ASIA CLEAN ENERGY FORUM 2026
Beyond Transition: Building Secure, Resilient, Inclusive, and Intelligent Energy Systems
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South Asia Regional Session

The Need of the Hour: Rethinking Energy Systems for Security and Integration

Scene Setting Presentation

Session 1: From Security to Strategy: Designing a Secure and Integrated South Asian Energy System

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KPMG

Global Energy Crisis points to a strategic reset for

What the Crisis Revealed

Energy = National Security Lever
Crisis elevated energy from strategic asset tied to geopolitics, inflation, and economic stability

Concentration = Vulnerability
Over-reliance on a single-source is a systemic risks & concentrated supply chains

Fossil Systems = Structural Volatility
Persistent exposure to price shocks and geopolitical risk

What the Crisis Accelerated

Renewables transitioned: 'climate choice' to 'strategic imperative'
Renewables now cheaper, scalable & security-enhancing (higher resilience)

Crisis Accelerated Transition
Record growth in renewables, storage & electrification

Digitalization & Intelligence critical
Centrality of digital & analytics layer (AI enablement)

Demand & Efficiency as First Response
Countries used this as a fast lever: "negawatts" = lowest-cost lever

What Must Change Going Forward ("Realizations")

From Fragmented → Integrated Systems
Traditional siloed planning provided inadequate – integrate power, gas, molecules, storage etc.

From Efficiency → Resilience by Design
Energy systems must be designed for shocks - redundancy, storage, flexibility & decentralized response, not only least-cost

From Global Dependence → Regional Resilience
Increasing regionalization of energy systems – domestic manufacturing & regional partnerships

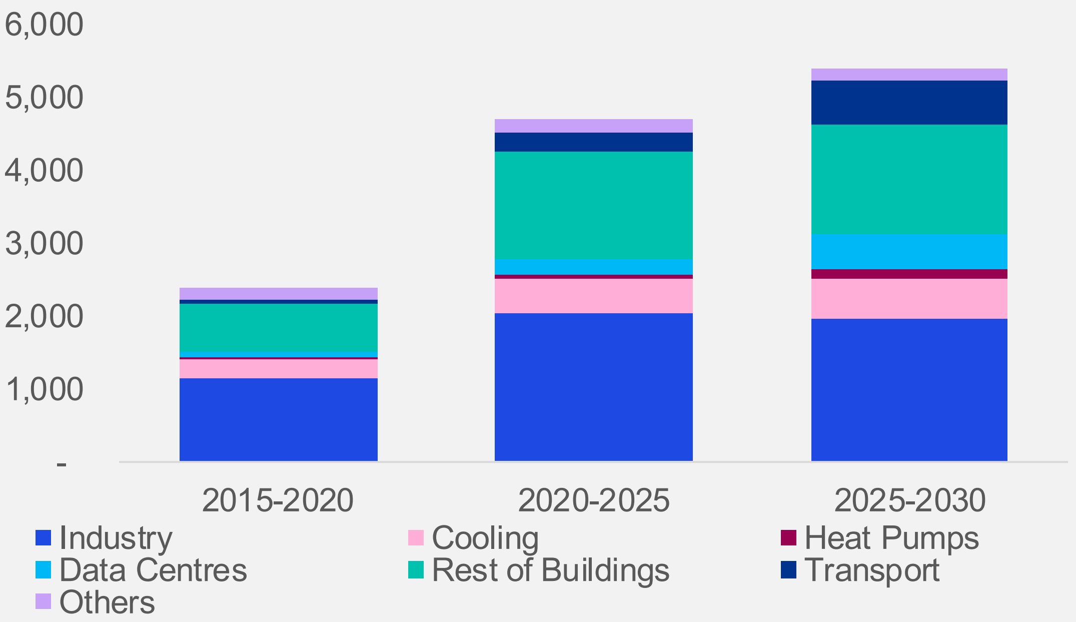
From Old Risks → New Dependencies
Critical minerals & clean supply chains are new vulnerabilities

Energy Transition (Sector)→ Whole-Economy Transformation
Energy strategy must align with industry, trade & economic policy

“How do we redesign energy systems that are not only clean - but secure, resilient, and intelligently integrated across the entire economy?”

