IRENA
International Renewable Energy Agency

Renewable Energy Trends and Prospects

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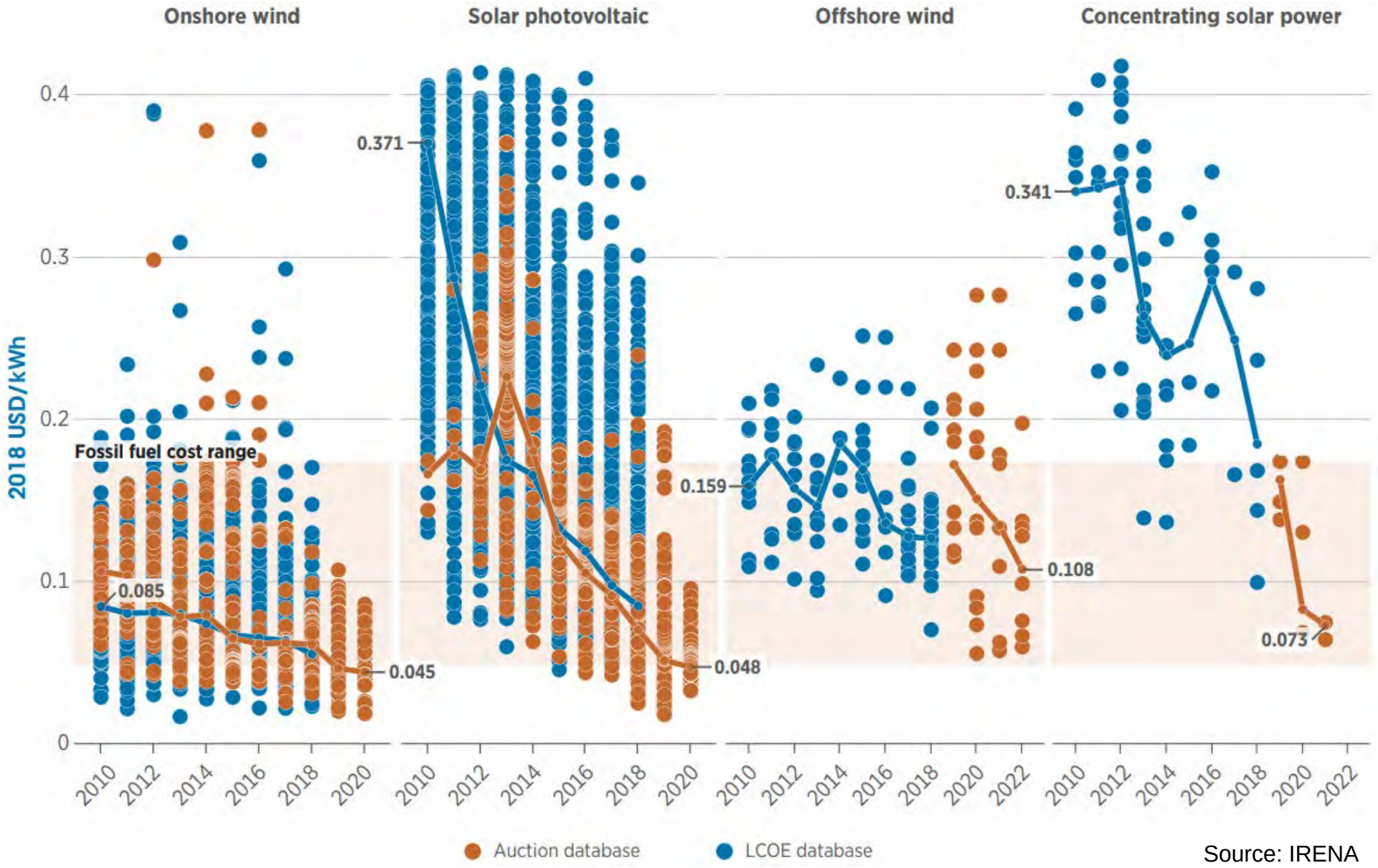
Solar & Wind: LCOE/auction price evolution overview - Continued rapid cost reduction in the coming years

