IRENA
International Renewable Energy Agency

The role of gas as clean energy carrier

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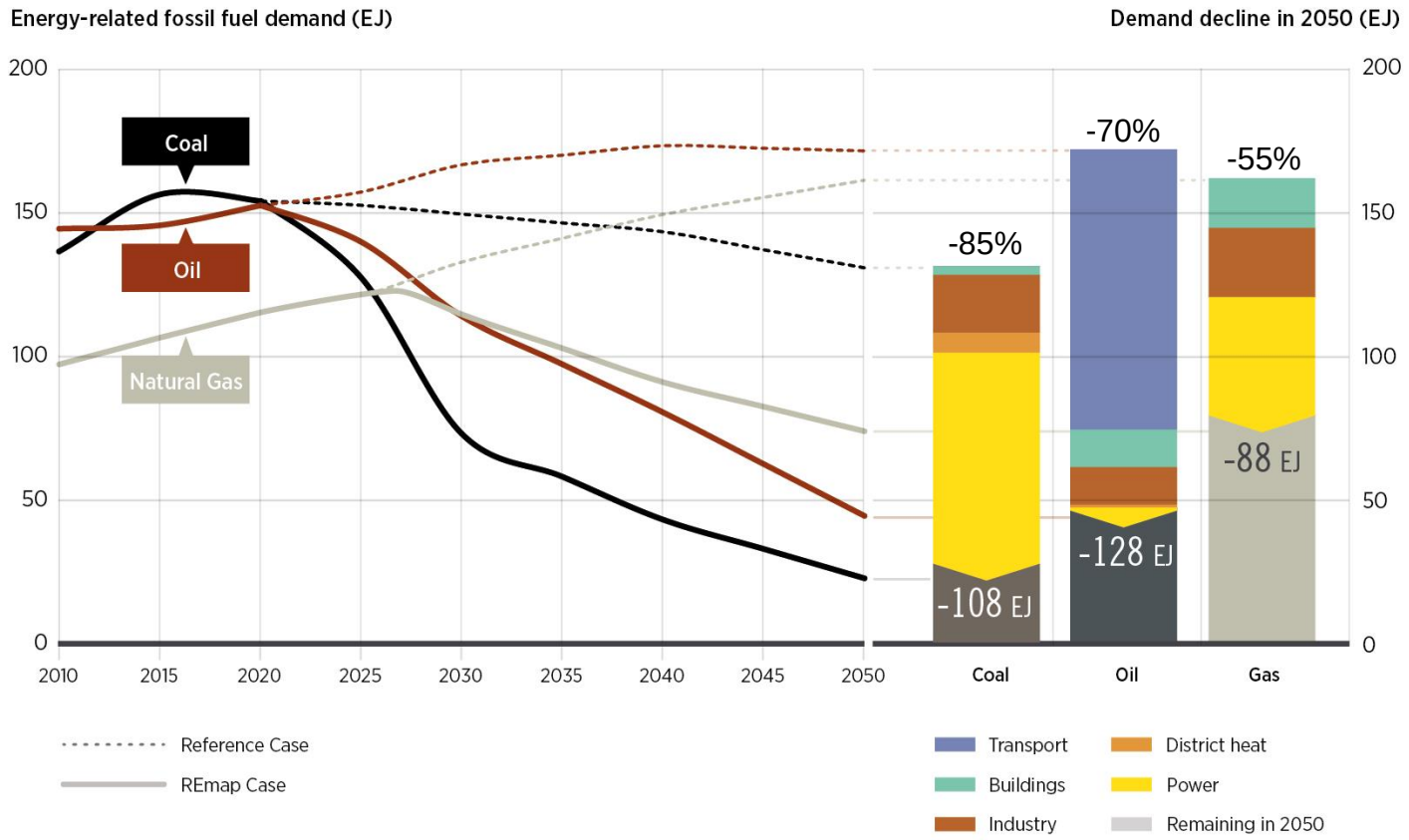
Gas Naturally COP24, 12 December 2018

What's new ?

- Climate action urgency and need to decarbonise energy supply and demand
  - Recognition that electrification has its limits
  - EV have changed the outlook for the transport sector
  - Scarcity of decarbonisation options in buildings heating, industry
- Low cost renewable power 2-3 cents/kWh
  - Need for flexibility in power systems
  - Need to deal with intermittency
- Prospect of stranded gas assets and realisation that this infrastructure can be used for hydrogen, synthetic methane, cleaned biogas
  - Future role of the gas industry
- Challenges
  - Economics
  - Chicken-or-egg problem related to infrastructure

Fossil fuel production must decline

Fossil fuel use (left), 2015-2050; decline in fossil fuel use by sector - REmap Case relative to Reference Case



Under the REmap Case, both oil and coal demand decline significantly and continuously, and natural gas demand peaks around 2027. In 2050, natural gas is the largest source of fossil fuel.