Energy demand is growing faster, more weather-sensitive, and more electrified than legacy systems were designed for

Global Electricity Total Demand by Sector and End-use (TWh, 2015-2030)



Future demand is driven by cooling, transport and climate-driven peaks not just traditional industrial consumption alone

Country	Key Demand Characteristics
India	**Cooling-led peaks, with rising digital & electrification loads** • Peak demand reached ~271 GW; data centre demand to rise from 1.5 GW (2025) to 13.5 GW (2032)
Nepal	**Electrification-led and winter-peaking demand profile** • Demand concentrated in morning and evening hours due to EV, e-cooking and household load; Future digital load
Bangladesh	**Rapid industrial, manufacturing and urban load growth** • Power demand growing at 7-10% annually
Bhutan	**Industry-led demand with winter stress; digital load emerging** • >75% industrial demand; 40–50 MW data centre emerging
Sri Lanka	**Emerging flexibility-intensive & tourism-linked demand** • >70% RE generation targeted by 2030; 1,700 MW RTS achieved by mid-2025

Demand is not just increasing, it is becoming harder to serve with legacy systems

Demand is becoming more peak-driven and variability-intensive - requiring fundamentally different system design

KPMG *Source: Electricity 2026, IEA*

South Asia's next growth cycle will be shaped by how it designs its energy system

Growth is Accelerating

Fastest-growing EMDE region even amid global headwinds

6.3%

Projected real GDP growth in 2026

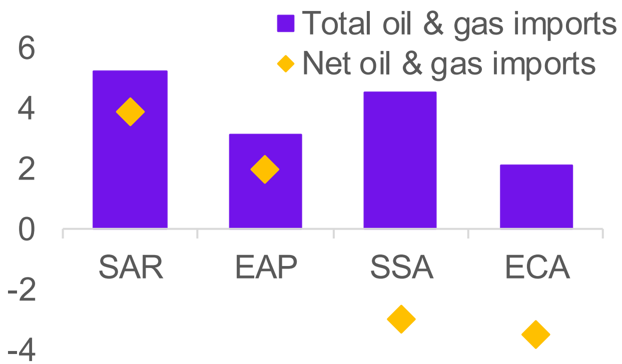
Source: South Asia Economic Update (April 2026), World Bank Group

Growth will increasingly depend on system reliability and flexibility - not just supply expansion

Vulnerability is Rising

Highest dependence on imported oil and gas among EMDE regions, increasing exposure to global price and supply shocks

Oil & gas imports (% of GDP, 2024)



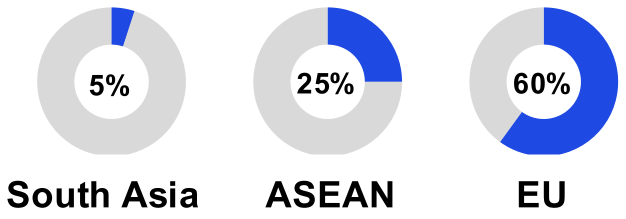
Source: CEPII BACI; World Development Indicators (database); World Bank.

External energy shocks are no longer episodic rather, they are a structural macroeconomic risk

Integration is Lagging

Power, fuels, and regional networks are expanding - but largely in parallel, not as an integrated system

Intra-regional trade as % of total trade



Source: SAARC Chamber of Commerce and Industry.

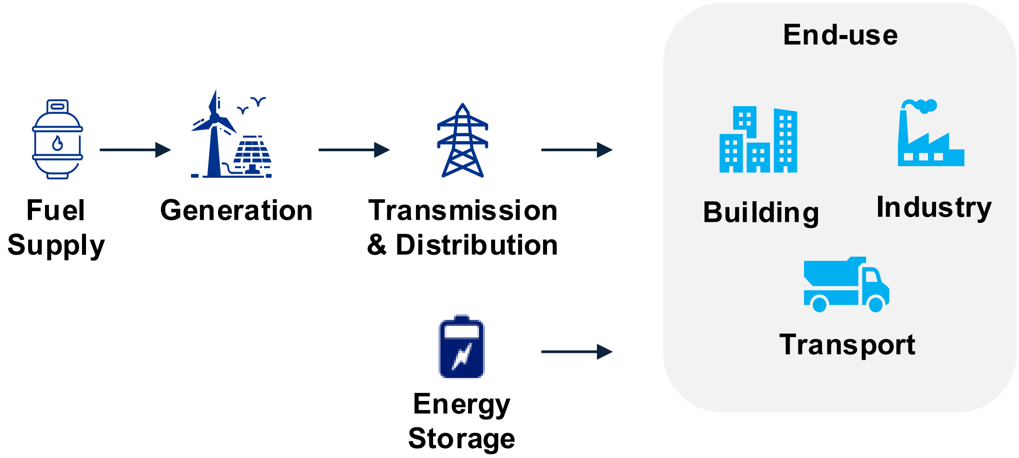
Fragmentation is now a strategic risk—raising costs, limiting flexibility, and weakening resilience