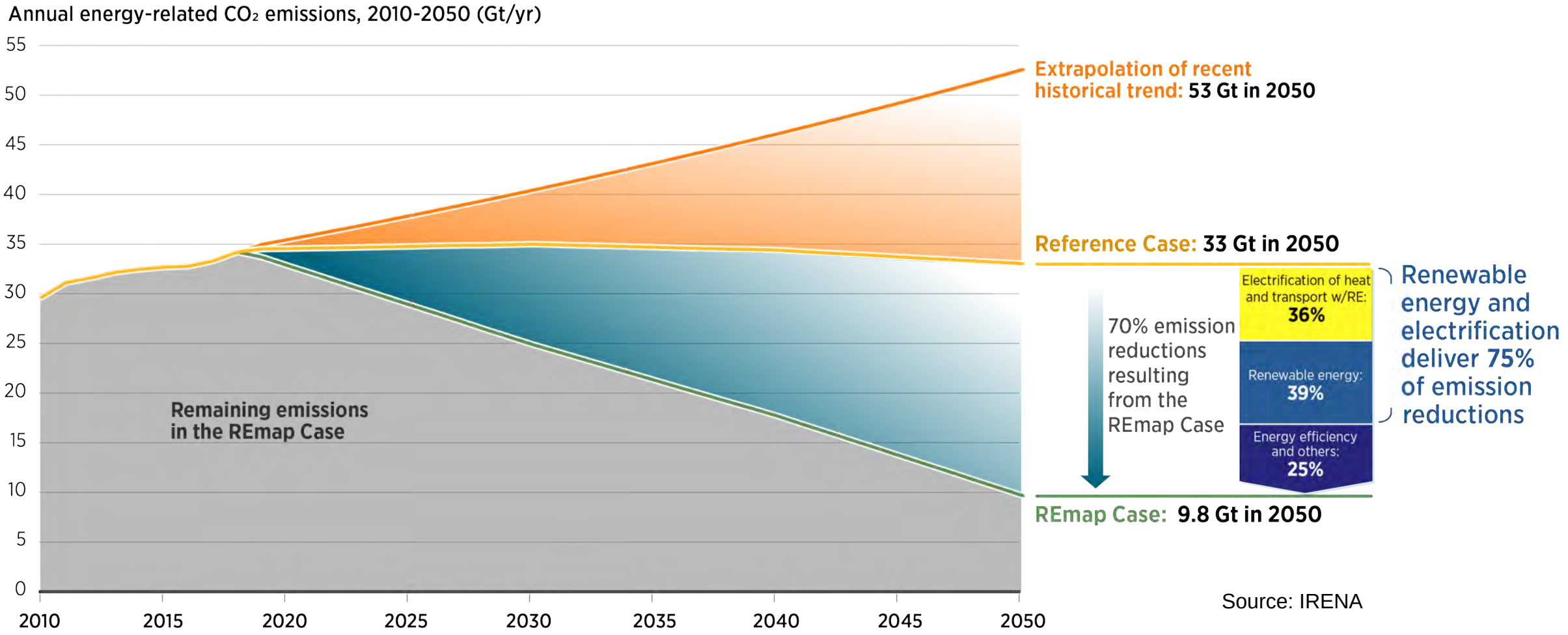


IRENA costing database of 15,000 large scale RE power projects and 1.5 million rooftop PV systems