Innovation landscape for power sector transformation

Many sources of flexibility

Massive expansion of interconnections and supergrids

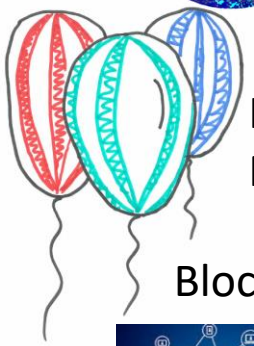
Electrification of end use sectors

Electric Vehicles and smart charging

Storage

Artificial Intelligence

Digitalization - IoT

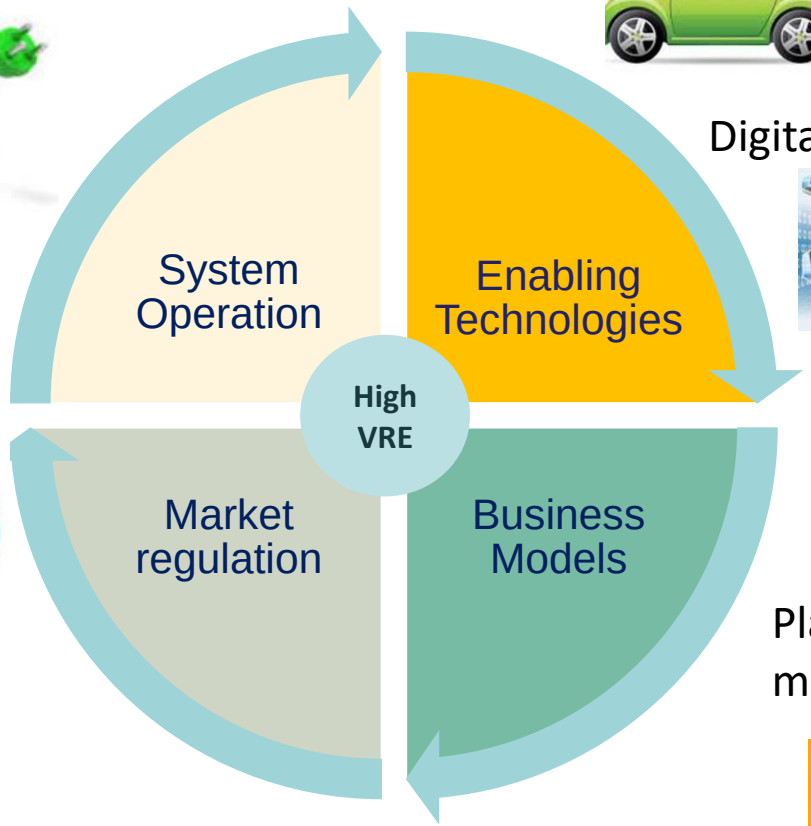


Hydrogen PtX

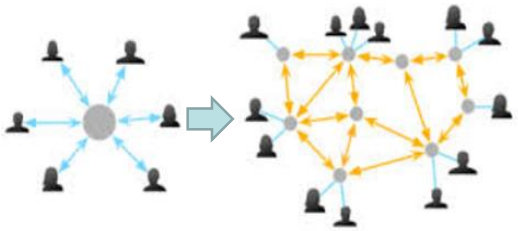
Blockchain

Encourage Flexibility, pricing that supports DSM/DSR

Value complement-arities in VRE

