizes interactions among producers, consumers, EVs, and distributed energy resources.
- ✓ **Utility Intelligence Platform (UIP)** – the intelligence fabric that transforms data into action through AI-driven forecasting, automation, and market coordination.



Together they form the world's first national-scale Energy Internet.

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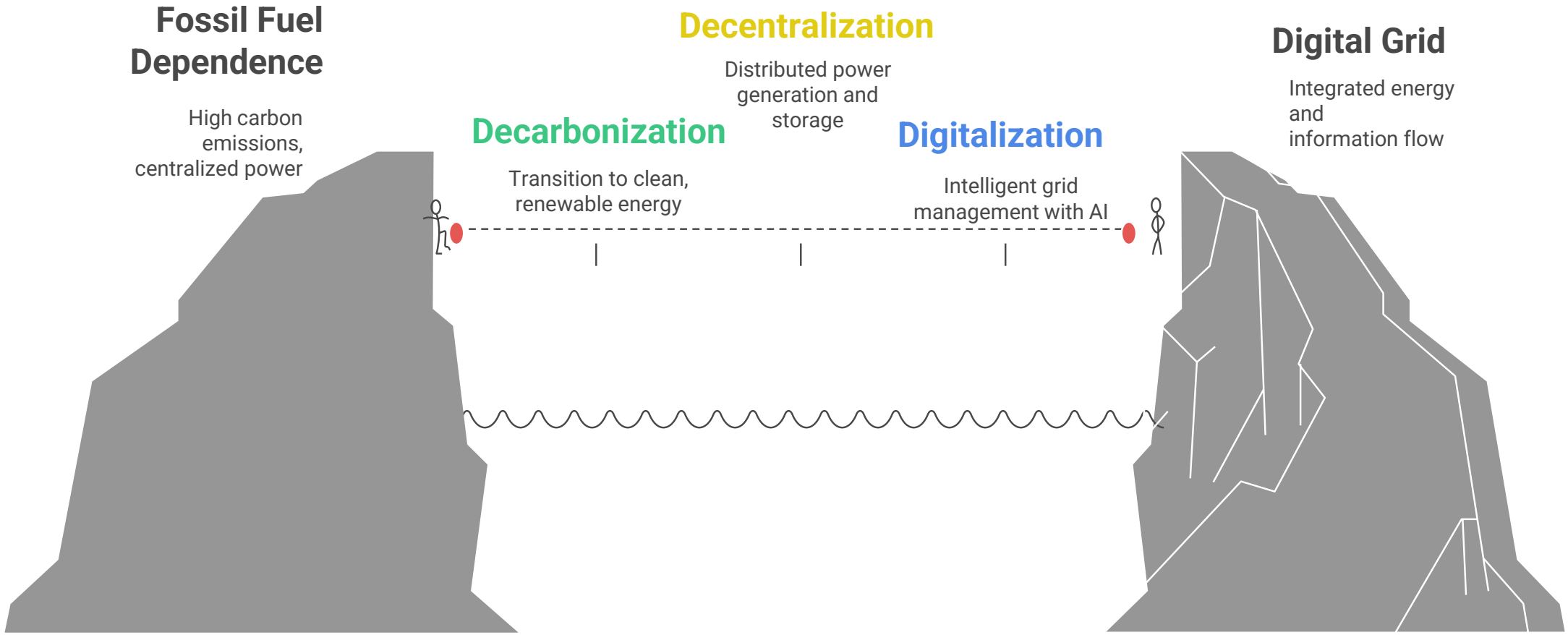
Power Sector’s 3D Transformation