Covering half of all existing and planned RE capacity

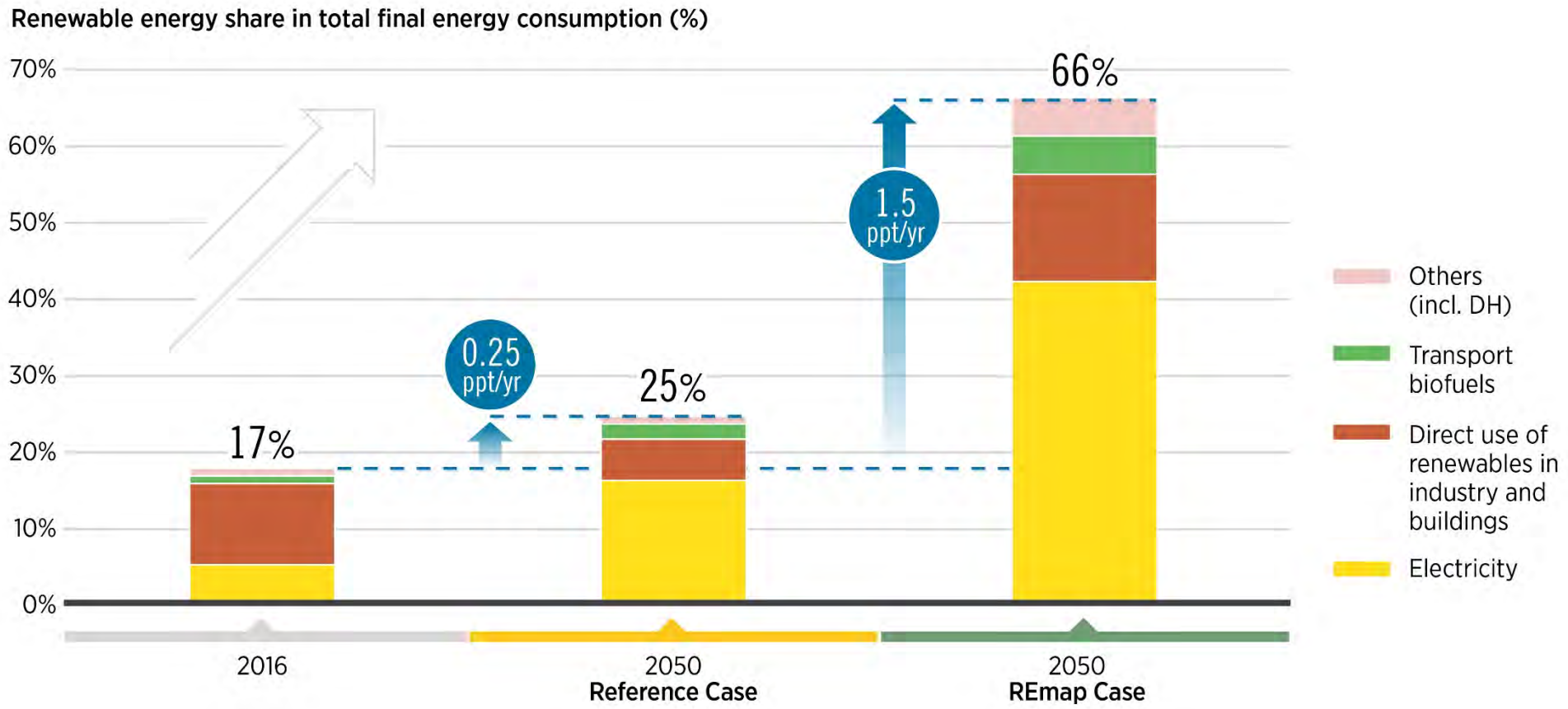
Source: IRENA

Renewables & electrification can deliver 75% of energy-related CO_2 emission reductions needed



