Session 2:
IRENA Innovation and Technology Centre

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IRENA Innovation

IRENA Innovation and Technology Centre

IRENA Innovation flagship products

- **Innovation landscapes**
- **Innovation weeks**

2016
Innovation Week
The Age of Renewable Power

2018
Innovation Week
Solutions for a renewable-powered future

2019 - 2020
Innovation Landscape
for a renewable-powered future: Solutions to integrate variable renewables

2021 – 2022
Innovation toolbox applied to countries: Sweden, African countries

2020
Innovation Week
Renewable solutions for transport and industry

2023
Innovation Landscape
for Smart electrification: Decarbonising end-use sectors with renewable power

2023
Innovation Week
Renewable solutions for end-use sectors

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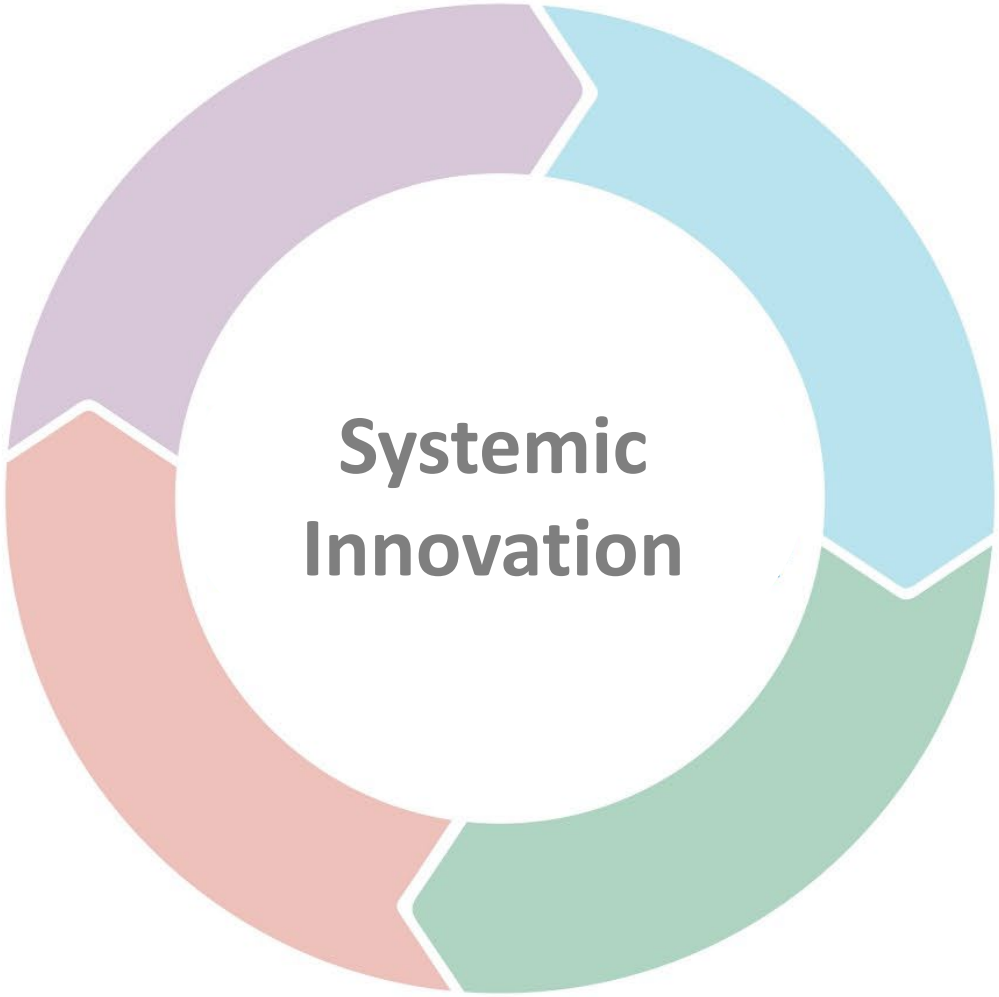

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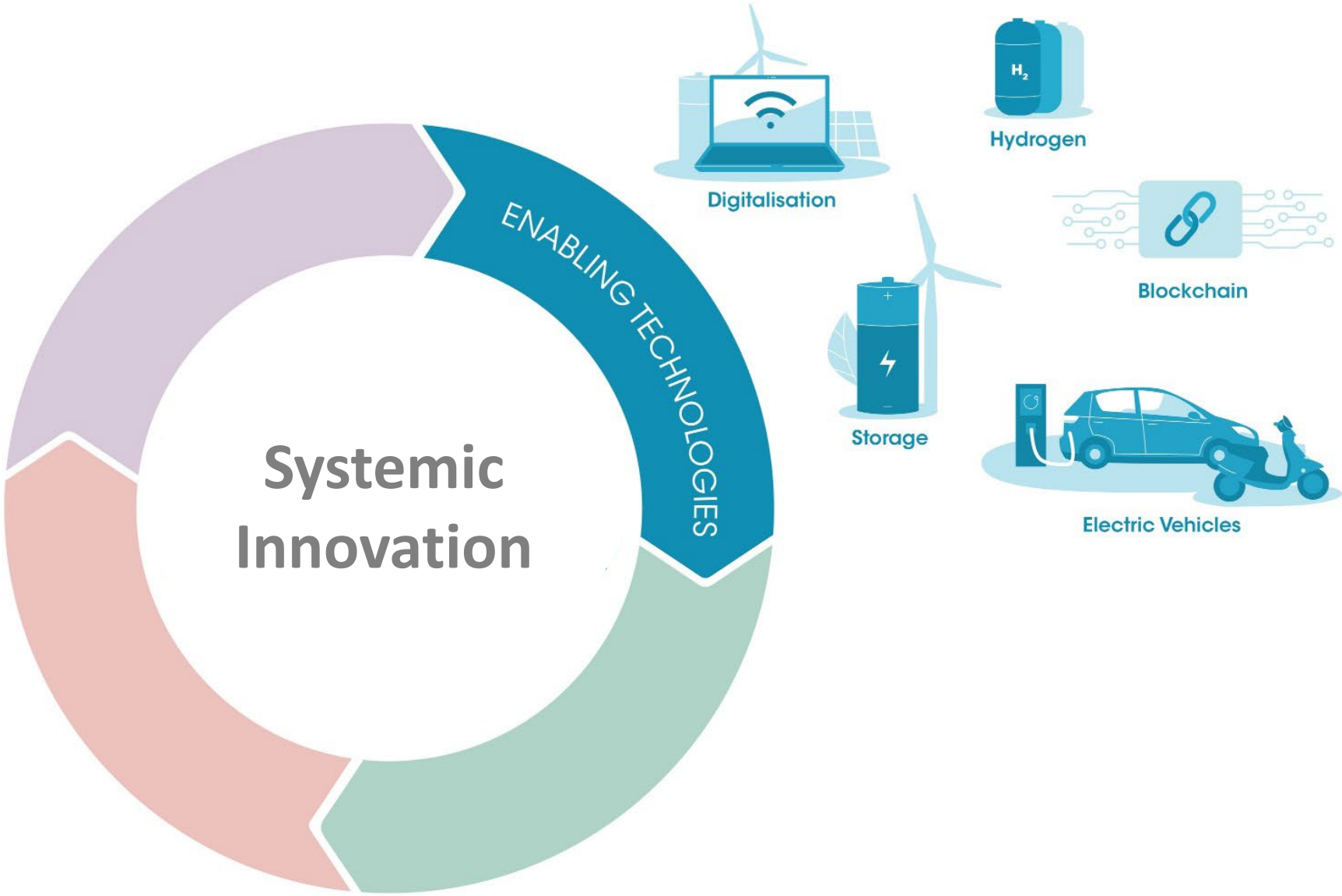

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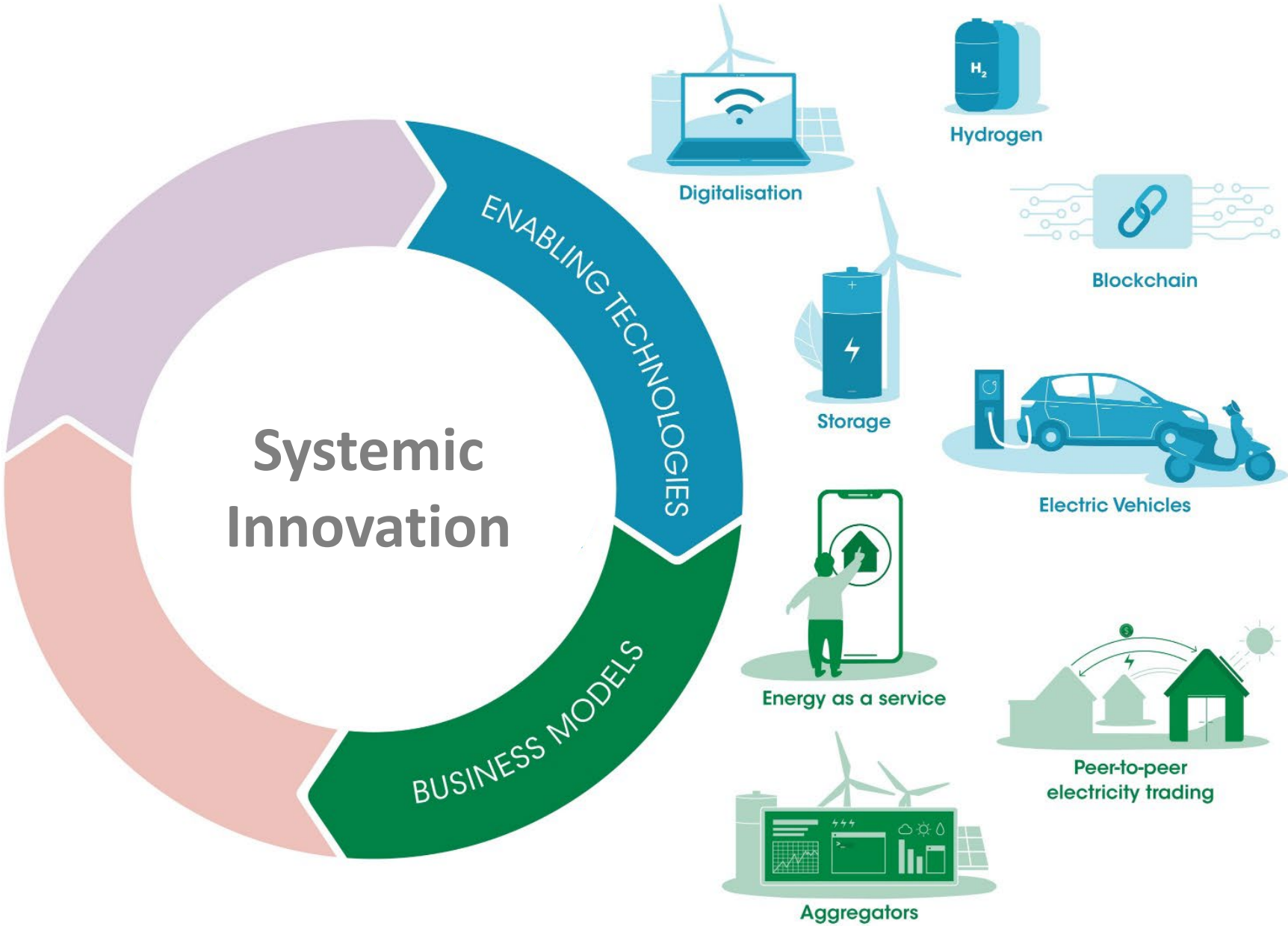