Transforming India's Energy Landscape

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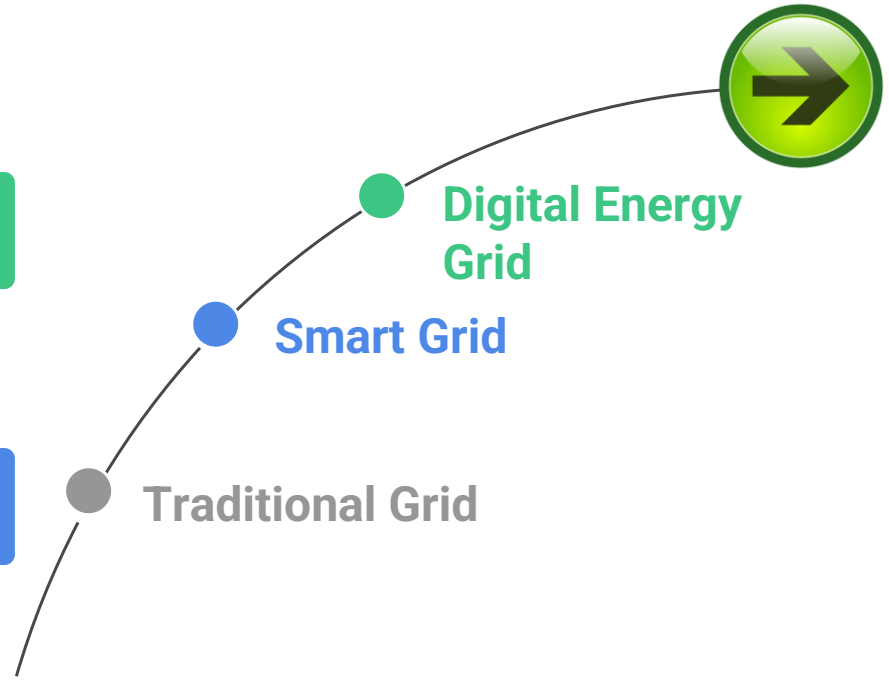
From Traditional Grids to Digital Energy Grids

Interoperable & AI-Driven
Fully digital, interoperable ecosystem with AI-driven automation and self-learning capabilities

Distributed & Predictive
Distributed generation, predictive analytics, and automated responses

Centralized & Reactive
Centralized power generation and reactive control



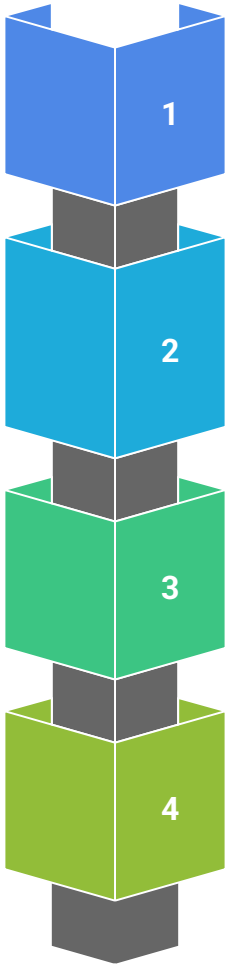
Traditional Grid	Digital Energy Grid
One-way power flow	Bidirectional prosumer flow
Manual operations	Autonomous real-time decisions
Siloed systems	Interoperable open infrastructure
Passive consumers	Active market participants
Utility-centric	Ecosystem-centric

The Four Layers of the Energy Internet

Thermal, Renewables, Biomass, Diesel/Gas/Oil, Large Hydro, Transmission, Substations

Digital /Smart meter, SCADA, Iot devices, Load Dispatch centers, EVs

Billing, P2P Trading, DER, DR, Power market



Physical Layer

The foundational infrastructure that supports all other layers.

Digital Backbone

The network that connects the physical layer to higher-level functions.

Data & Intelligence Fabric

The layer that processes data and provides insights.

Market Layer

The interface where users interact with the system.