Source: IRENA

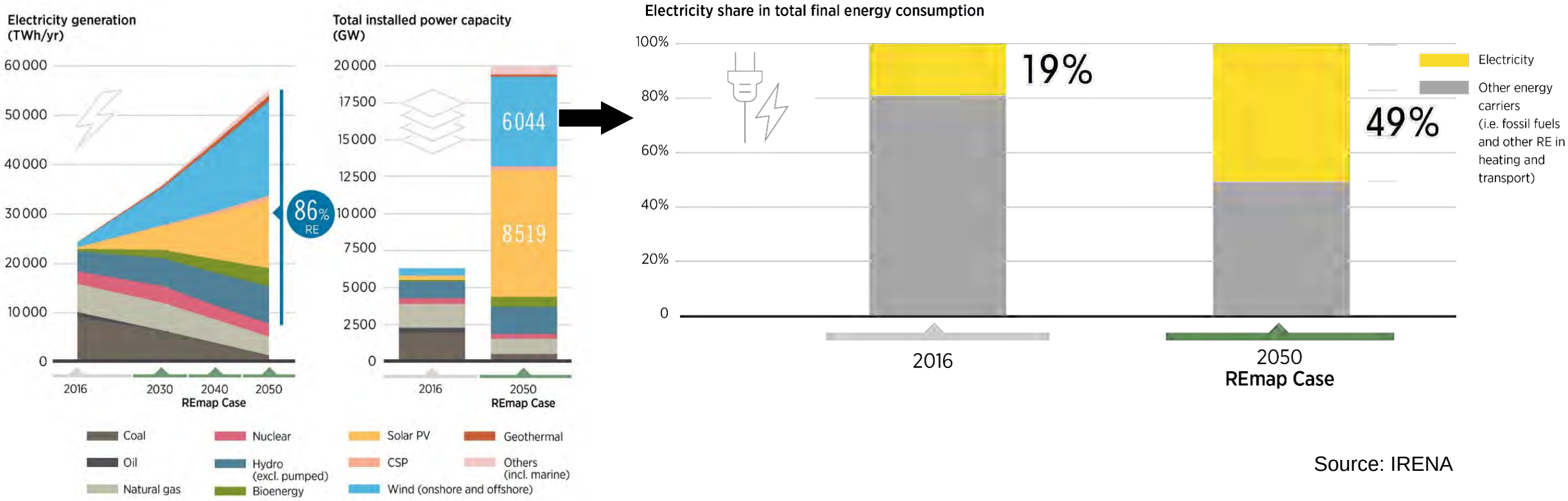
Growing share of renewables in final energy consumption – RE power and electrification are key



Source: IRENA

The share of renewables in total final energy consumption (TFEC) needs to **ramp up six-fold** – from a historical average of 0.25 percentage points per year to almost 1.5 percentage points per year

Electrification paired with renewables is a major solution for decarbonisation



Source: IRENA

By 2050,

- Electricity becomes the central energy carrier
- 86% of electricity generation will come from renewables

A transformed energy system: Scaling up renewables not just for power, but also for heat and transport

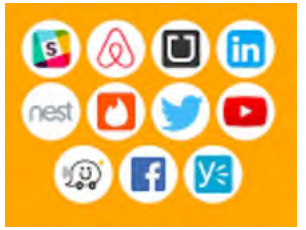
Innovation landscape for power sector transformation