The strategic question is shifting from "How much capacity should we add?" to "How should the system be designed?"

Note: EMDE = Emerging Markets and Developing Economies; SAR = South Asia; EAP = East Asia and Pacific; SSA = Sub-Saharan Africa; ECA = Europe and Central Asia.

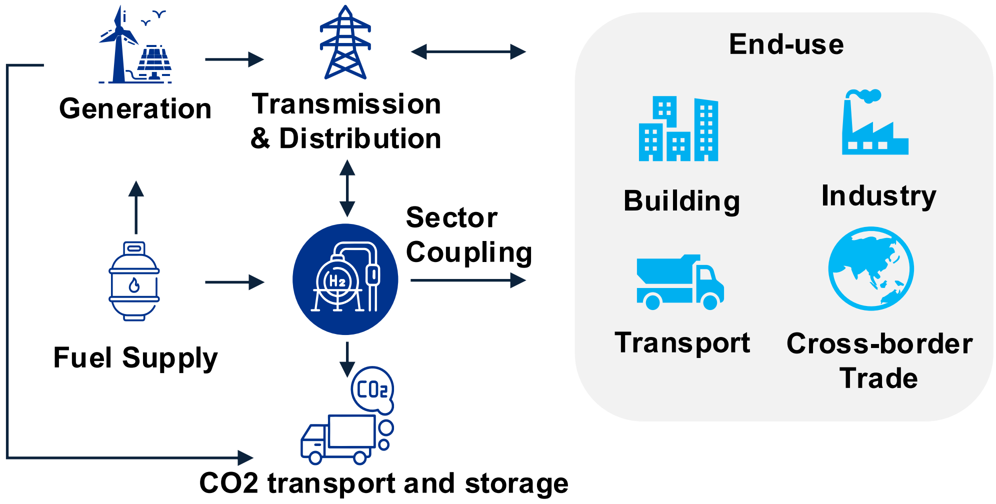
Fragmented energy system leads to inefficiencies and missed opportunities towards a secure and efficient energy system