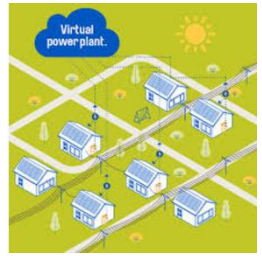


Decentralized system and Distributed generation

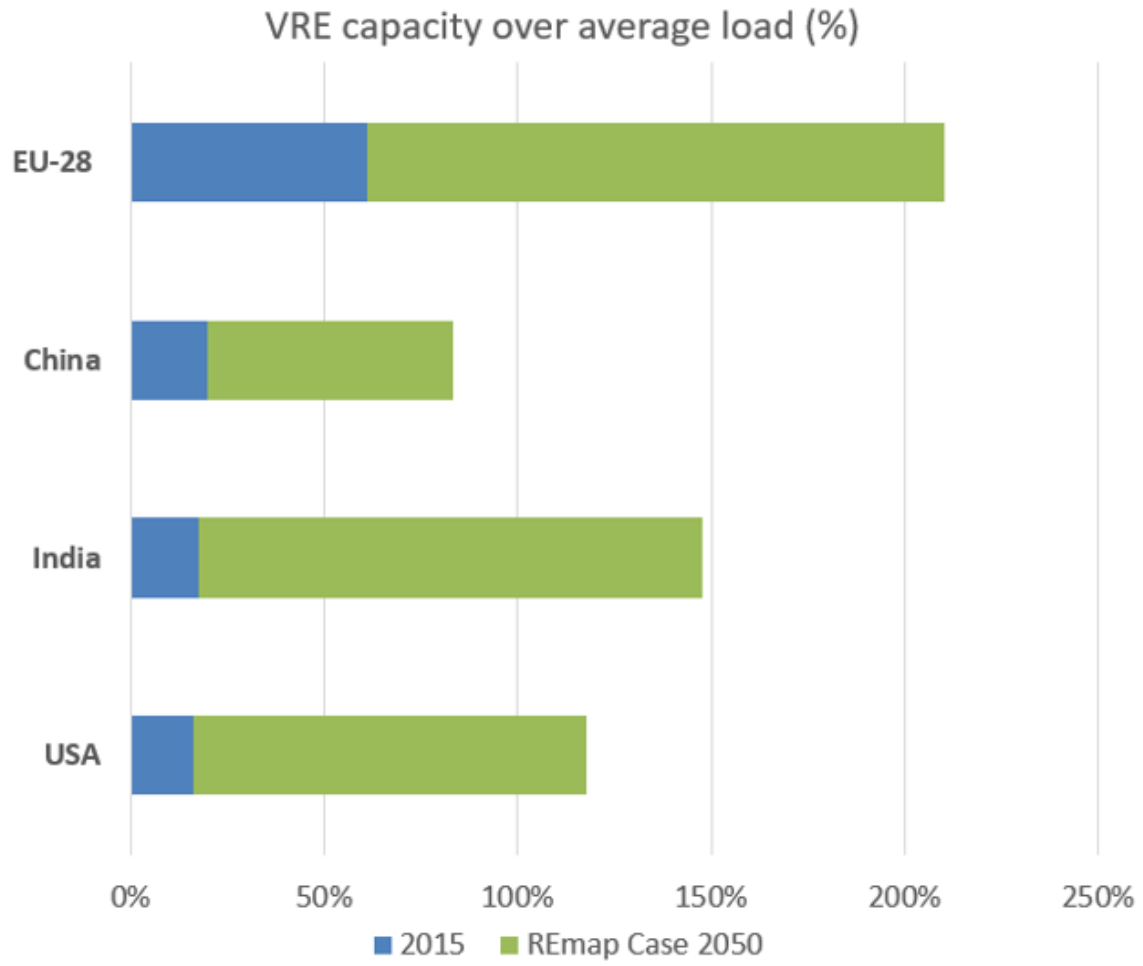


Platform business model

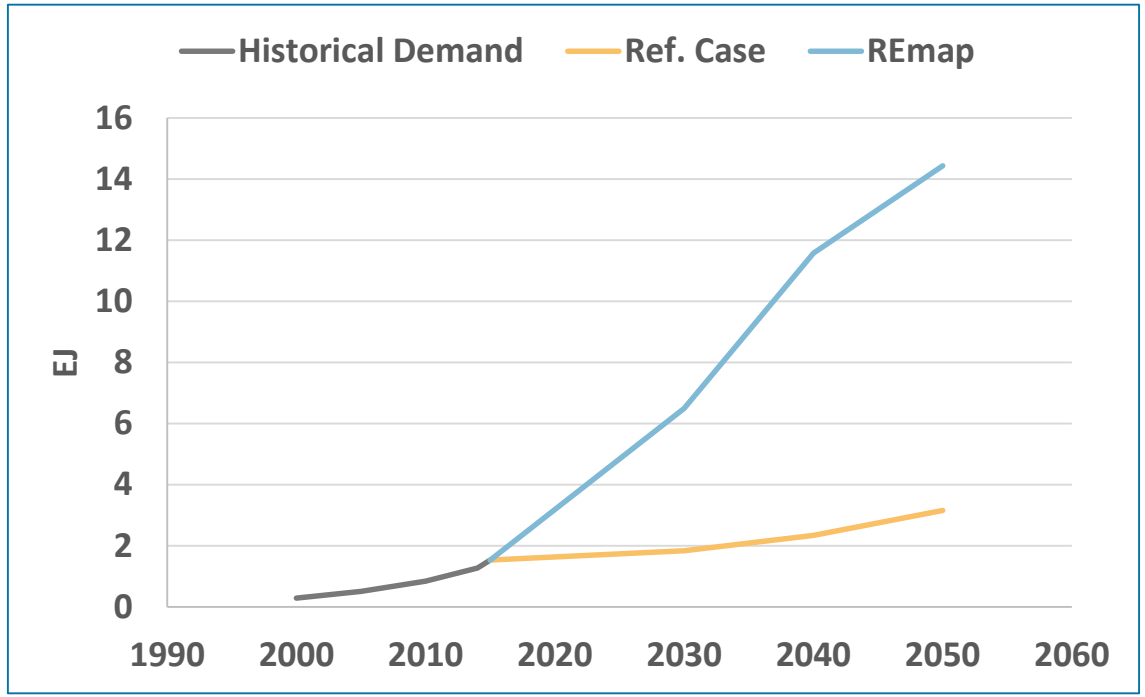
Aggregators- VPP



VRE capacity will exceed demand, storage will be needed