EVs and smart charging

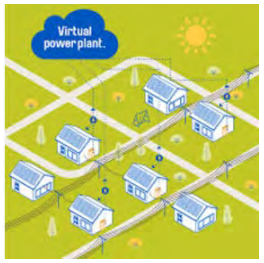
Storage

Artificial Intelligence

Platform business model



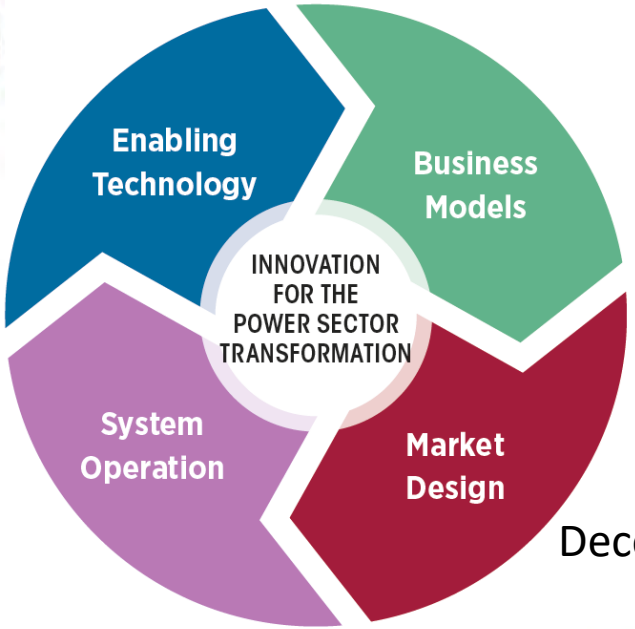
Aggregators- VPP



Digitalisation - IoT

Blockchain

Hydrogen, PtX

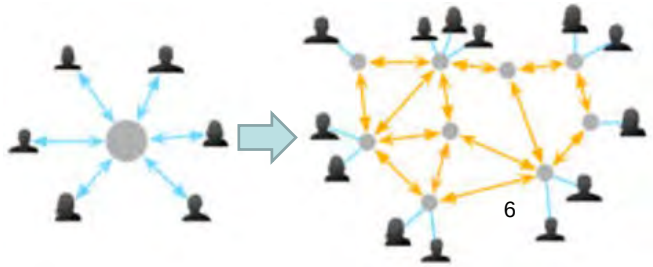


Encourage Flexibility, pricing that supports DSM/DSR

Massive expansion of interconnections and supergrids

Electrification of end use sectors

Decentralised system and Distributed generation



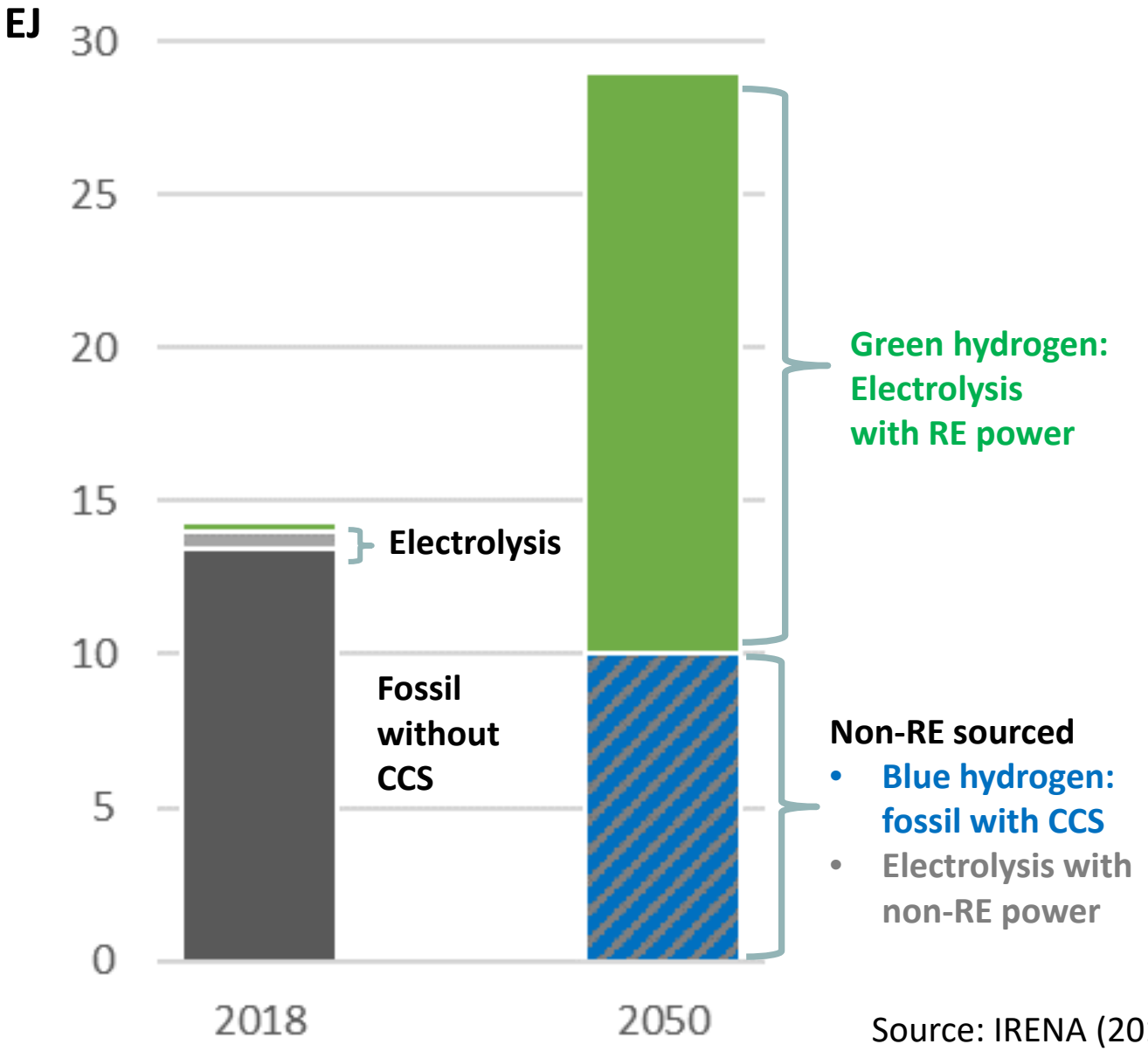
Value complement-arities in VRE

“The other half” – hard-to-decarbonise sectors

- Zero carbon 2050 means also a climate neutral industry sector
- The power sector is making progress