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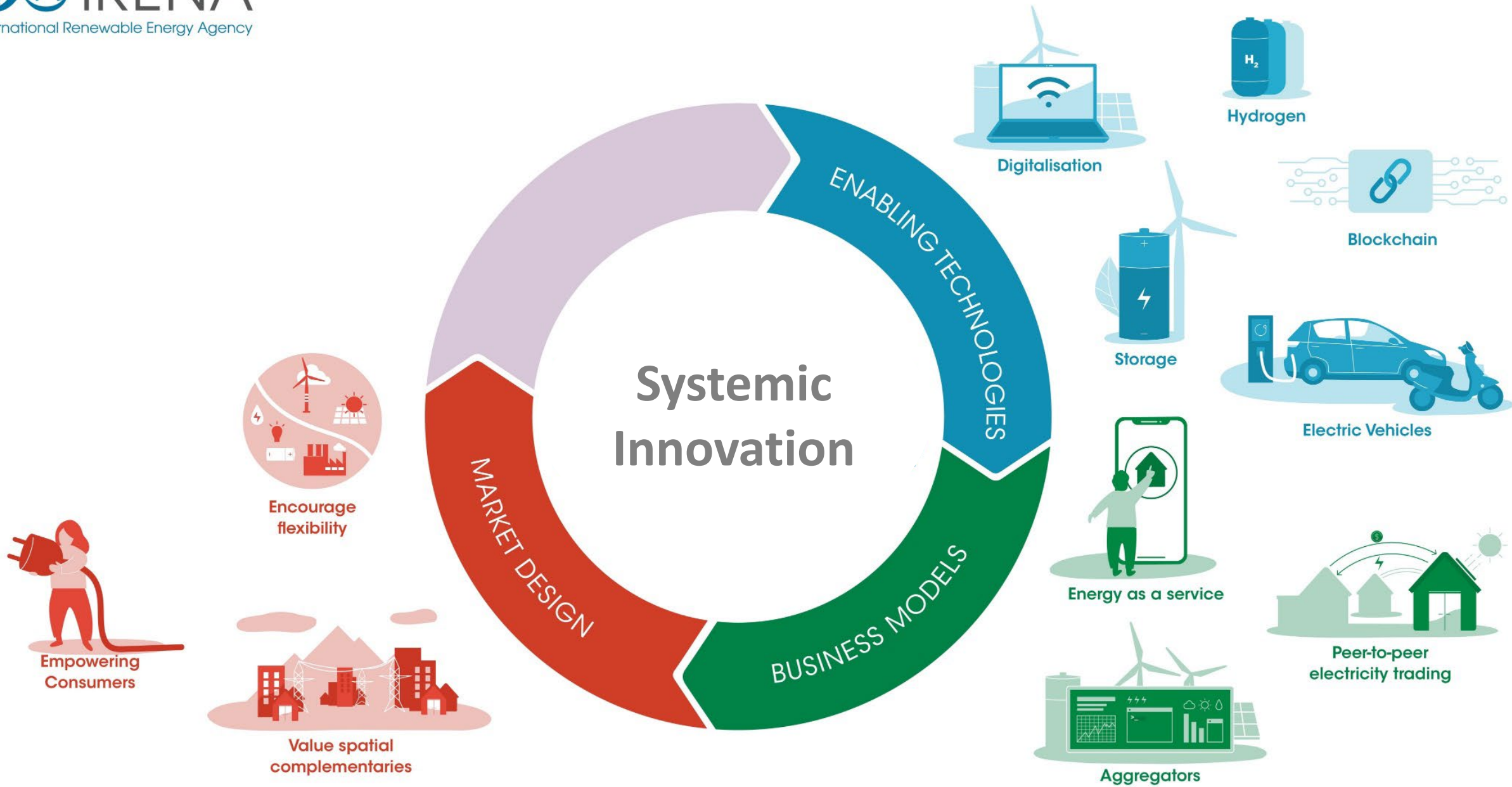
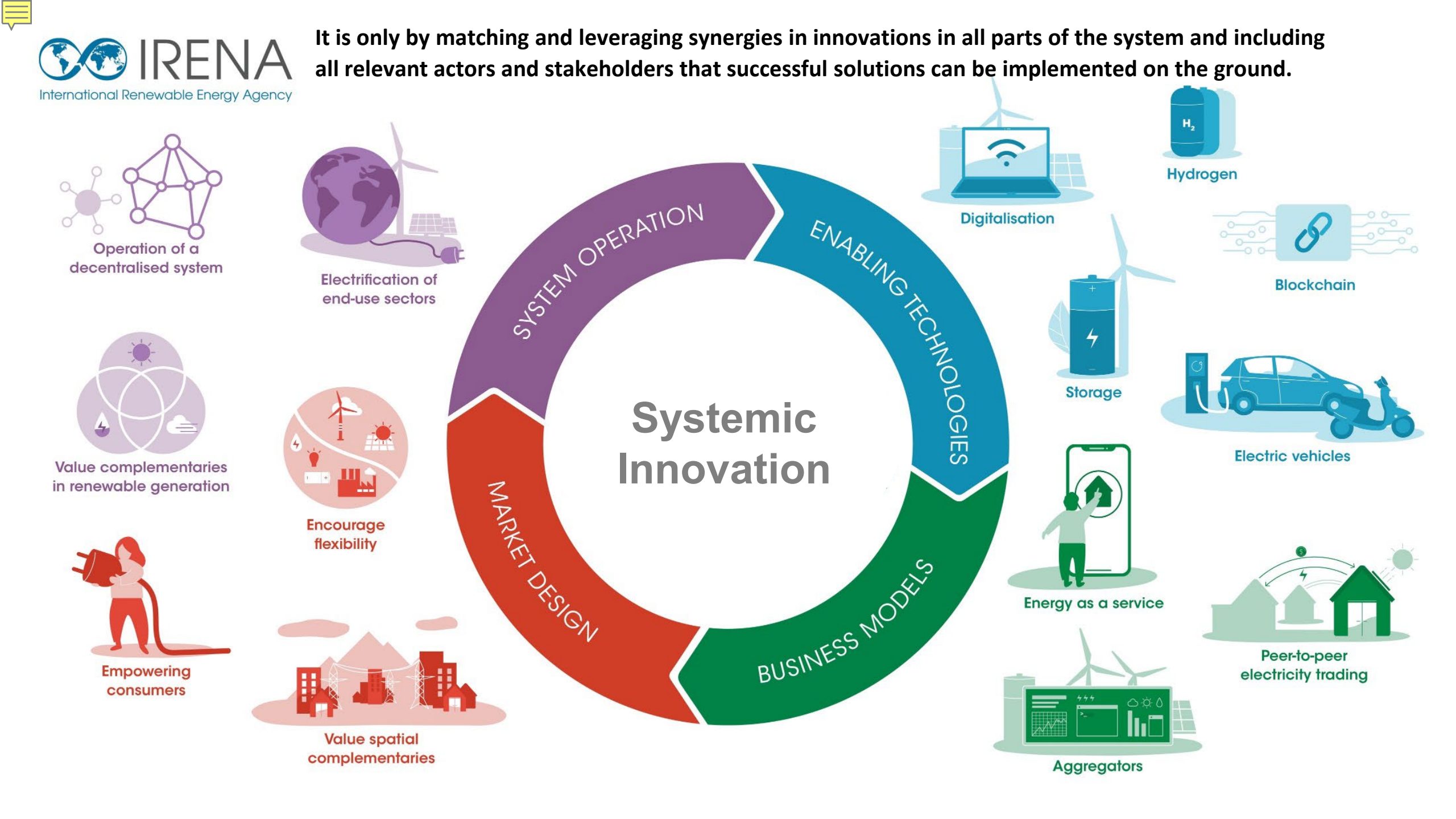
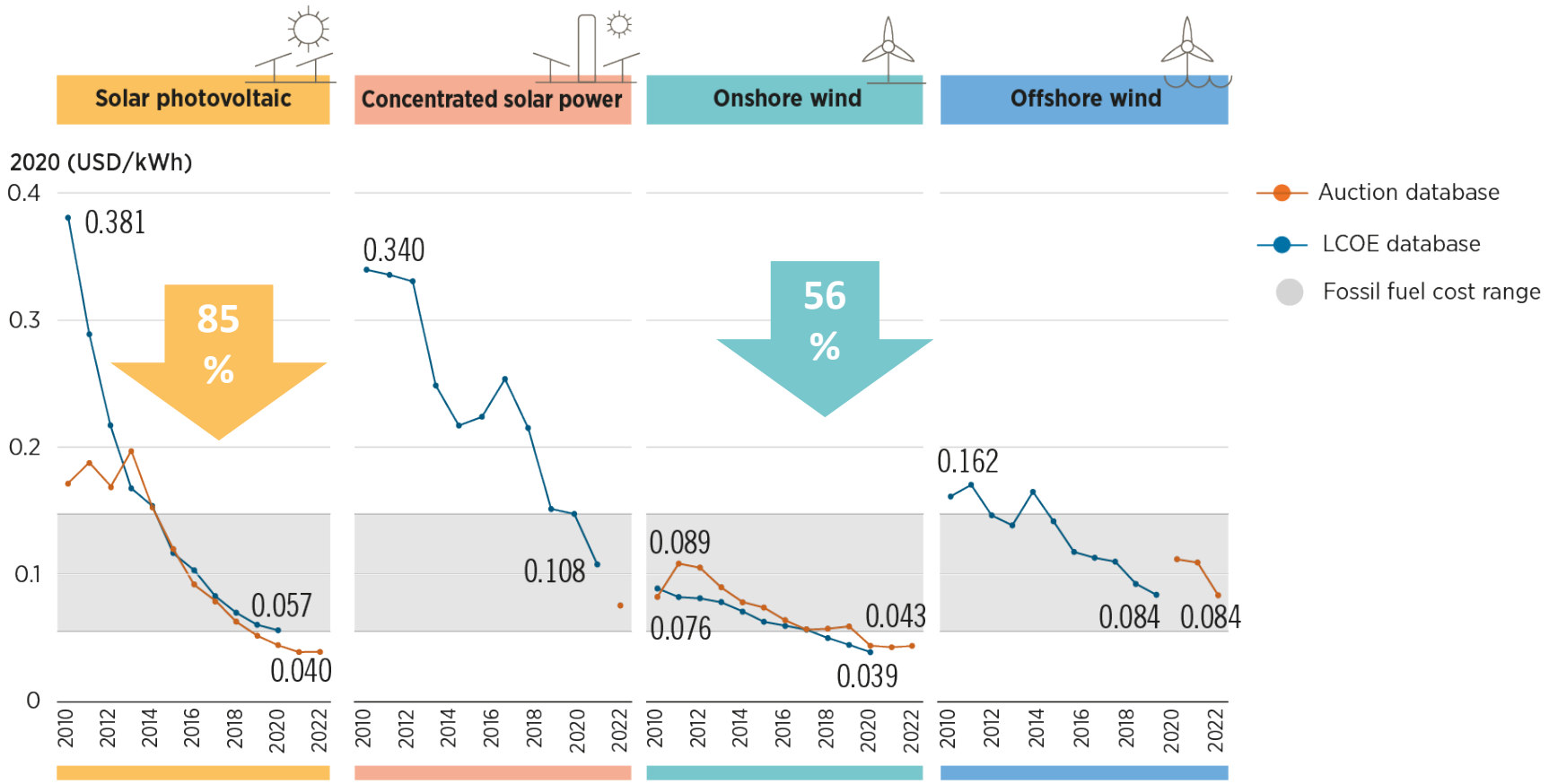