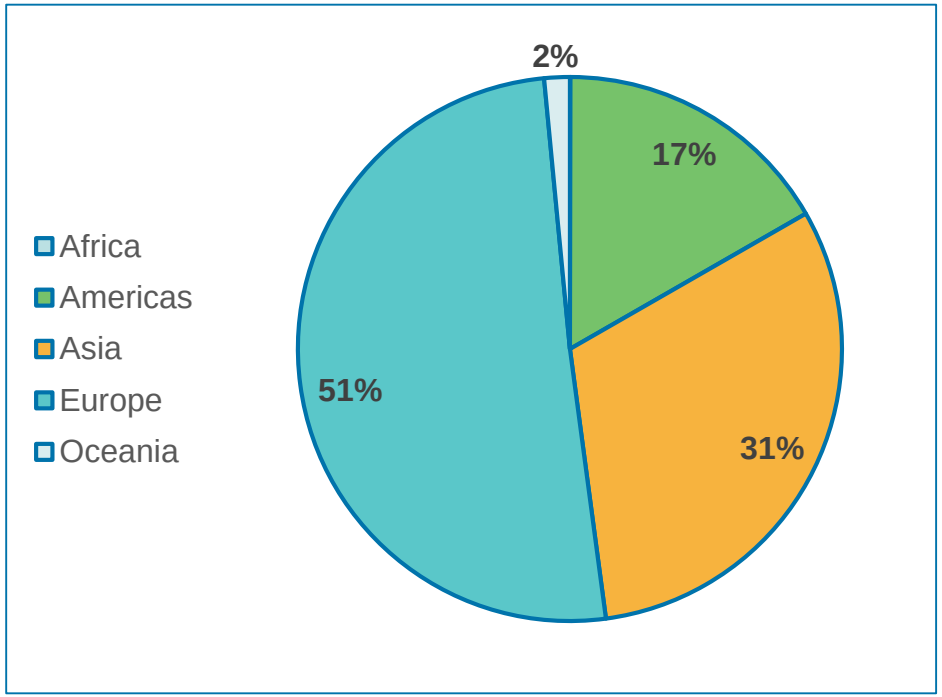


Biogas potentials



Biogas demand in REmap scenario

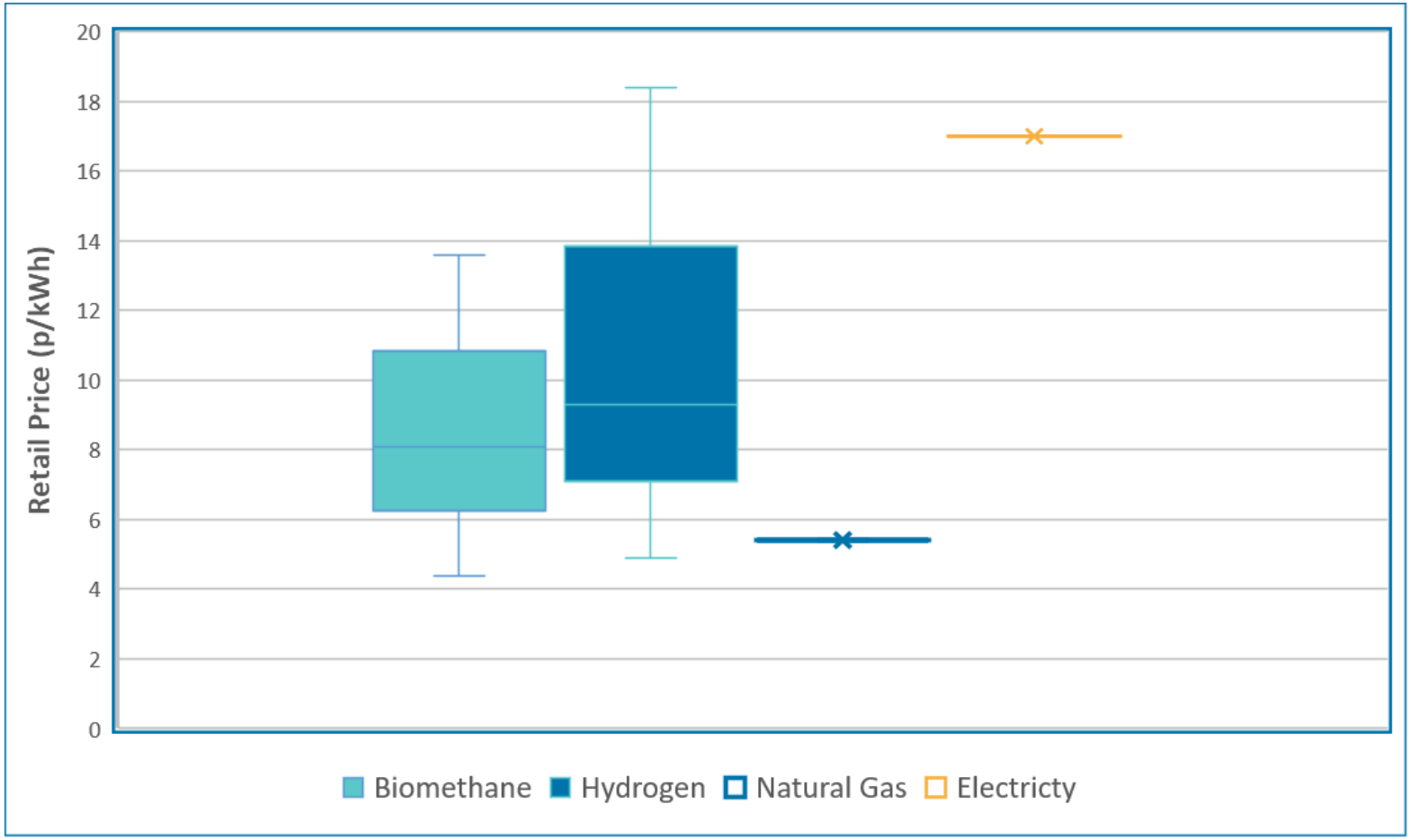
Source: (IRENA, 2018)



Biogas production in continents

Source: (World Bioenergy Association, 2017)

