



# **The Role of Renewables towards Net Zero Opportunities and Challenges ahead**

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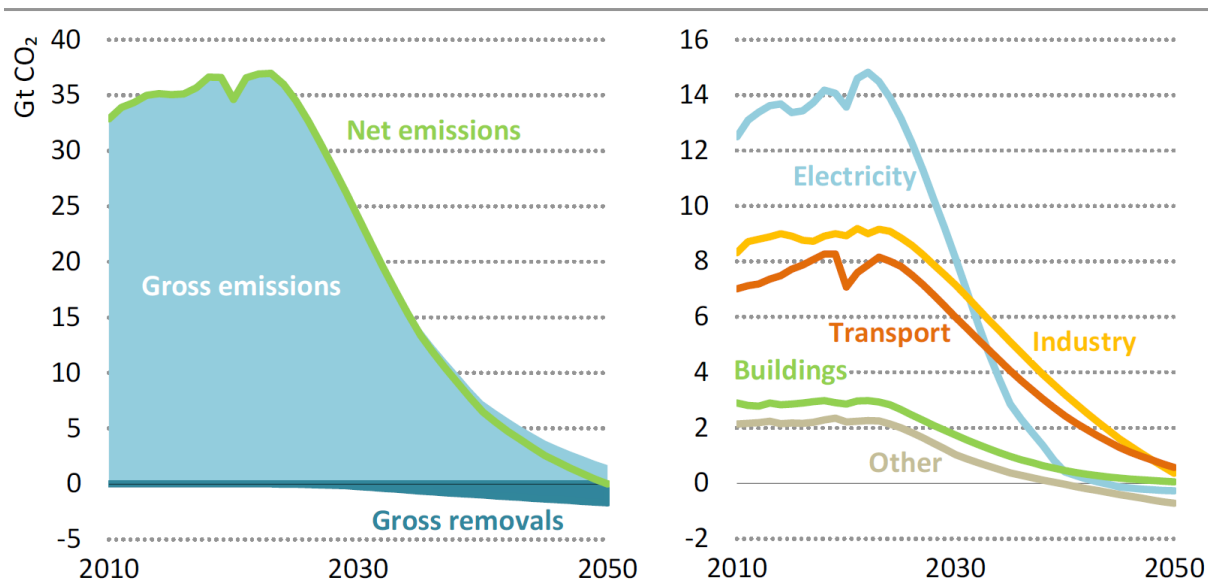
Sunshine Project 50<sup>th</sup> Anniversary Symposium NEDO  
20<sup>th</sup> June 2024

International  
Energy Agency

# Net Zero Emission (NZE) Scenario by 2050

# NZE requires a paradigm shift in energy supply and use

Total net CO<sub>2</sub> emissions, and net emissions by sector in the NZE Scenario, 2010-2050