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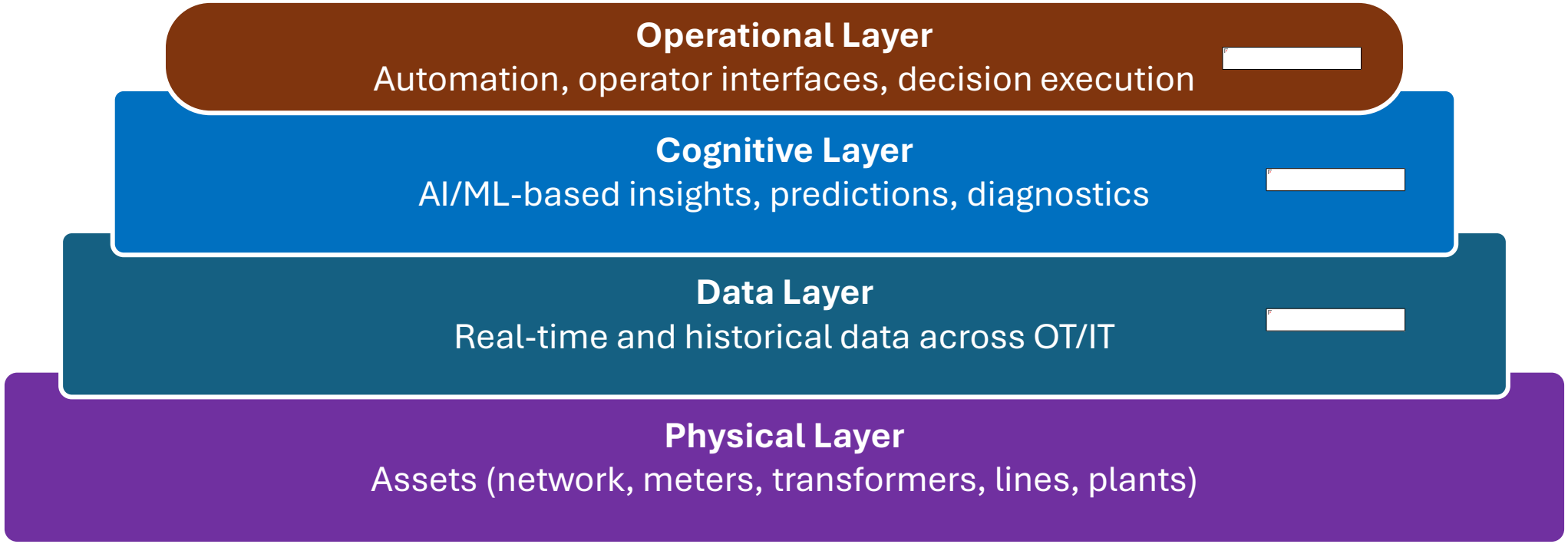
ImpresaAI+ Utility Quadruplet

An Intelligence Platform for Utilities

A 4-layer Intelligence Framework to help utility operate in smart and adaptive way.



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India Energy Stack — The “UPI for Energy”

Core Digital Architecture of the Energy Internet

Unified Digital Identity

(EC-ID, EP-ID, AR-ID, T-Hash)

- Each entity in the Energy Internet—whether a person, prosumer, asset, or transaction—has a verifiable, portable, and interoperable digital identity.
- EC-ID (Energy Consumer ID): A single, authenticated identifier for every consumer across utilities, enabling seamless service portability.
- EP-ID (Energy Prosumer ID): Links rooftop solar, EV, and storage assets under one digital persona, supporting energy trading and net-metering.
- AR-ID (Asset Registry ID): Digitally twins every meter, transformer, and inverter, allowing lifecycle tracking and predictive maintenance.
- T-Hash (Transaction Hash): Creates immutable, timestamped records for every energy transaction or consent event.

Consent-Based Data

(User-controlled sharing | Granular permissions | Real-time revocation)

- User sovereignty: Consumers and prosumers decide who can access their data, for what purpose, and for how long.
- Granularity: Consent can be granted at the attribute level — e.g., voltage data shared, billing data withheld.
- Revocability: Permissions can be withdrawn instantly, ensuring continuous compliance with evolving privacy laws.
- Audit trail: Every consent action generates a cryptographically verifiable transaction hash (T-Hash).

Open APIs

(Interoperability | Innovation | No vendor lock-in)

- Interoperable by design: Open API standards align utilities, startups, and regulators around a shared data language.
- Plug-and-play innovation: Developers and third parties can build applications—billing, DER optimization, EV charging, demand response—without proprietary barriers.
- Scalability: Common APIs simplify national-scale deployments, aligning with India Stack and the Unified Energy Interface (UEI).
- Vendor neutrality: Eliminates silos and ensures long-term sustainability of public infrastructure.