Traditional Approach – Fragmented Planning



System outcomes are driven by isolated components

Emerging Integrated Systems *(Power to X)*



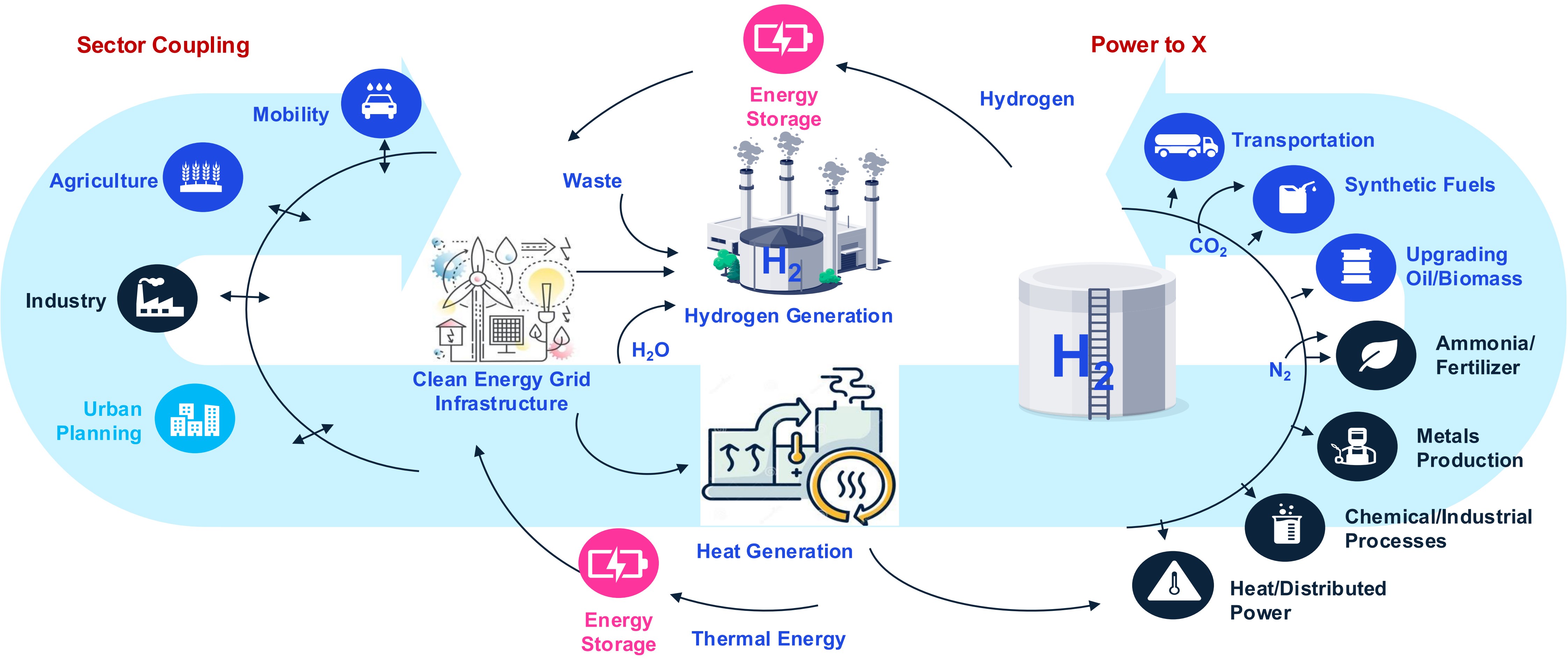
System outcomes depend on coordination, not isolated components

Key System-level Inefficiencies due to Fragmented Planning

Generation without system readiness	Grid expansion without demand alignment	Storage treated as optional	Regional complementarities underutilised
Capacity added without evacuation, flexibility, or balancing	Transmission expansion misaligned with future load centres	Storage remains peripheral rather than core system infrastructure	Cross-border diversity and trade remain largely untapped

Fundamentally, today's grid and gas models rarely co-optimize heat, mobility, industry and molecules together

Integrated Energy Systems “Power to X / Sector Coupling’ at play



Electrons start the journey – but through Power-to-X, they become fuels, heat, and feedstocks that travel across every sector

Integrated energy system design must happen at three levels

Integrated Energy System Design

Level 1 – Intra-system Integration

Integrate renewables into core system operations

- Co-plan RE, grids, and storage
- Scale flexible capacity (storage, hydro, demand response)
- Strengthen grid operations and system forecasting

Improves flexibility and reliability in high-renewables systems

Level 2 – Inter-system Integration

Plan Power with other sectors (X - heat, mobility, industry & molecules)

- Link electricity with industrial demand and clean fuels
- Align energy systems with clusters, ports, logistics
- Prioritise clean fuels for hard-to-abate sectors

Turns energy transition into a competitiveness and jobs opportunity

Level 3 – Inter-country Integration

Expand systems across countries and markets

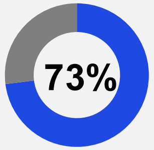
- Leverage aggregation benefits
- Enable and scale regional power trade and system balancing
- Align regulations and market mechanisms

Lowers costs and diversifies system risk

Integration is not one reform, it must happen across power system operations, sectors, and countries

Inter-system integration in action: Electrifying transport to reshape energy demand

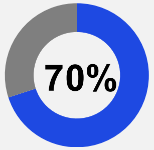
Transport Electrification at National Scale:	Electric Vehicle Adoption in Nepal