- Electromobility is emerging as a solution for light-duty vehicles
- This leaves “the other half”
  - Energy-intensive industry
  - Other transportation modes
- Solutions need to be tailored to sectoral needs
- Requirements:
  - Affordable technology
  - An enabling framework for sectors that are operating in an international and very competitive market (carbon leakage)
  - Fear of carbon leakage and loss of competitiveness has resulted in a lack of policy action to date

Source of hydrogen – today and 2050

A shift to clean hydrogen with a key role for green hydrogen



Source: IRENA (2019)

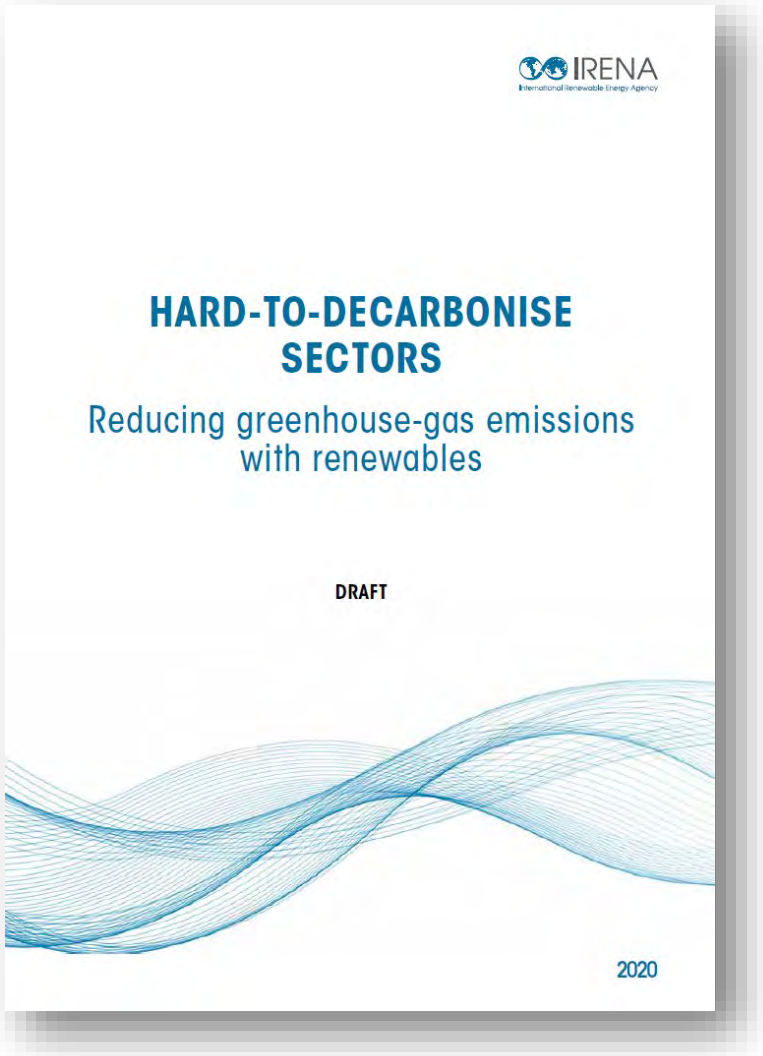
Today:
About 14 EJ hydrogen produced mainly from fossil source - **green and blue hydrogen production is negligible**