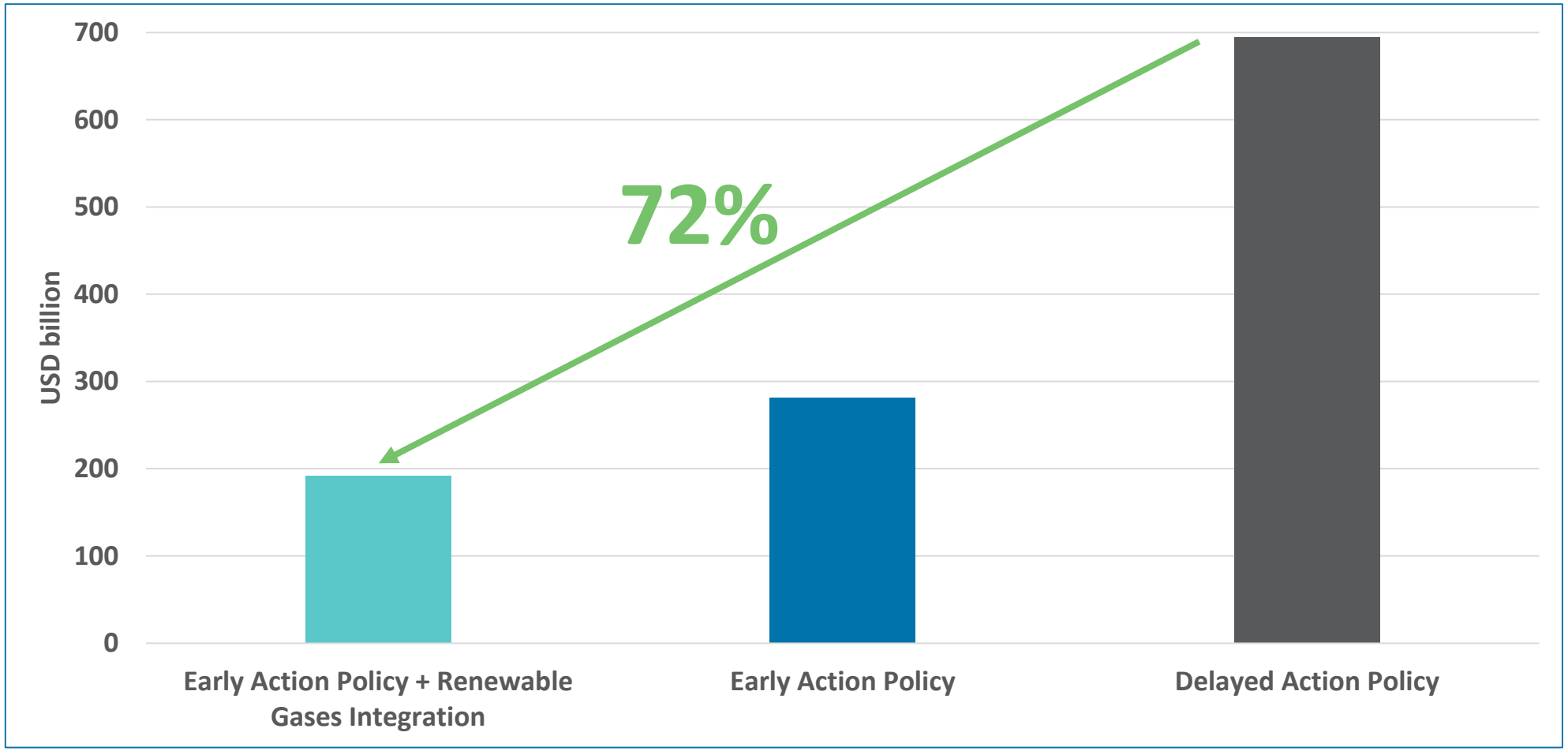
Hydrogen and Biomethane Market



Biogas Retail Price of hydrogen and biomethane Compared to EU average retail prices of Natural gas and electricity

Source: (Sustainable Gas Institute Imperial College London, 2017)