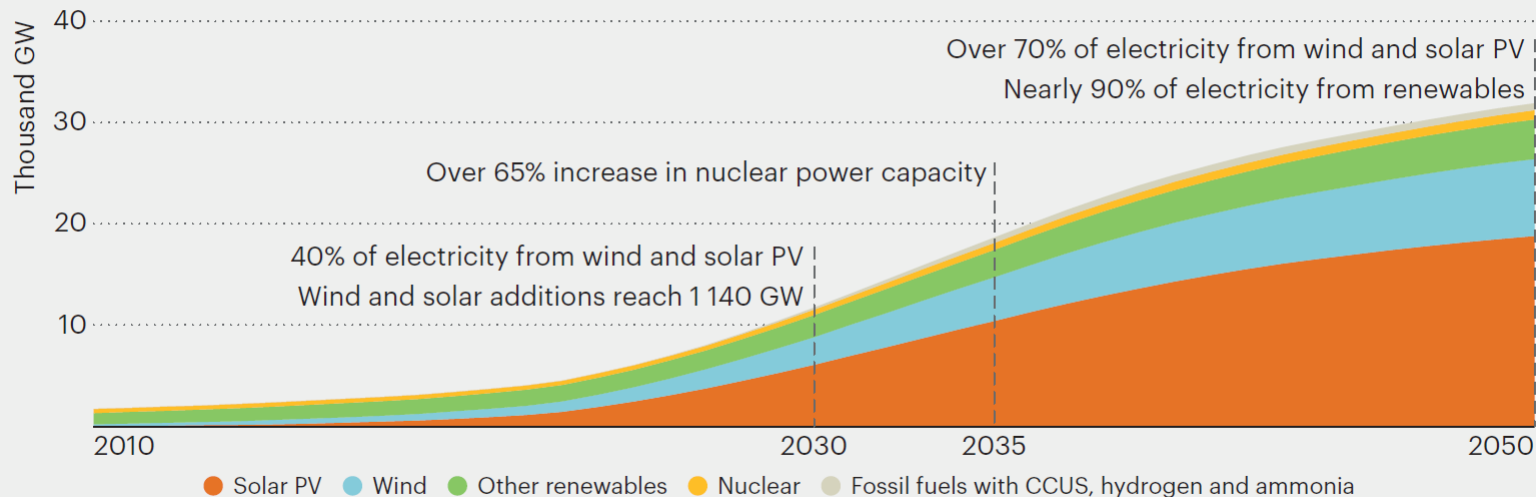


**By 2050 total energy demand decreases while the global economy is more than twice as large as in 2022. The share of modern renewables on total energy supply reaches almost 30% by 2030 and more than 70% in 2050.**

# Electricity leads the way to net zero

Global electricity capacity by source, NZE scenario

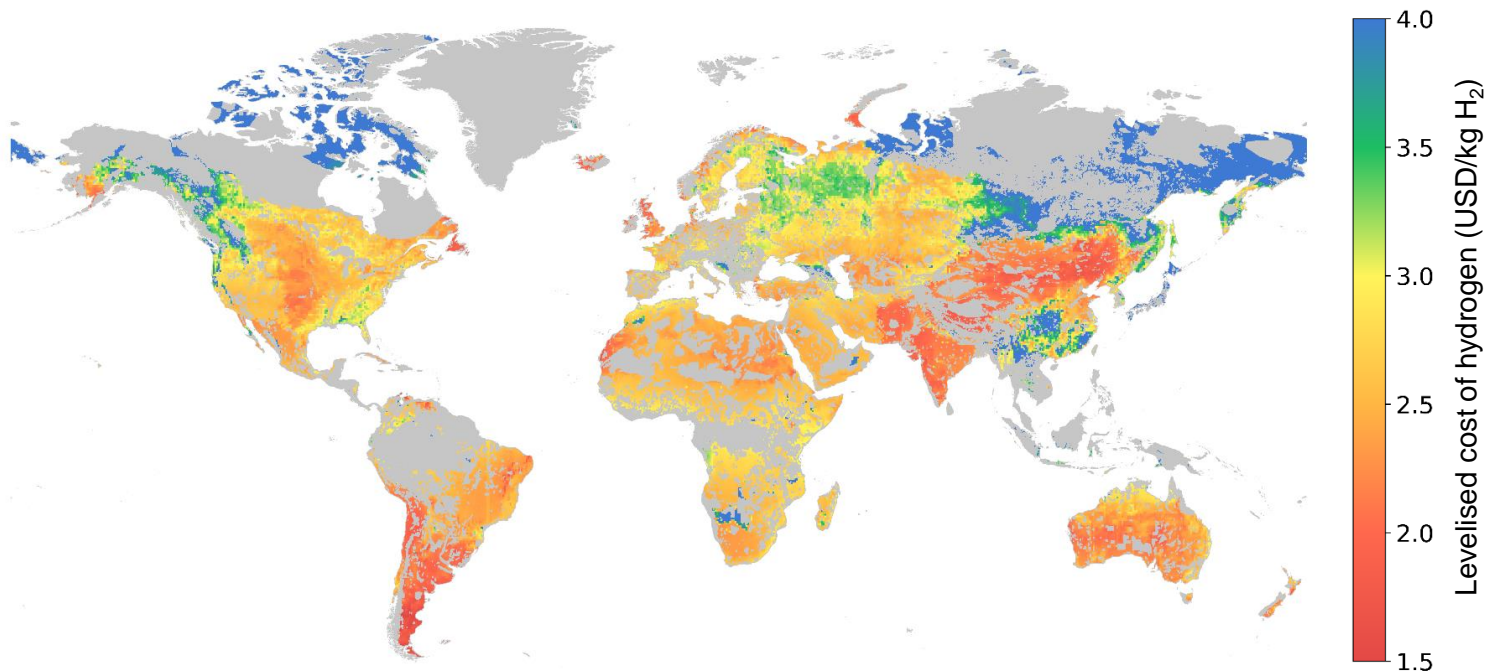
## Low-emissions electricity generation capacity by source