2050:
Two-thirds of hydrogen produced could come from green hydrogen

Demonstration projects with electrolysis – with increasingly bigger sizes (> 50 MW)

Hard-to-decarbonise sectors

- Road freight transport
- Aviation
- Shipping
- Iron and steel making
- Aluminium making
- Chemicals and petrochemicals production
- Cement making
- Greening the gas system
- Desalination



(2020, in preparation)

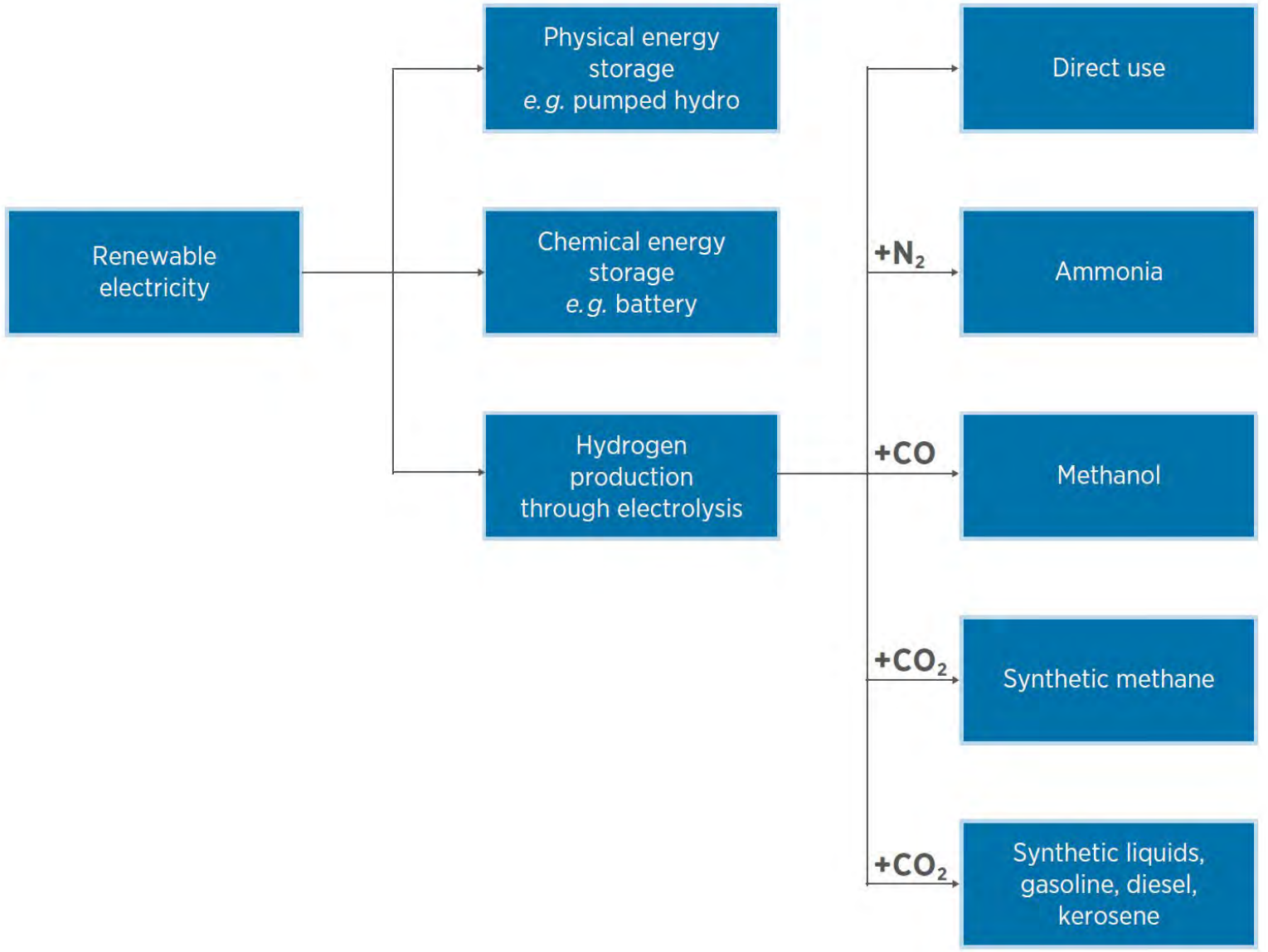
Global energy and climate relevance of hard-to-decarbonise sectors