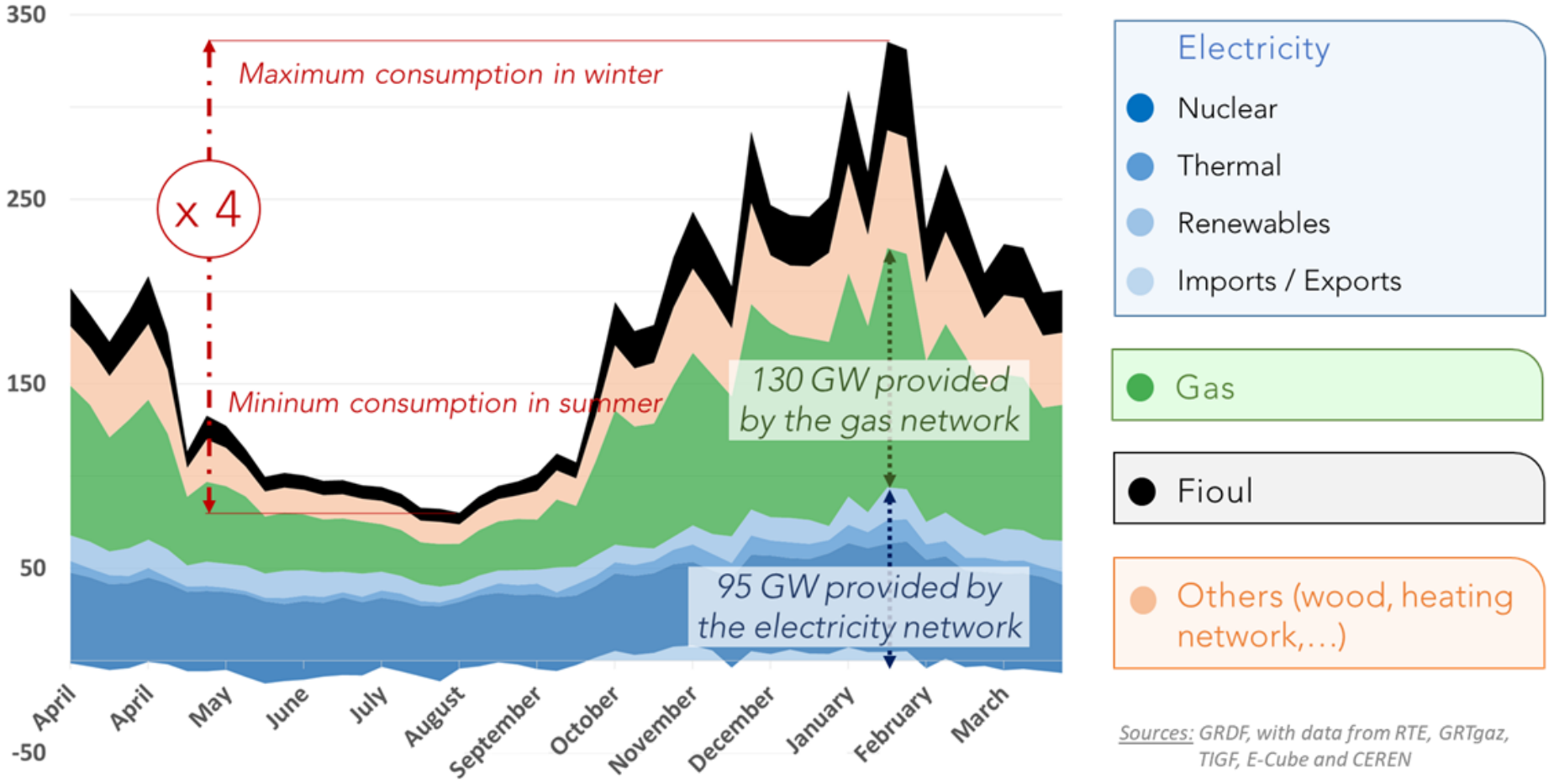
Renewable Gases and Stranded Assets



Effect of Renewable gases deployment on the value of Natural Gas Stranded Assets

Seasonality of heating energy demand
Ex. France

Weekly energy peaks at 8am, starting from April 1st 2016 to March 31th 2017



Sources: GRDF, with data from RTE, GRTgaz, TIGF, E-Cube and CEREN

Hydrogen in the energy transition

Hydrogen and electricity, as energy carriers, are complementary in a world dominated by renewable energy

Decarbonising Transport:

- **Fuel cells**
  - FCEVs are complementary to BEVs in decarbonising road transport
  - Technical maturity within the next 5-15 years
  - Suitable for road, rail and maritime
- **Drop-in synthetic liquid fuels**
  - Complementary to biofuels
  - Mainly aviation

Decarbonising Industry:

- Replace fossil-fuel based feedstocks
- Applications in iron & steel, petrochemical, refining
- Potential in high-temperature processes

Decarbonising the gas grid:

- Capture low electricity prices on the market
- Provide seasonal storage for solar and wind
- Provide grid services from electrolysers

Hydrogen production via electrolysis – off-grid solar and wind

- Requires **PEM** flexibility to be able to **follow variations** in VRE generation
- Possible to **access lowest-cost electricity** from best **renewable** resources, avoid grid cost
- **Low** capacity factor for electrolysers is a significant **challenge**
- Cost reductions in solar, wind and electrolysers will increase competitiveness over time

- Guaranteed to be 100% RE
- **Requires supply chain** to transport H_2 to demand, or relocate demand/manufacturing (e.g. as happened in the past for aluminum)
- Production cost:
  - **Current**: 5–6 $/kg - **Target**: 1–3 $/kg