It is only by matching and leveraging synergies in innovations in all parts of the system and including all relevant actors and stakeholders that successful solutions can be implemented on the ground.

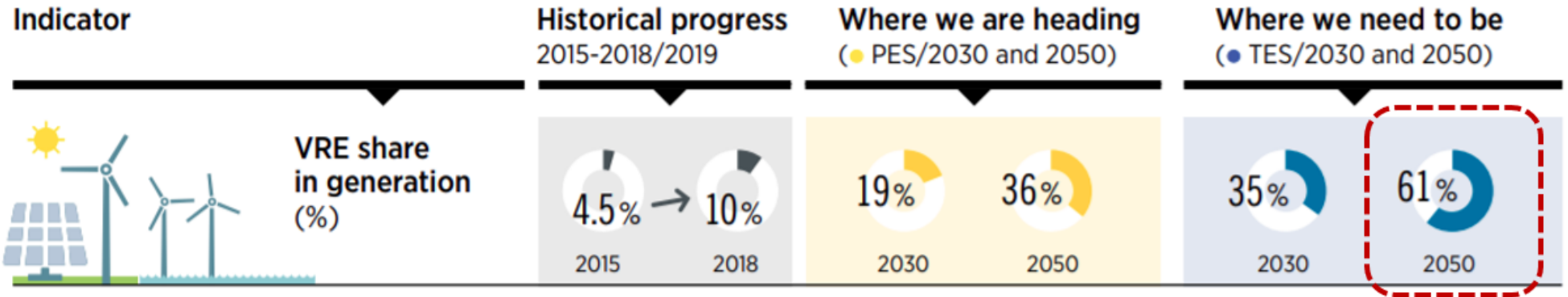


Integrating high shares of renewables in power systems

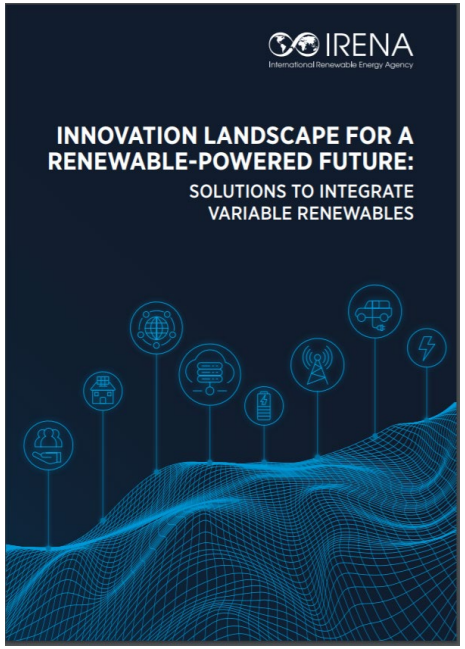


In the last 10 years, the global weighted average levelised cost of electricity from

- utility-scale solar photovoltaic (PV) projects fell by 85%,
- concentrating solar power (CSP) by 68%;
- on-shore wind by 56%, and
- off-shore wind by 48%.



30 key innovations for wind and solar PV integration



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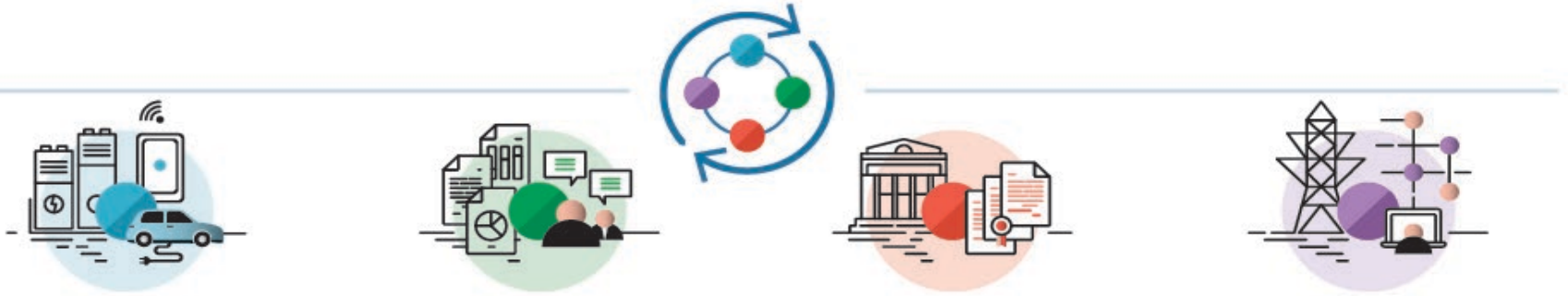


ENABLING TECHNOLOGIES

1	Utility-scale batteries
2	Behind-the-meter batteries
3	Electric-vehicle smart charging
4	Renewable power-to-heat
5	Renewable power-to-hydrogen
6	Internet of things
7	Artificial intelligence and big data
8	Blockchain
9	Renewable mini-grids
10	Supergrids
11	Flexibility in conventional power plants

BUSINESS MODELS

12	Aggregators
13	Peer-to-peer electricity trading
14	Energy-as-a-service
15	Community-ownership models
16	Pay-as-you-go models

MARKET DESIGN

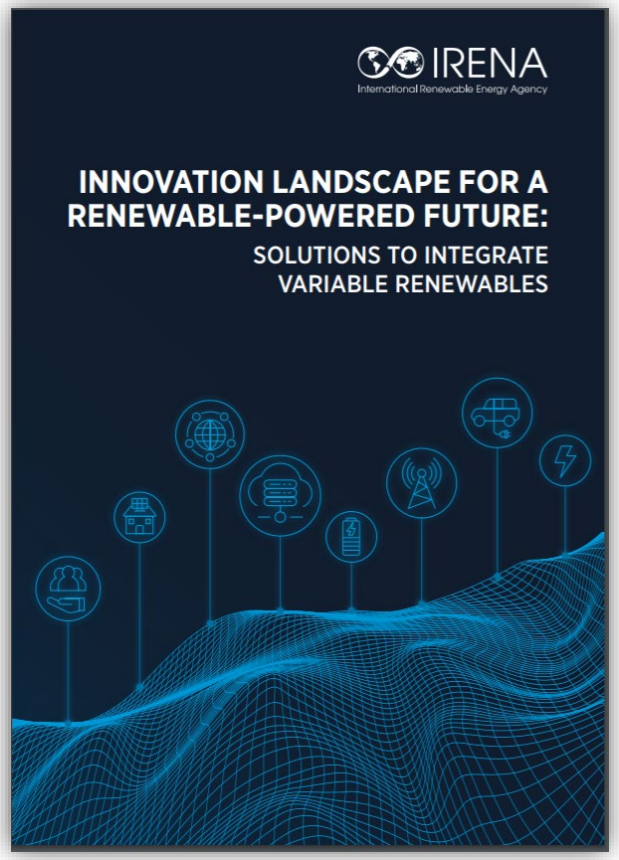
17	Increasing time granularity in electricity markets
18	Increasing space granularity in electricity markets
19	Innovative ancillary services
20	Re-designing capacity markets
21	Regional markets
22	Time-of-use tariffs
23	Market integration of distributed energy resources
24	Net billing schemes

SYSTEM OPERATION

25	Future role of distribution system operators
26	Co-operation between transmission and distribution system operators
27	Advanced forecasting of variable renewable power generation
28	Innovative operation of pumped hydropower storage
29	Virtual power lines
30	Dynamic line rating

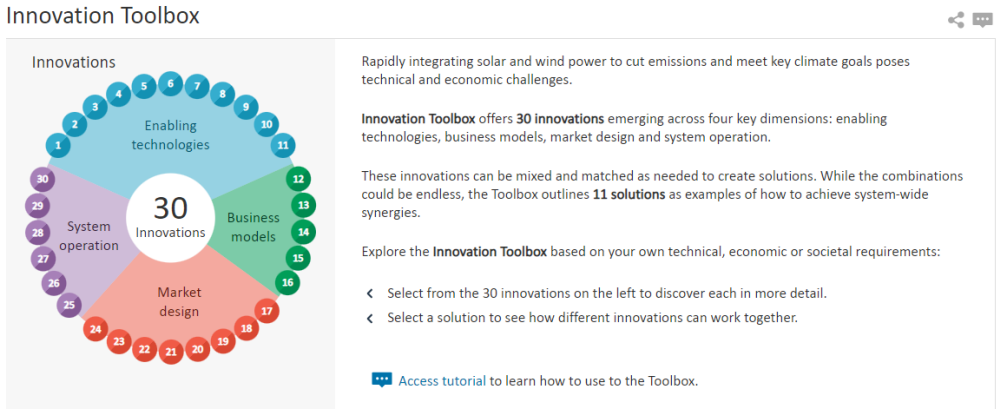
Source: IRENA (2019), Innovation landscape for a renewable-powered future: Solutions to integrate variable renewables