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UIP – The Analytics-Driven Utility Platform

Core Digital Architecture of the Energy Internet

- Core Capabilities of UIP:
  - Real-Time Grid Optimization
    - Autonomous balancing of supply, demand, and storage using AI-driven forecasts and control loops.
  - Predictive Maintenance
    - Digital twins of assets detect degradation early, reducing outages and extending asset life.
  - P2P Trading Enablement
    - Seamless exchange of energy between prosumers through trusted, auditable digital transactions.
  - Dynamic Pricing & Demand Response
    - Tariffs that adapt to grid conditions — encouraging efficiency, fairness, and participation.
  - Unified Data Fabric
    - One interoperable analytics layer linking AMI, GIS, SCADA, EV, and renewables data in real time.

UIP – The Analytics-Driven Utility Platform

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UIP — The Brain of the Grid

Data from generation assets (output, status, faults) feeding into UIP

UIP optimizing load flows, detecting anomalies

UIP managing voltage, reliability, transformer load

Two-way data flow for prosumers, demand response

UIP generating insights, compliance analytics, and forecasts

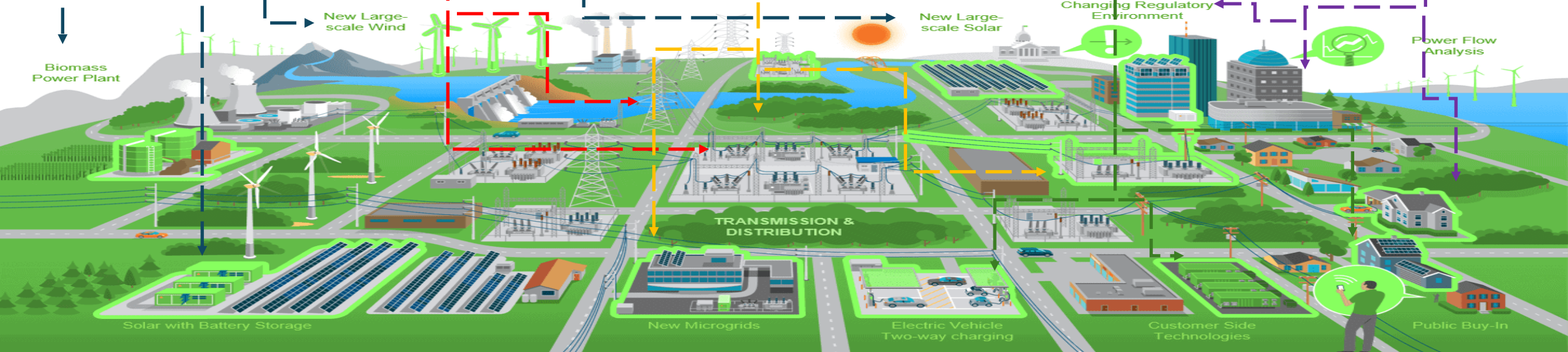
GENERATION

TRANSMISSION

DISTRIBUTION

CONSUMPTION / PROSUMPTION

MARKET / POLICY / REGULATORY



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But 65–70% Digital Grid Projects Will Fail Globally