**Renewables make up nearly 60% of electricity generation in 2030 and nearly 90% in 2050, propelled largely by solar PV and wind. Electricity accounts for more than half of total final energy consumption by 2050**

# Scaling up deployment will bring down costs for renewable hydrogen

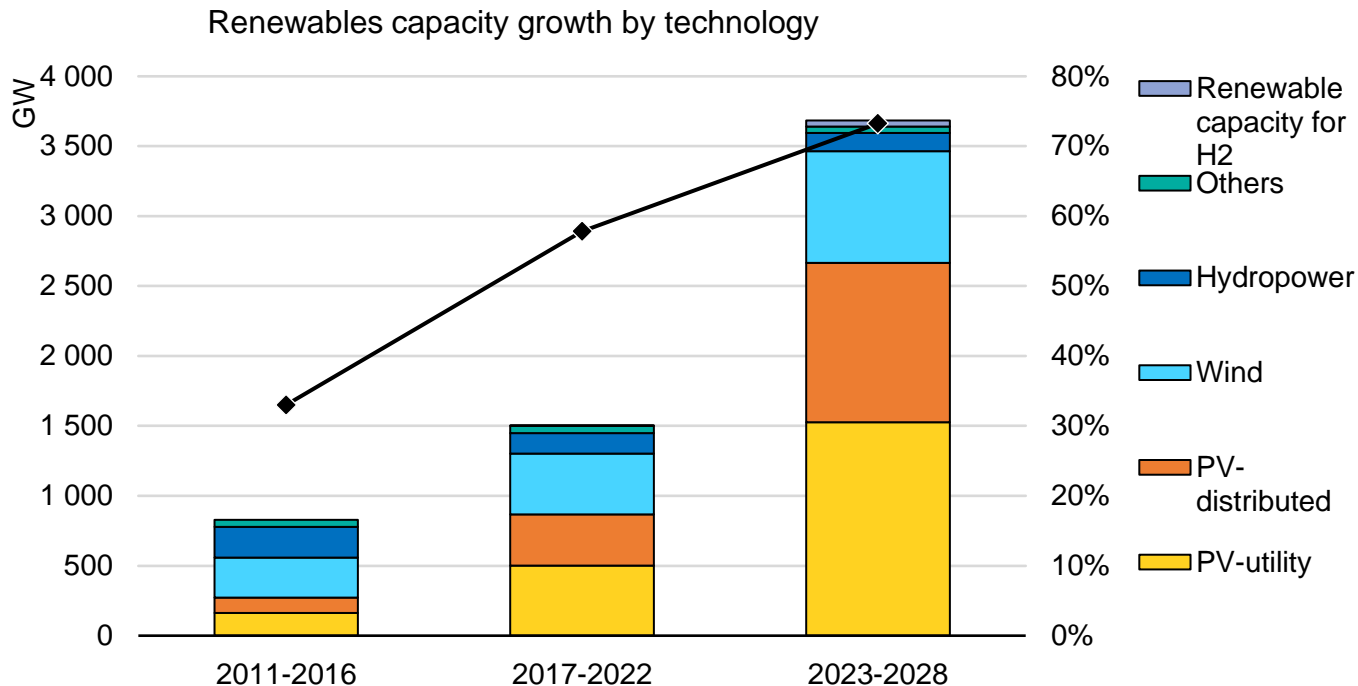
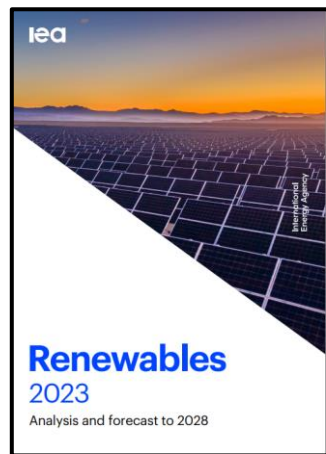
Hydrogen production costs from hybrid solar PV and onshore wind systems in the NZE Scenario in 2030