IRENA Innovation Landscape (2019 – 2020)



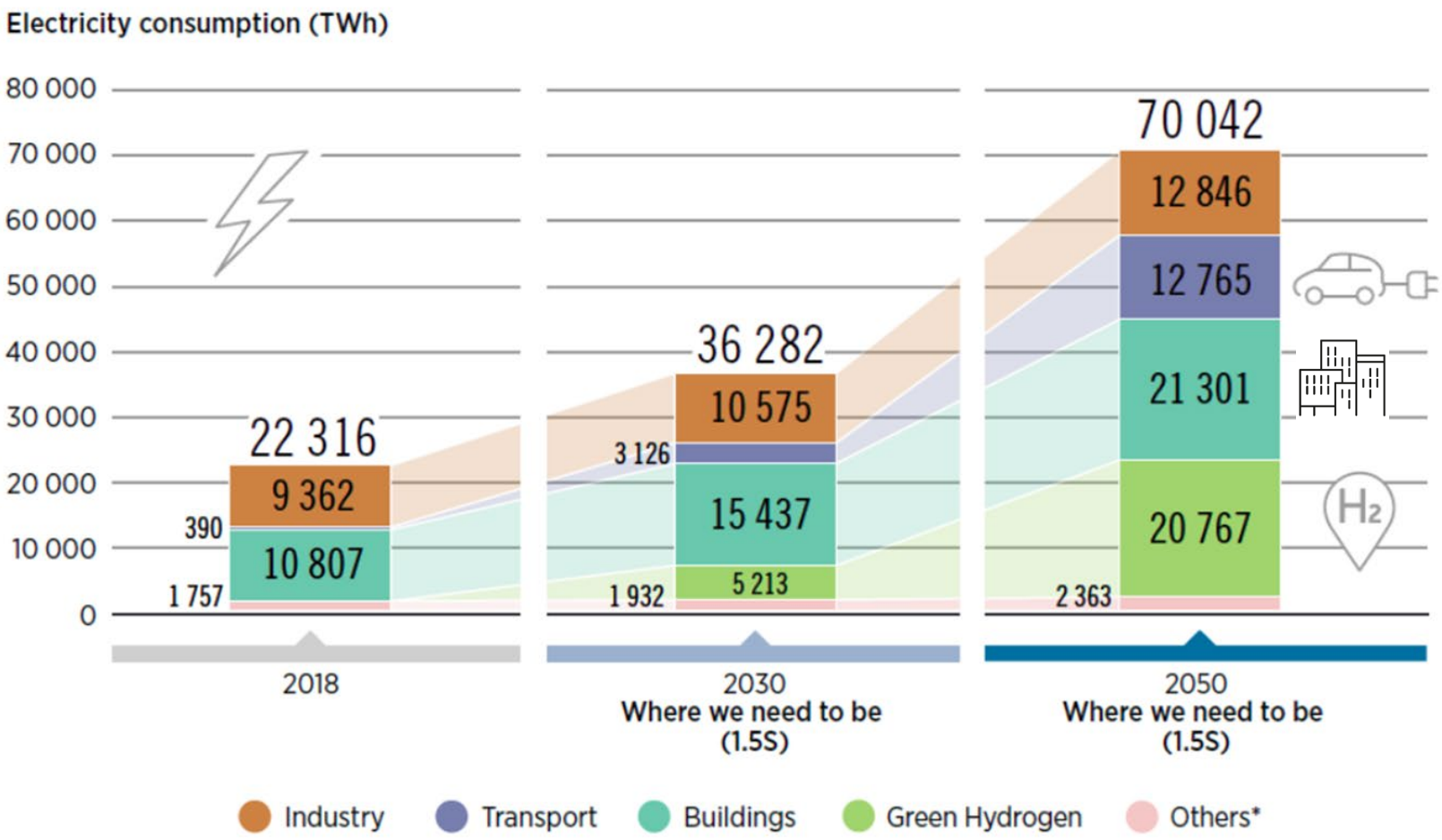
https://www.irena.org/publications/2019/Feb/Innovation-landscape-for-a-renewable-powered-future

https://www.irena.org/innovation/Toolbox



Massive electrification requires a smart approach

Electricity consumption by sector, 2018, 2030 and 2050 (TWh/yr) in the 1.5°C Scenario



Smart electrification enables

(1) power systems to accommodate new loads in a cost-efficient manner and creates

(2) flexibility in power systems, which allows the integration of a larger share of renewables, making the power systems more robust and resilient.

(3) For end uses, electrification is the most cost-effective solution for decarbonising these sectors.

Source: https://irena.org/publications/2022/Mar/World-Energy-Transitions-Outlook-2022

Innovation landscape for smart electrification

TO BE LAUNCHED IN JUNE 2023

- **The toolbox includes 100 innovations in technology, business models, market design and system planning and operation, that can play a role in transforming and decarbonising the energy use sector following smart electrification strategies**

IRENA INNOVATION WEEK 2023

Renewable solutions to decarbonise end-use sectors

25 – 28 September 2023 • Bonn, Germany

Innovation Week 2023 builds on previous editions IRENA Innovation Weeks in 2016 and 2018, and the virtual edition in 2020.

The discussions will focus on emerging solutions to decarbonise the transport, buildings and industry sectors, both via direct and indirect electrification.

- Aims to:
  - **Connect** industry experts and policy makers
  - **Showcase** emerging innovative solutions
  - **Inspire and inform** the energy transition

https://innovationweek.irena.org/

2018 event included over
80 expert speakers
& 350 participants
from over 70 countries.

2020 virtual event included
over 100 expert speakers
& 1600 participants
from over 130 countries.

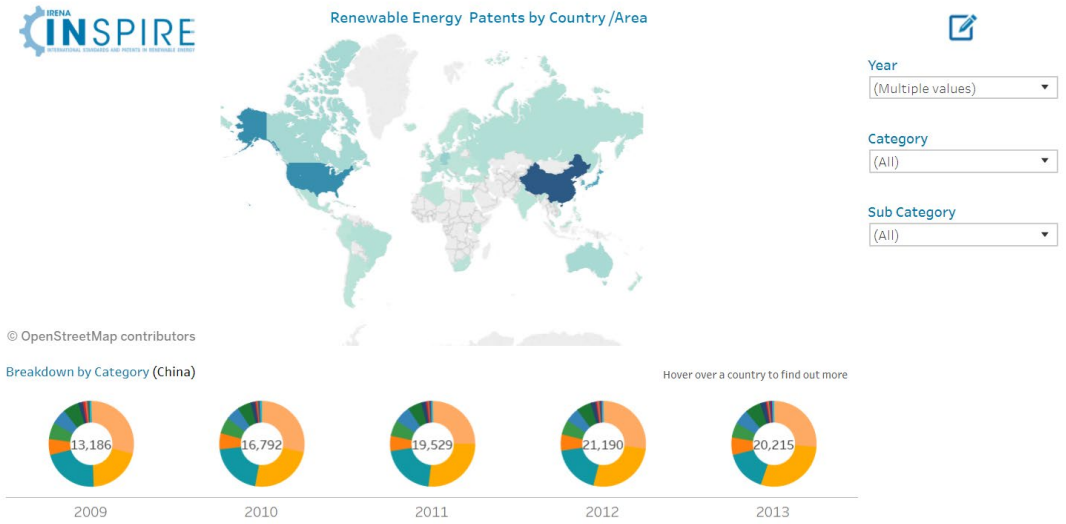
Many other innovation knowledge products

Innovation Outlooks

End-use applications

- **Decarbonising industry sectors**
- **Decarbonising aviation and shipping**
- **Green gases and green hydrogen**
- **Critical materials**

The International Standards and Patents in Renewable Energy



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Technology and Infrastructure

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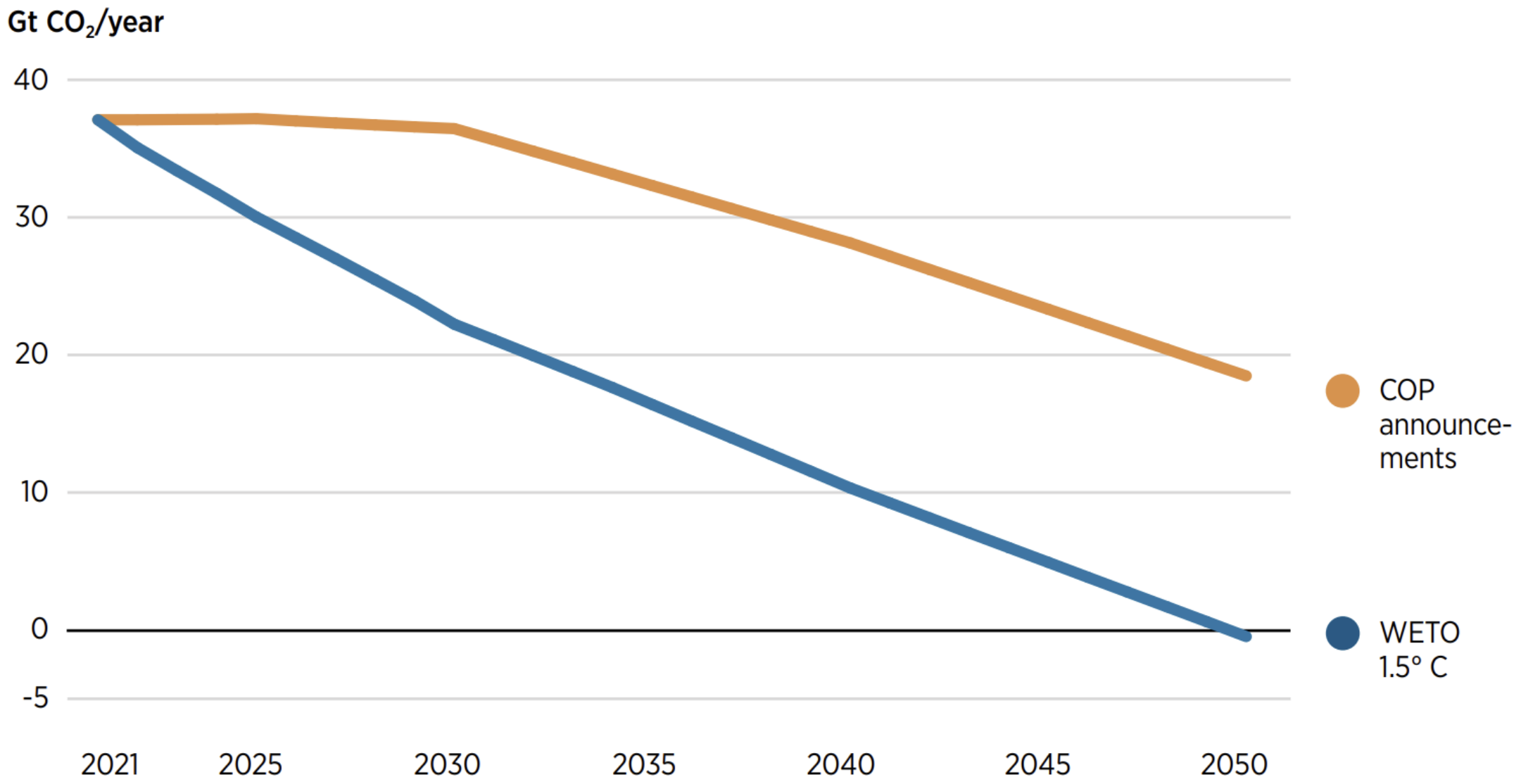
Technology and Infrastructure

We aspire to be a catalyst for decarbonizing the energy infrastructure to achieve greater climate ambition

The team assists energy and climate stakeholders in transforming the energy infrastructure across all energy subsectors to achieve net zero emissions, while balancing development goals and adapting to national contexts. We collaborate with industry leaders to anticipate the impact of new technologies and aid in the planning, implementation, and scaling of the deployment of renewable energy technologies.