New private EV car sales as % of total sales in 2025

1,500+

EV charging stations in 2025



Targeted EV share in commercial public transport by 2030

550+ MWh

Daily power consumption of EVs

System Role and Impact

- Shifts transport energy from imported fuels to domestic electricity
- Introduces new and flexible load into the power system

Operationalization Strategy

- Strong policy incentives (low import duties and taxes for EVs)
- Rapid expansion of charging infrastructure
- Alignment with surplus hydropower availability to absorb demand

Value Unlocked

- Enables sector coupling between power and transport
- Reduces fossil fuel imports and improves energy security
- Creates new demand for domestic hydropower generation

Electrification of transport is not just a demand shift, it is a system-level integration of energy supply and end-use sectors

Inter-country integration in action: Expanding power systems across borders

Cross-border Power Trade in South Asia:	Bangladesh, Bhutan, India, Nepal (BBIN)

~23.5 TWh
Trade across region in 2025

~40 MW
First trilateral trade: Nepal to Bangladesh via India's grid

3X
Growth in trade since 2013

System Role and Impact
- Optimises complementary resources across countries
- Balances seasonal and real-time variability across systems
- Reduces redundant capacity needs

Operationalization Strategy
- Cross-border transmission expansion
- Standardised regulatory frameworks
- Multilateral trading frameworks
- Market participation in power exchange (DAM/RTM)

Value Unlocked
- Lowers costs through regional resource optimisation
- Improves reliability via shared system reserves
- Enables renewable integration at regional scale

Regional integration allows systems to operate as one - unlocking cost, flexibility, and reliability beyond national systems

Note: DAM = Day-Ahead Market; RTM = Real-Time Market

Intra-system integration in action: Embedding storage into grid operations

Utility-scale BESS Deployment at Distribution Level:	BRPL Kilokari BESS Project (Delhi)

Location: Kilokari Substation, Delhi, India

Capacity: 20 MW / 40 MWh

Commissioning year: 2025

Backup: 4 hours peak-time support - 2 each during afternoon and night peaks

Coverage: Serves ~100,000 consumers

System Role and Impact

- Manages urban peak demand and load variability
- Enables higher renewable integration at distribution level
- Improves grid stability and reliability under high-stress conditions

Operationalization Strategy

- Embedded in long-term resource adequacy planning
- Deployed close to load centres (distribution-level integration)

Value Unlocked

- Delivers stacked services across the grid (balancing, reserves, peak shaving, ancillary services, and grid stability functions)
- Shifts storage from optional asset to core infrastructure

Storage is being integrated into how power systems are planned - —not just deployed as standalone projects