**Various regions around the world have excellent renewable resources for low-cost hydrogen production.  
Costs could approach USD 1.5 kg H<sub>2</sub> by 2030.**

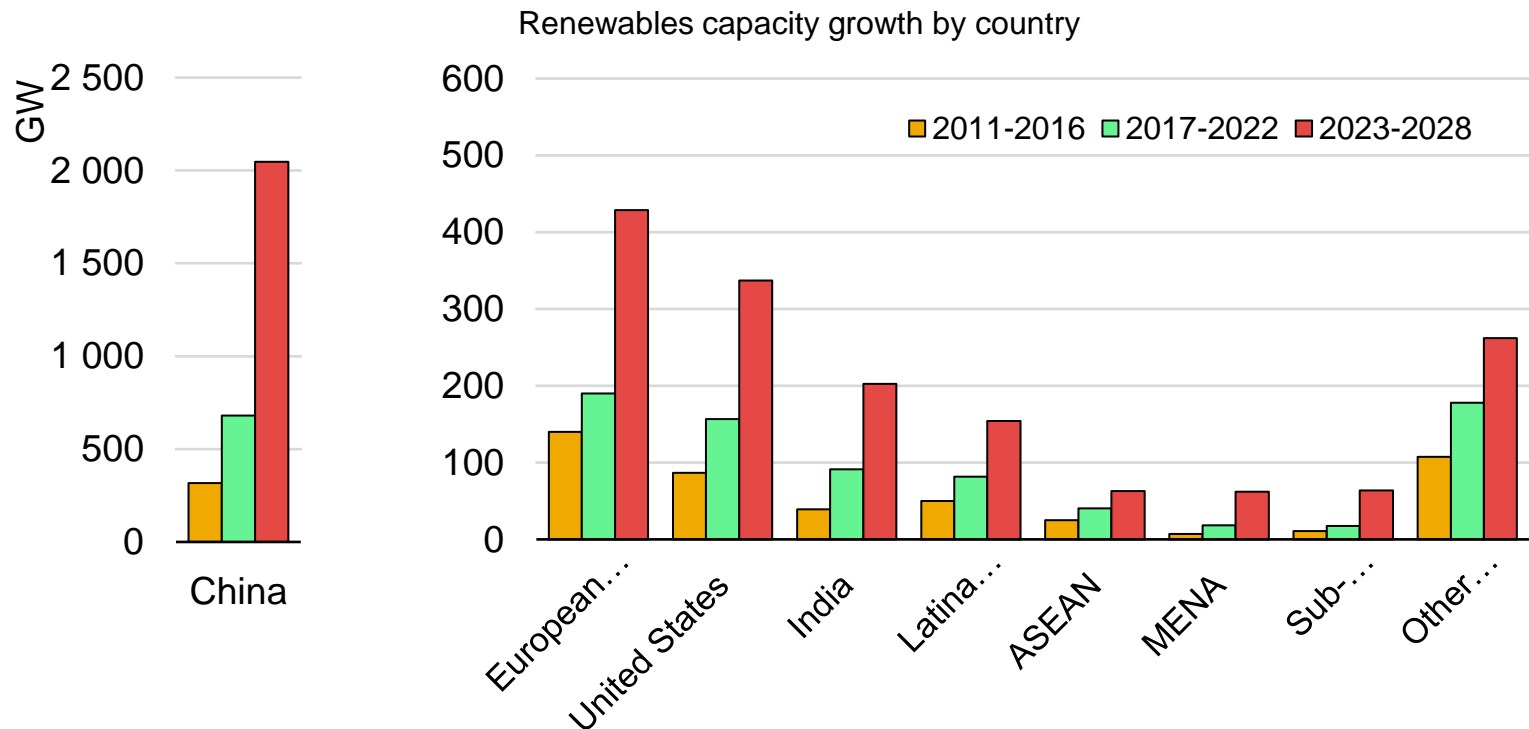
# Tracking Progress

# Unprecedented expansion of renewables driven by solar PV



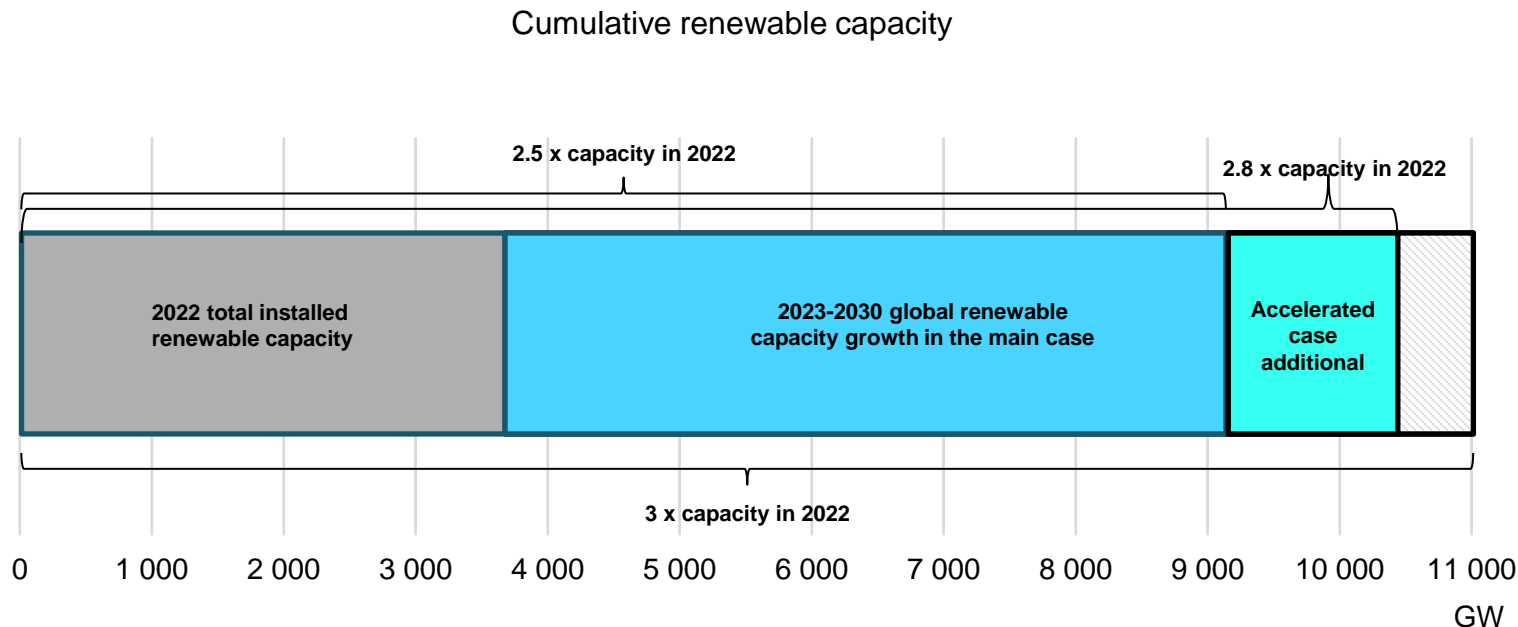
**Declining prices and faster adaption of rooftop systems push PV forecast up. Wind forecast outside of China is less optimistic due to higher costs and slow permitting. RE capacity for hydrogen growth only account for 7% of announced projects**

# Policies accelerate renewable deployment everywhere



**China, EU, US and India account for almost 85% of global expansion but renewables expansion rapidly catches up also in other parts of the world. For instance, growth in MENA and Sub-Saharan Africa matching ASEAN.**

# Tripling of RE capacity by 2030 is within reach but more effort is needed



**Massive renewables capacity growth is led by steadily cheaper solar PV, while wind and hydropower's accelerated expansion is challenged by permitting, financing and social acceptance issues**