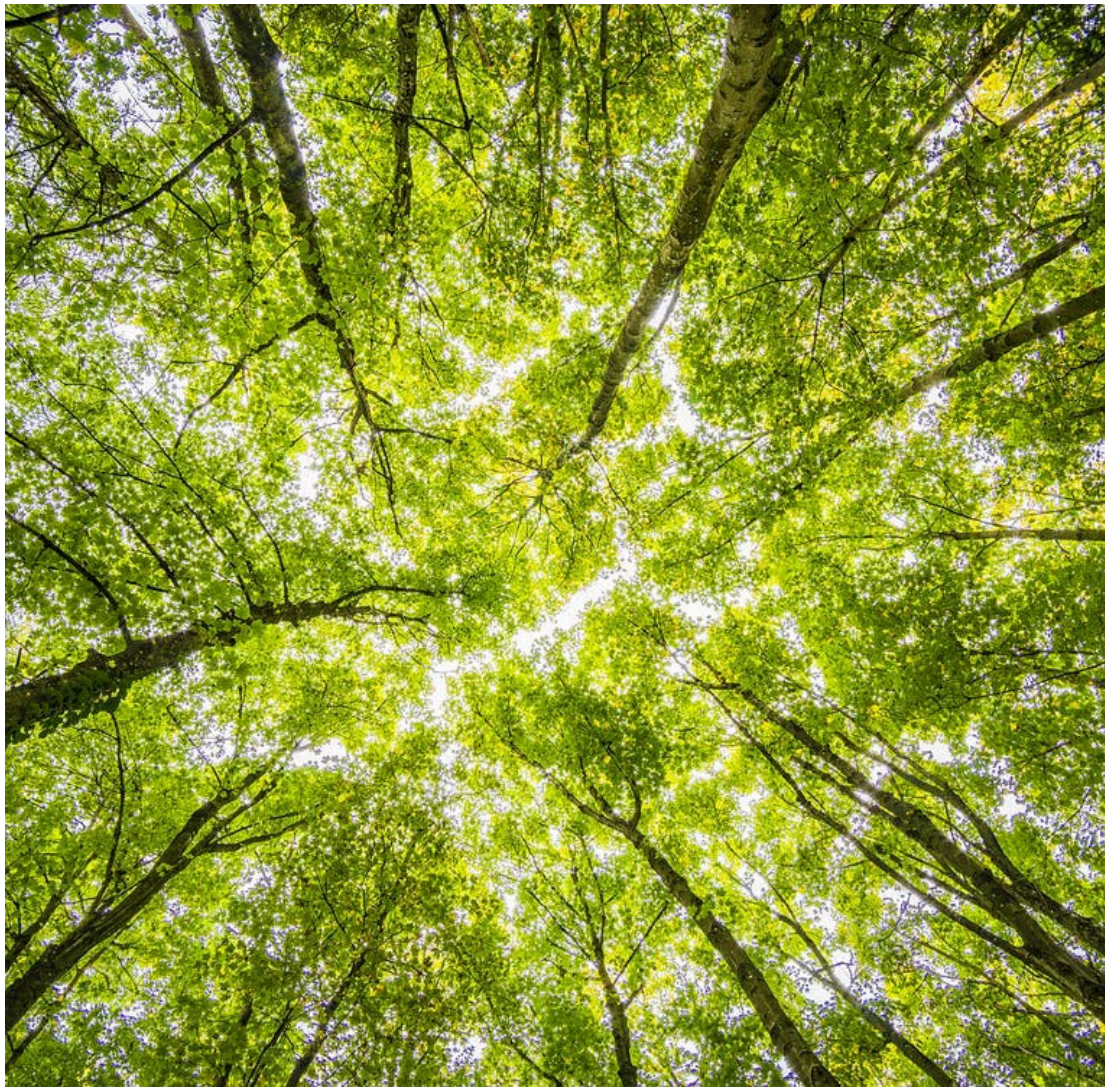
Technology and Infrastructure - Climate action support



Technology and Infrastructure - Climate action support

Assisting countries in developing and implementing mitigation and adaptation measures to **enhance NDCs, strengthen NDC implementation plans, and advance LT-LEDS** through:

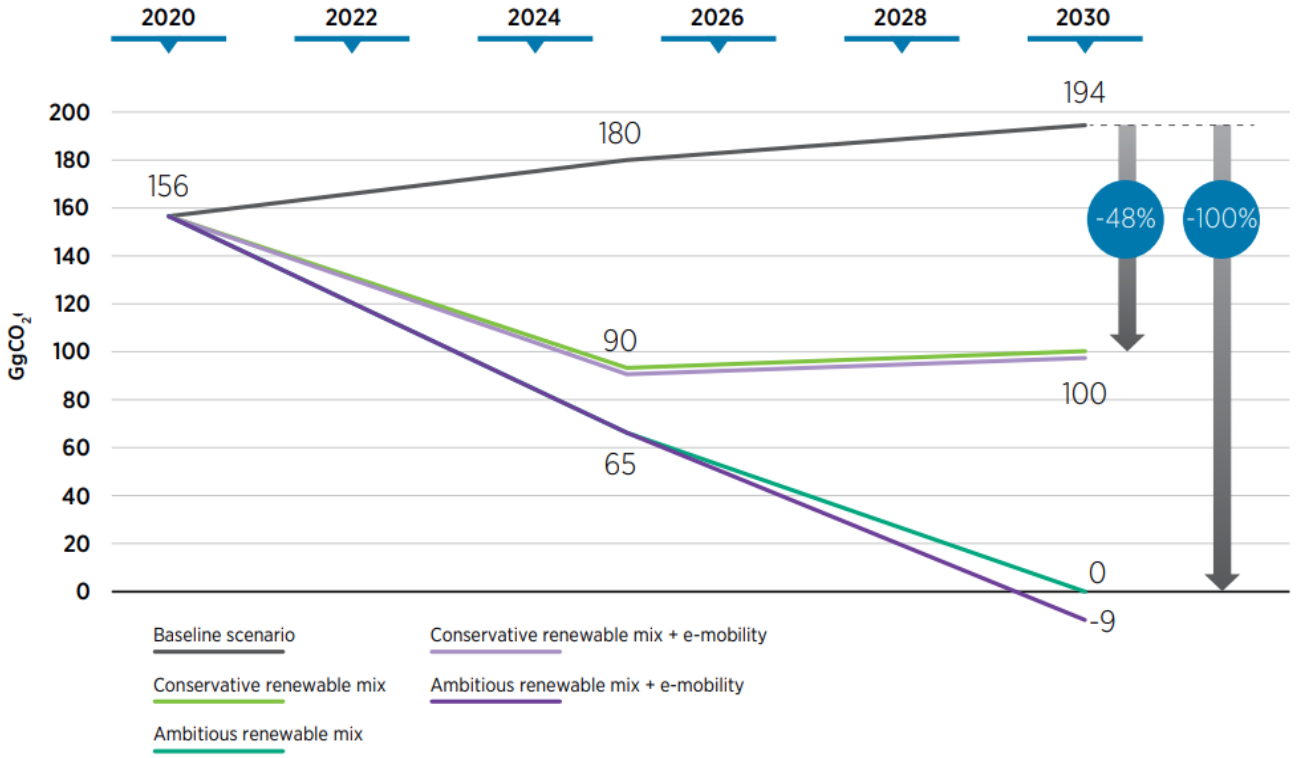
- Technical assessment of the performance, mitigation potential, associated costs, and adaptation co-benefits of renewable energy technologies and associated infrastructure in the power, transport, buildings and industry sub-sectors.
- Grid infrastructure assessment and integration of VRE
- Capacity building on renewable energy technologies and related infrastructure.