Why 60–70% Digital Grid Projects Will Fail Globally

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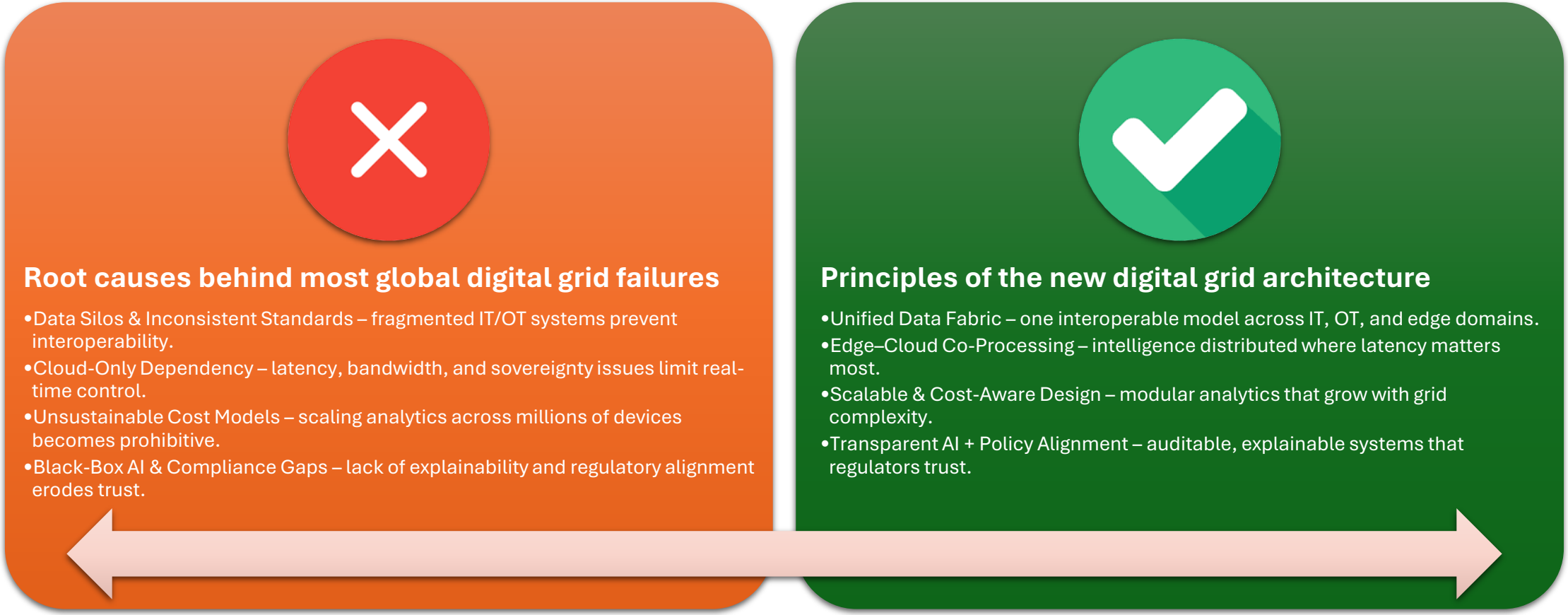

Digital grids don't fail because of technology — they fail because of architecture. UIP changes that.

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The New Utility Intelligence Checklist

What's Actually Needed

- ✓ **Data Unification** | Break the silos between IT, OT, and IoT — one data model powering every decision.
- ✓ **Edge + Cloud Architecture** | Real-time analytics at the edge, deep learning at the cloud — unified intelligence without latency.
- ✓ **Cost-Optimized Storage** | Tiered storage for petabyte-scale utility data — efficient, secure, and compliant.
- ✓ **Deployment Flexibility** | Run anywhere — data center, edge node, or cloud — without vendor lock-in.
- ✓ **Explainable AI** | Transparent and interpretable models — trusted by operators and regulators alike.
- ✓ **99.9 % Reliability** | Mission-critical uptime with built-in redundancy and self-healing workflows.
- ✓ **Modular Open Standards** | Plug-and-play integration with existing MDM, HES, GIS, AMI and SCADA systems.

> *ImpresaAI+ delivers all these — purpose-built for India's digital grid.*

Why ImpresaAI+ for India

Built for India. Proven Globally.

- Up to 85–99% accuracy in load forecasting with precision-driven load disaggregation
- 10–20% reduction in technical losses
- Scaled to ingest ~20 TB data every day in a single instance
- Seamless integration with Oracle, SAP, ESRI GIS, SCADA, AMI systems (>12 head end systems), and leading platforms like Itron, Esri, GE, and AspenTech
- Time-to-value: 3 months, using prebuilt data models, AI templates, and ready-to-deploy AI models

India’s Critical Moves for the Next 18 Months

The Three Imperatives

- ➢ Deploy Intelligence with Digital Infrastructure
  - From data collection → to real-time decisioning → to autonomous operations.
- ➢ Embrace Open Architecture (Beckn + UEI)
  - The Energy Internet grows like UPI — many players, one trusted backbone.
- ➢ Build the Ecosystem (Startups • Innovators • Investors)
  - A thriving, self-sustaining Energy Internet economy by 2026.

India has a 12–18-month global lead. The window is now.
The world will follow the model we build — if we move fast, together.