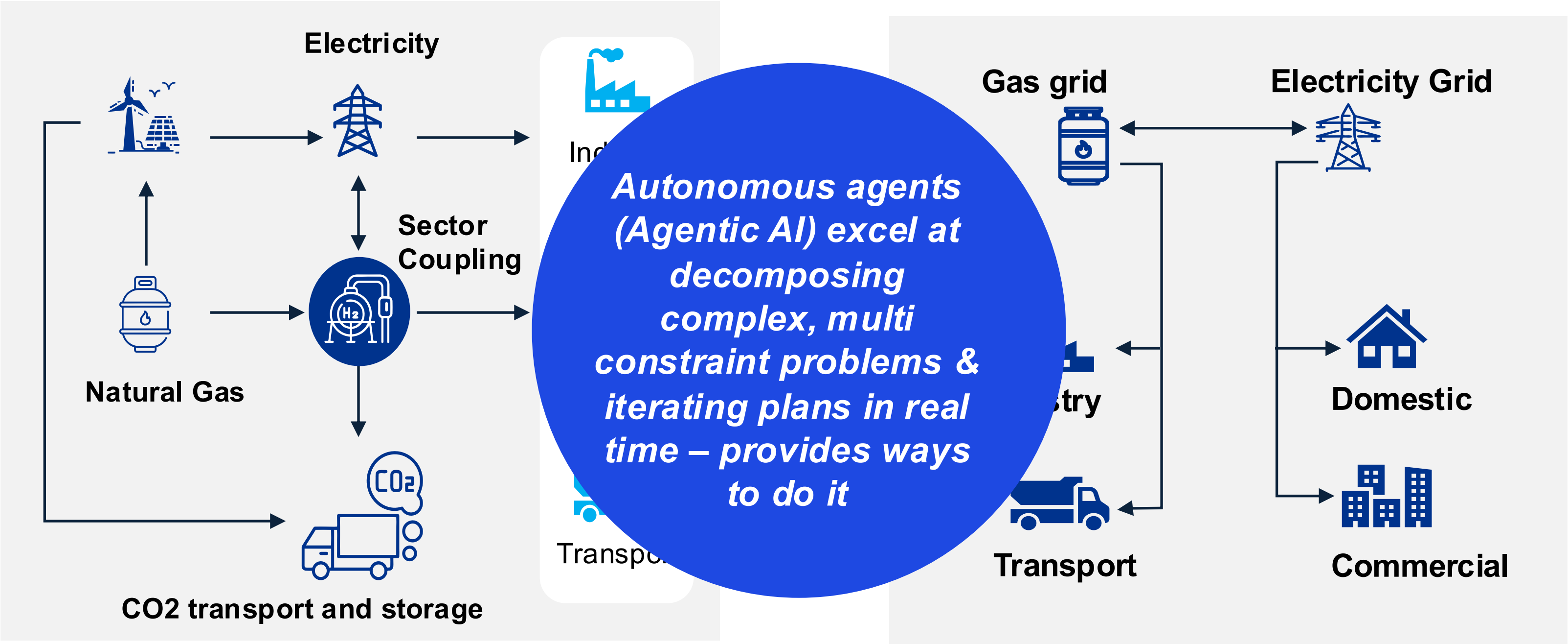
Integration is complex: Decisions in one system create consequence for multiple interconnected systems

Complexity spike

Electrification, hydrogen, e-fuels, CO_2 loops, and EV to grid all compete for the same grids, pipes, and capital

Co-optimization

Co optimise heat, mobility, industry, and molecules together



Not easy! Too many systems and sub-systems

Deliberate Choice to move from:

Static 10-20 yrs planning to rolling and adaptive cycles	**Link multiple energy vectors and tools (digital twins, agentic AI etc)**	**Enables muti-agency and cross sector coordination**

Framework - Integrated planning need to shift from traditional siloed planning/forecasting to an integrated, adaptive, and intelligence-augmented model

1 Adopt a System-of-Systems Mindset

- Treat **energy system as an interconnected web of vectors** (electricity, heat, fuels, hydrogen, CO_2) & sectors
- **Action:** Create integrated energy models that co-optimise the above across temporal & spatial scales

2 Build a Multi-Vector Digital Twin

- Consider **dynamic simulation model** that includes power grids; hydrogen/gas networks; district heating systems; storage assets; carbon capture
- **Benefits:** Real-time scenario testing; local vs national impact; **investment recommendations & trade offs**

3 Integrate Agentic AI and Generative AI Tools

- **Agentic AI:** Automates scenario building; co-optimisation, & re-planning
- **Benefits**: **Integrate info from multiple sources** – texts, tech specs, engg. data, climate models into decision-support
- Gives **semantically searchable knowledge graphs**

4 Shift to Adaptive, Iterative Planning Cycles

- Transition from 5-10 yr masterplans to **rolling forecasts updated quarterly or semi-annually**
- **Scenario trees with branching futures** (e.g., hydrogen succeeds vs. fails in transport)
- **Contingency pathways** with market signals-based triggers (e.g. carbon price, storage costs)

5 Quantify Cross-Sectoral Value Streams

- **Embed economic metrics that span sectors**: (i) value of avoided grid upgrades vs local H_2 production; (ii) value of EVs acting as peaking storage etc.
- **Tools:** Social cost of carbon, **LCOx** (levelised cost of energy/fuel/heat), marginal abatement cost curves, etc.)

6 Institutionalize Inter-Agency Coordination

- **Centralized Integrated Energy Planning Task Force** that coordinates across power, transport, gas, industry, & climate ministries
- Align KPIs (e.g., emissions reduction, reliability, cost) across agencies
- Several countries aligned to approach – Germany, UK etc.

Thank You

“The need of the hour is not just cleaner energy—but secure and integrated energy systems - because energy systems that connect are the ones that endure.”

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