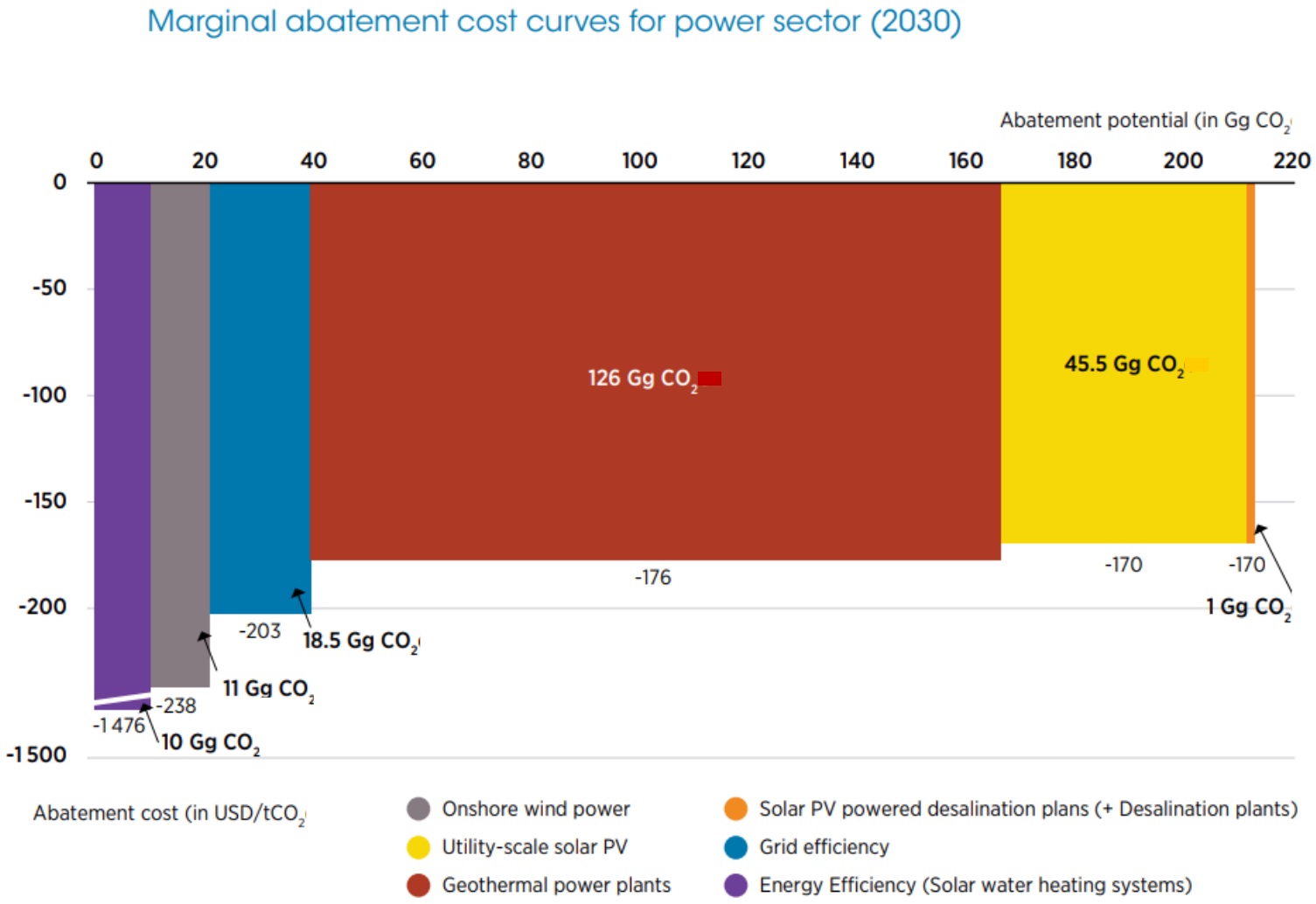
Technology and Infrastructure - Climate action support

Assessment of cost-effective mitigation options

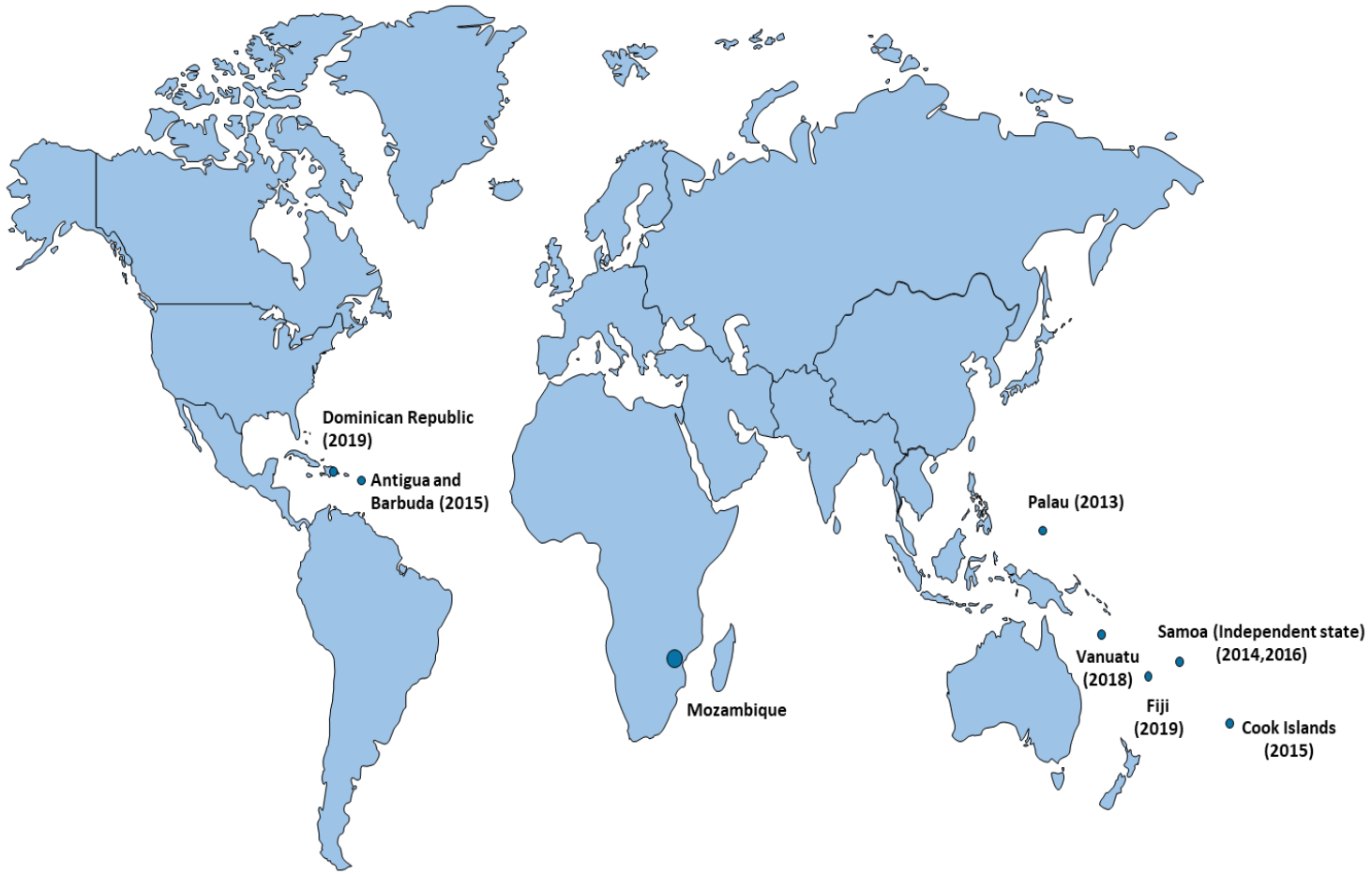
Reduction in total GHG emissions estimated from the implementation of mitigation options in 2030 compared with a baseline scenario



Technology and Infrastructure - Climate action support



Technology and Infrastructure - Grid Assessment and Modelling



Disclaimer: This map is provided for illustration purposes only. Boundaries and names shown on this map do not imply the expression of any opinion on the part of IRENA concerning the status of any region, country, territory, city or area or of its authorities, or concerning the delimitation of frontiers or boundaries.

List of studies completed include

1. Palau –Technical study
2. Samoa - Technical study
3. Antigua and Barbuda - Technical study
4. The Cook Islands - Technical study
5. Vanuatu –Techno-economic study
6. Fiji- Technical study
7. The Dominican Republic-Techno-economic study
8. The Republic of Mozambique-Technical study

Technology and Infrastructure - Grid Assessment and Modelling

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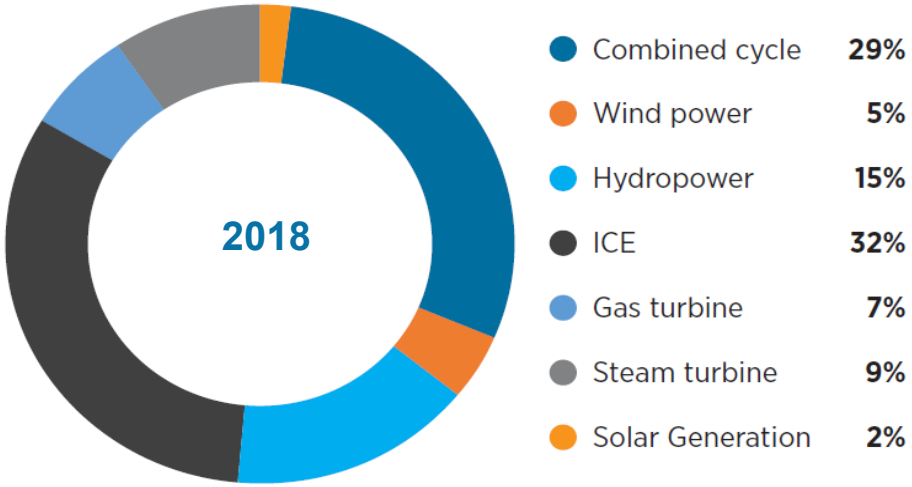
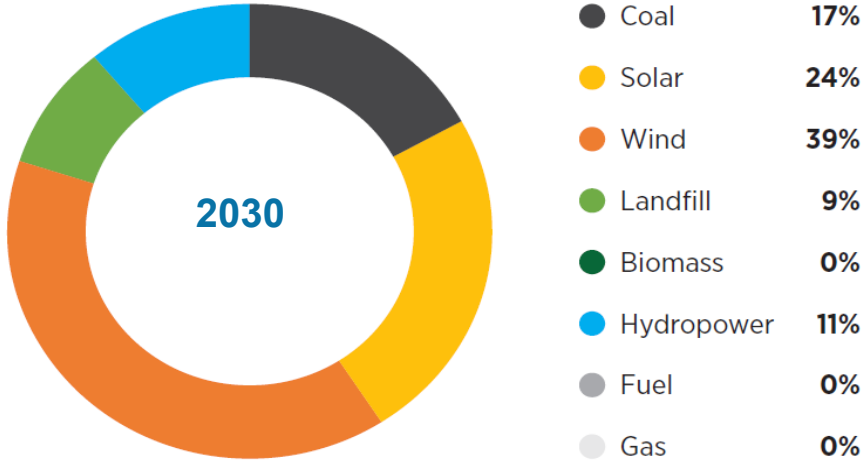
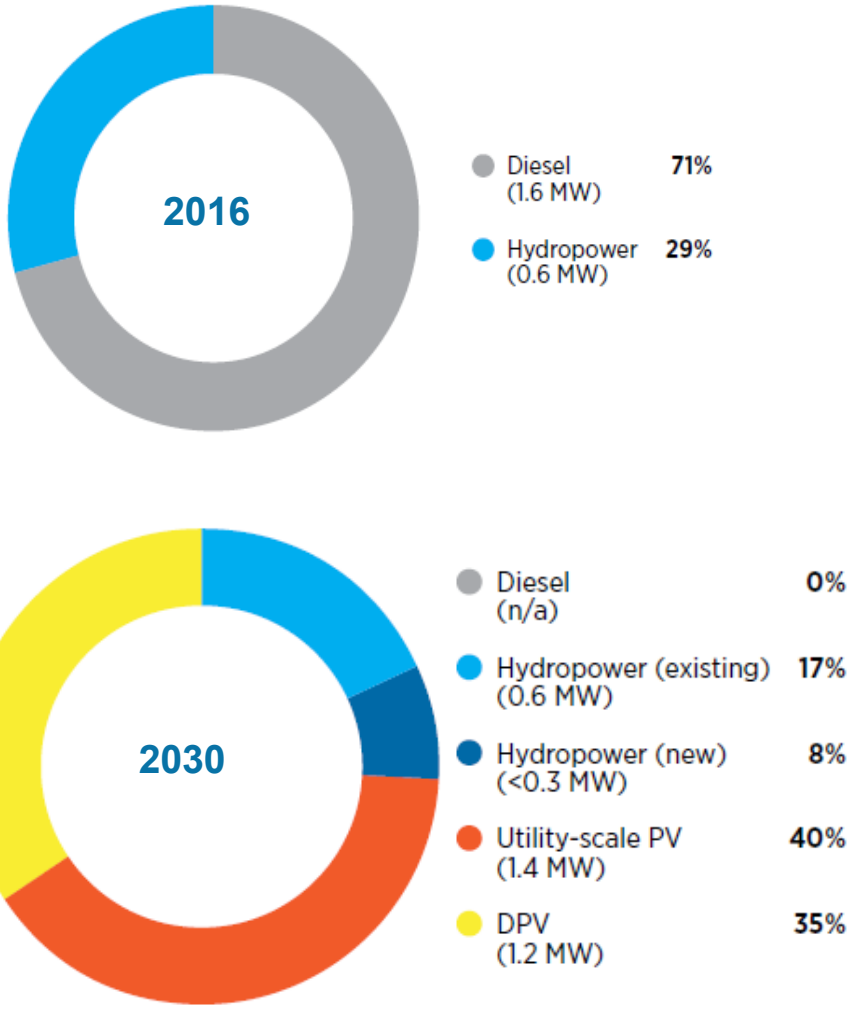
Previous state	New state
Regulated fuel influx	Variable Renewable Energy
Synchronous machines	Inverter-based resources
Large-scale power plants	Distributed generation
Flexible generation	Flexible generation, demand and storage
Process automation	Autonomous operation / Digital Smart Grid
Electric light and power	Electric light, power, heating and mobility
Consumers	Prosumers