Sector	2017 Final energy use [EJ/yr]	2017 CO_2 emissions (Direct and indirect energy & process) [Gt/yr]
Road freight	24.0	1.75
Aviation	13.5	0.85
Shipping	9.1	0.68
Iron and steel	34	3.63
Aluminium	6.0	0.85
Chemical and petrochemical	46.8	2.72
Cement	10.7	2.48
Gas sector	130.0	7.28
Total	**274.1**	**20.24**

IRENA calculations

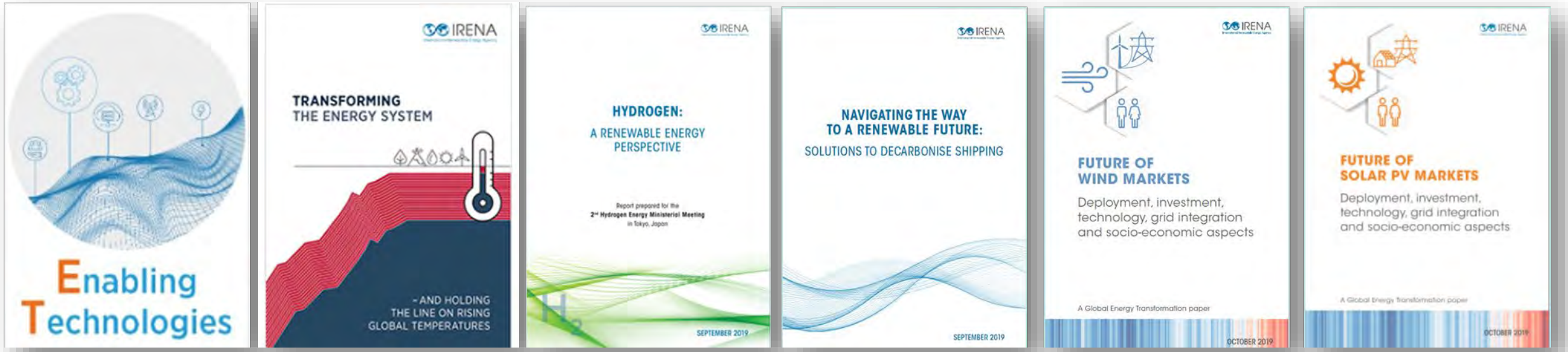
Solutions

- Electrification
- Hydrogen
- E-fuels: Synfuels and synthetic feedstocks
- Circular economy
- CCUS
- BECCS



Thank you!

Select 2019 publications



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