Decarbonising the gas grid

Use existing transportation pipelines for hydrogen from RE or gas/CCS

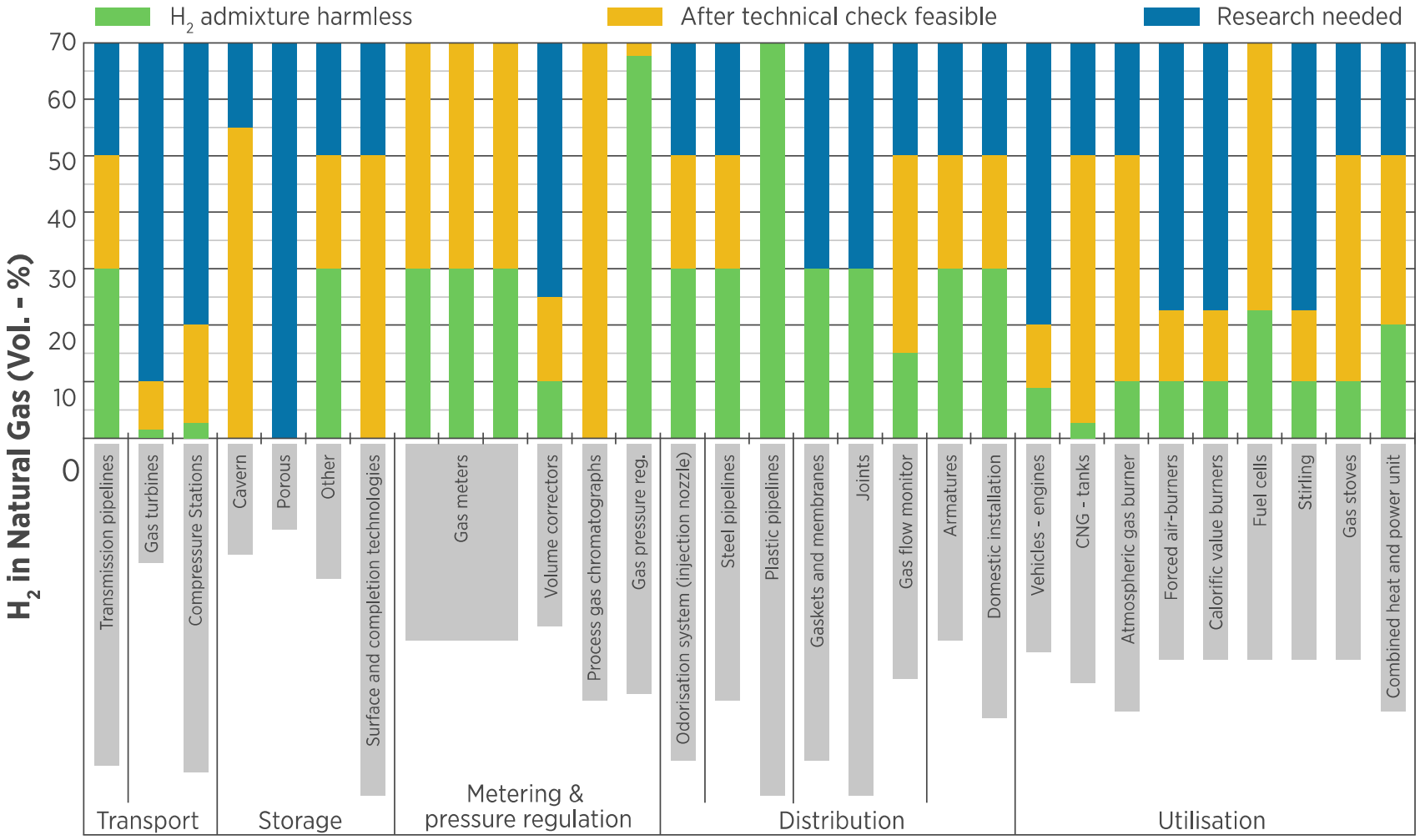
Short-term: Injection could support early-stage hydrogen infrastructure development and economies of scale

- **Up to 10-20%** blend: minor investments
- **Greater than 20%:** significant changes in infrastructure and end-use applications

Long-term: Store large amounts of renewables while decarbonising gas

- **Large capacity of gas network** EU natural gas grid stores around 1200 TWh of energy
- **Enable further deployment of solar and wind** into continental power grids where renewable resources are close to gas grid
- **Possible creation of a global market** tapping into best remote/off-grid renewable resources

Decarbonising the gas grid



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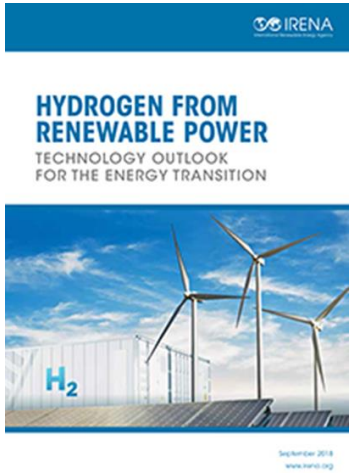
Thank you!



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