Technology and Infrastructure - Grid Assessment and Modelling







Technology and Infrastructure

By adopting best practices, leveraging digital technologies, and collaborating across borders can accelerate the transition towards a greener future.

- **Global collaboration** drives renewable energy deployment
- Increasing ambition in mitigation and establishing bridges in adaptation
- Climate stakeholders secure the energy value chain, ensuring **grid reliability**
- **Best practices**, like distributed energy integration, modernize grids

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World Energy Transitions Outlook 2023: 1.5°C Pathway

IRENA Innovation and Technology Centre

IRENA – IITC – Renewable Energy Roadmaps

➢ Selected project: **World Energy Transition Outlook 2023**

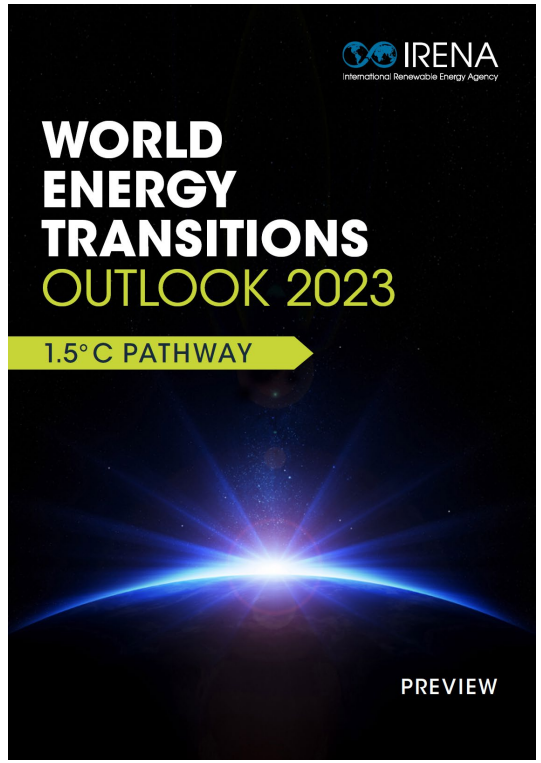
- Evaluates 1.5 Paris Agreement Scenario and Planned Energy Scenario. Assessing gaps for end use sectors and supply of fuels and power
- Detailed technology based, sectorial roadmaps, identify investment needs, finance and policies
- Volume I report focus on energy system transition pathways will be ready by June Volume II report focus on social-economic analysis will be following
- Regional Energy Transition Outlooks are under development to better capture the regional and national context

Planned Energy Scenario

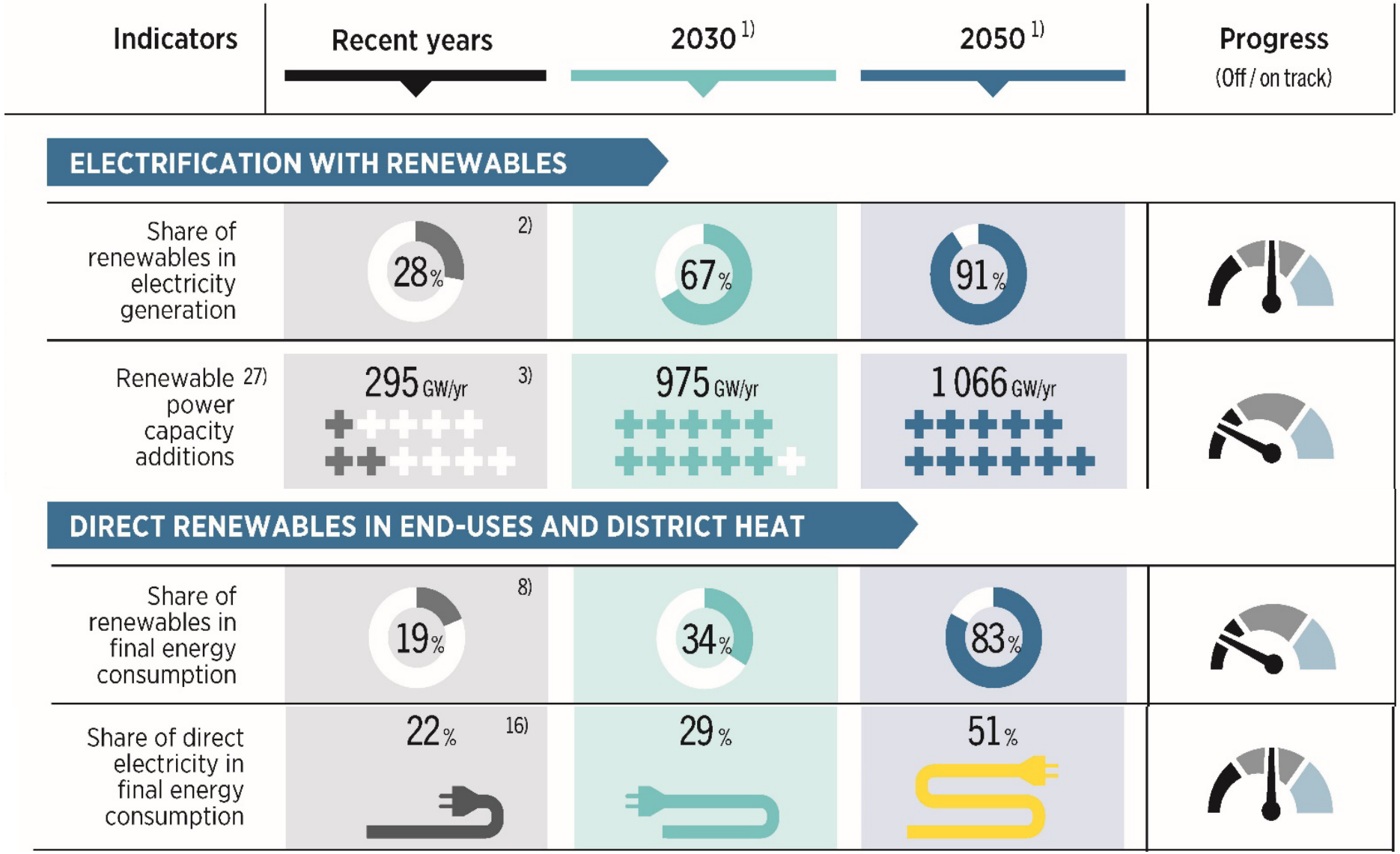
The **Planned Energy Scenario** is the primary reference case for this study, providing a perspective on energy system developments based on governments' energy plans and other planned targets and policies in place at the time of analysis with a focus on G20 countries.

1.5°C Scenario

The **1.5°C Scenario** describes an energy transition pathway aligned with the 1.5°C climate goal – that is, to limit global average temperature increase by the end of the present century to 1.5°C, relative to pre-industrial levels. It prioritises readily available technology solutions, which can be scaled up at the necessary pace to meet the 1.5°C goal.



Despite some progress, the energy transition is far from being on track to 1.5°C

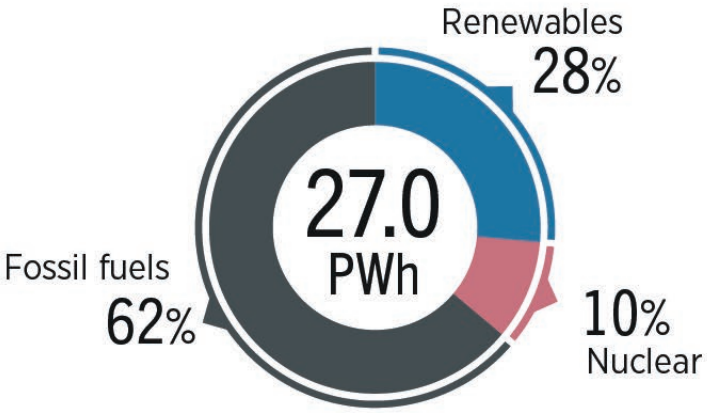


- Achieving the 2050 target depends on **sufficient action by 2030**. Radical action is needed to change the current trajectory.
- This will require **political will** and well-targeted **policy packages**.

Power generation needs to more than triple by 2050

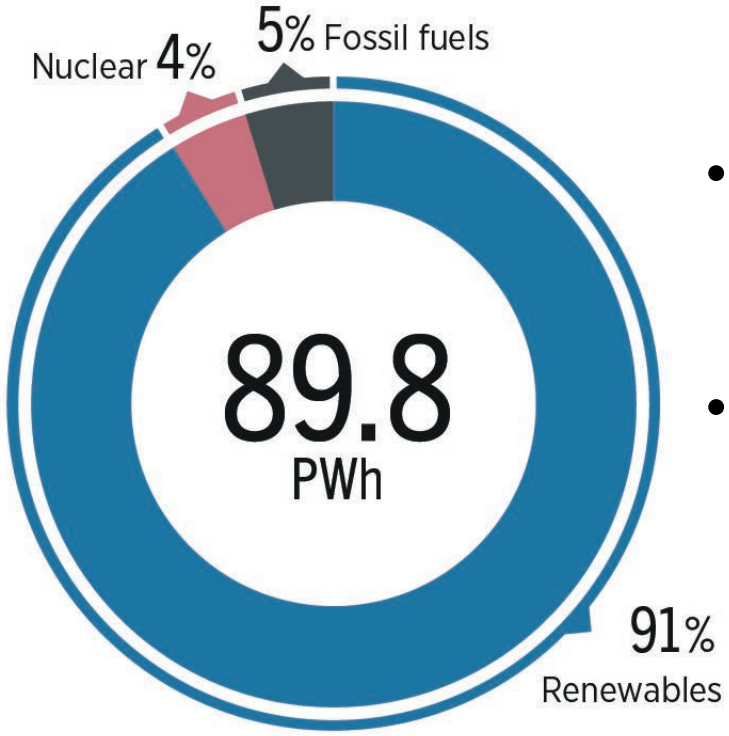
2020

Gross electricity generation (PWh)



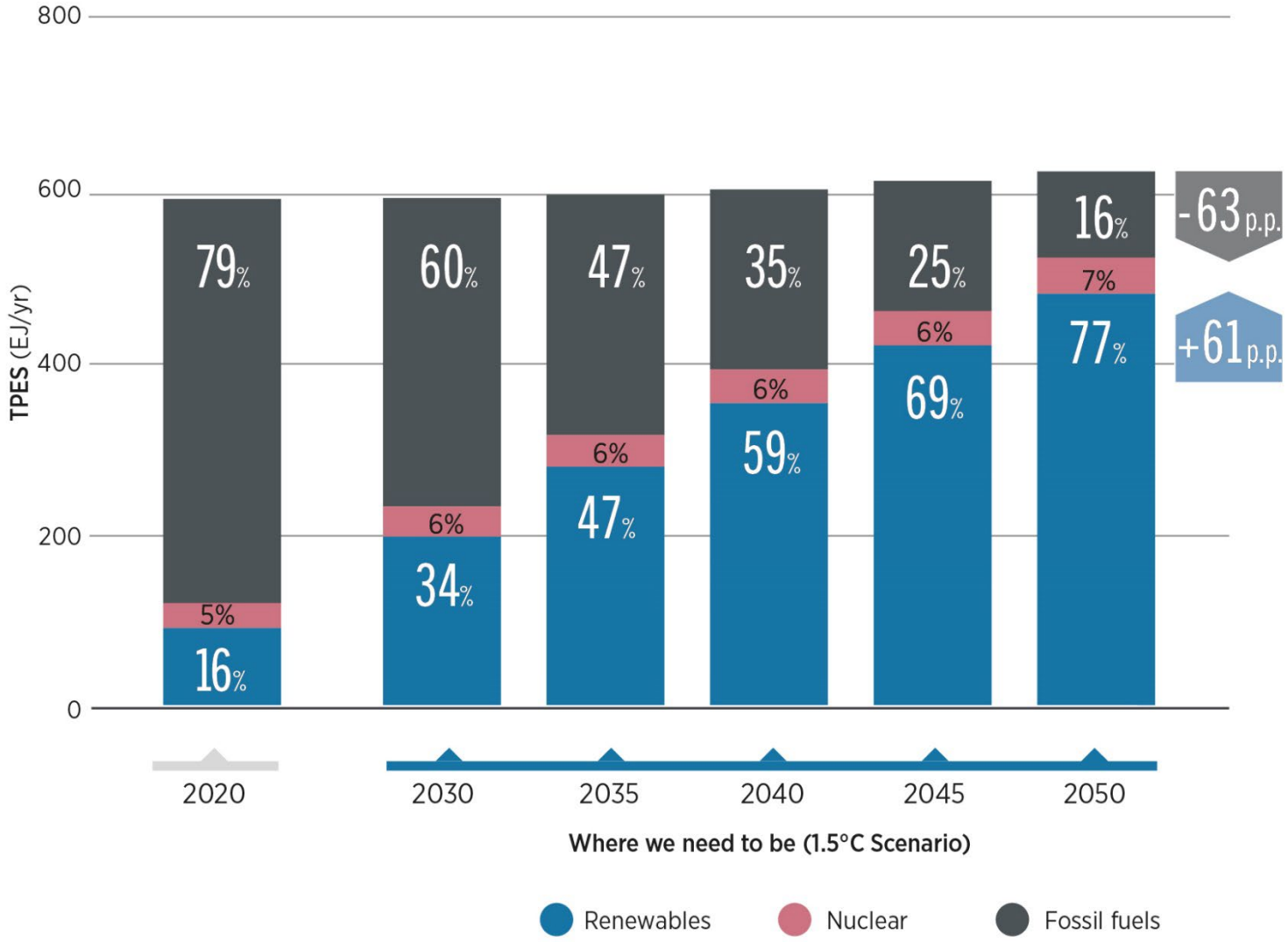
2050: Where we need to be (1.5-S)

Gross electricity generation (PWh)



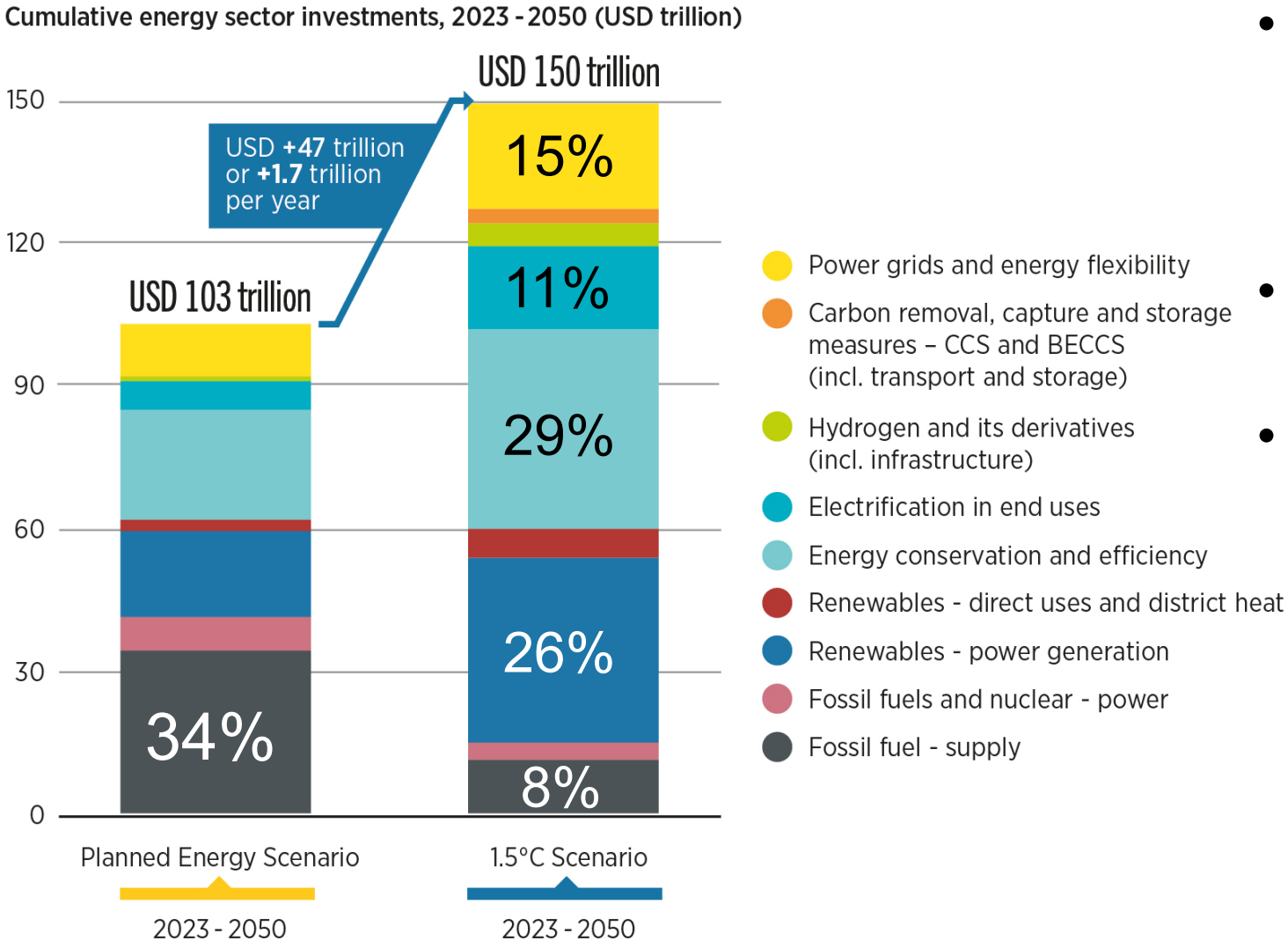
- **91%** of total electricity supply comes from **renewable** sources, compared to 28% in 2020
- **Coal**- and **oil**-based power generation would be **phased out entirely** by 2050
- **Natural gas** would only provide **5%** of total electricity needs, with **4%** met by **nuclear** in 2050

Renewables dominate total primary energy supply in 2050



- **Share of renewables** in total primary energy supply would grow from 16% in 2020 to **77% in 2050**
- The net gain of **61 percentage points** of **renewable energy share**, driven by a mix of end-use **electrification**, **renewable fuels and direct use**
- **Total primary energy supply stays stabilized** due to increased **energy efficiency** and growth of **renewables**

Investment priorities: renewables, efficiency and electrification



- **Energy investment decisions** should simultaneously **drive the transition** and **reduce the risk of stranded assets**
- **40%** of **planned energy investment** remains still aimed at **fossil fuels**
- A combination of **scale-up** and **reallocation** of investment in **energy transition technologies** with supporting **infrastructures** and **efficiency measures** is needed for achieving 1.5°C target (**USD 1.7 trillion/yr additional in average**)

Thank you!

For more information please contact:
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