## Renewable Energy Progress Tracker

Explore electricity, heat and transport data from Renewables 2023

[Link available](#)  
[Renewable Energy Progress Tracker – Data Tools - IEA](#)

Country/region

Denmark

Renewable electricity

Transport biofuels

Renewable heat

### COP28 Tripling Renewable Capacity Pledge

Tracking countries' ambitions and identifying policies to bridge the gap

International Energy Agency

5-year capacity growth by generation technology, Denmark

Generation technology

All

GW

20

15

10

5

0

-5

2011-2016

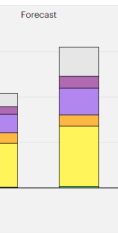
2017-2022

2023-2028

2023-2028

Main case

Accelerated case



Primary policy and market drivers for utility-scale renewable growth, Denmark

%

100

80

60

40

20

0

Green certificates 9%

Hydrogen projects 16%

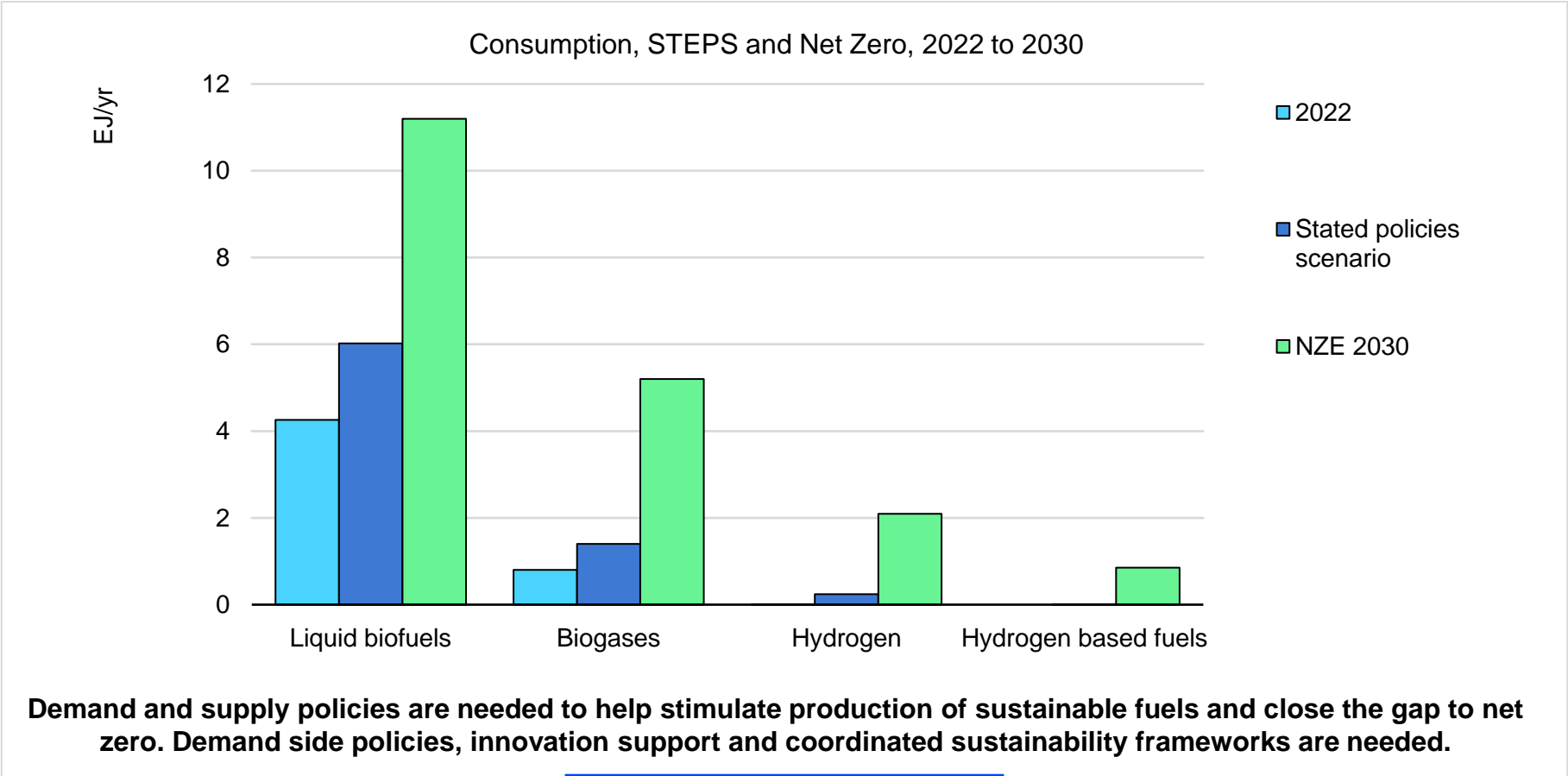
Auctions and tenders 23%

Corporate Power Purchase agreement 26%

Merchant 26%

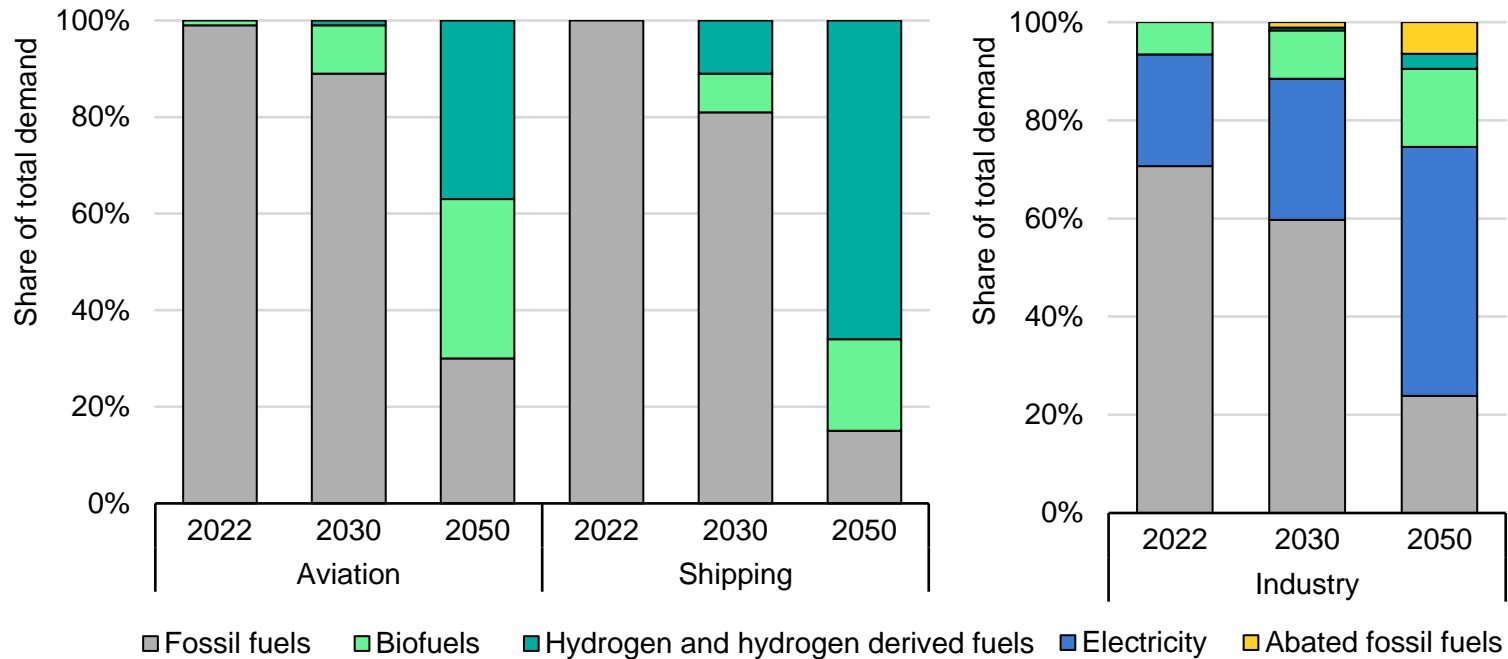
2023-2028

# Sustainable fuels are not on track for Net Zero



# Aviation, shipping, and industry depend on sustainable fuels to decarbonise

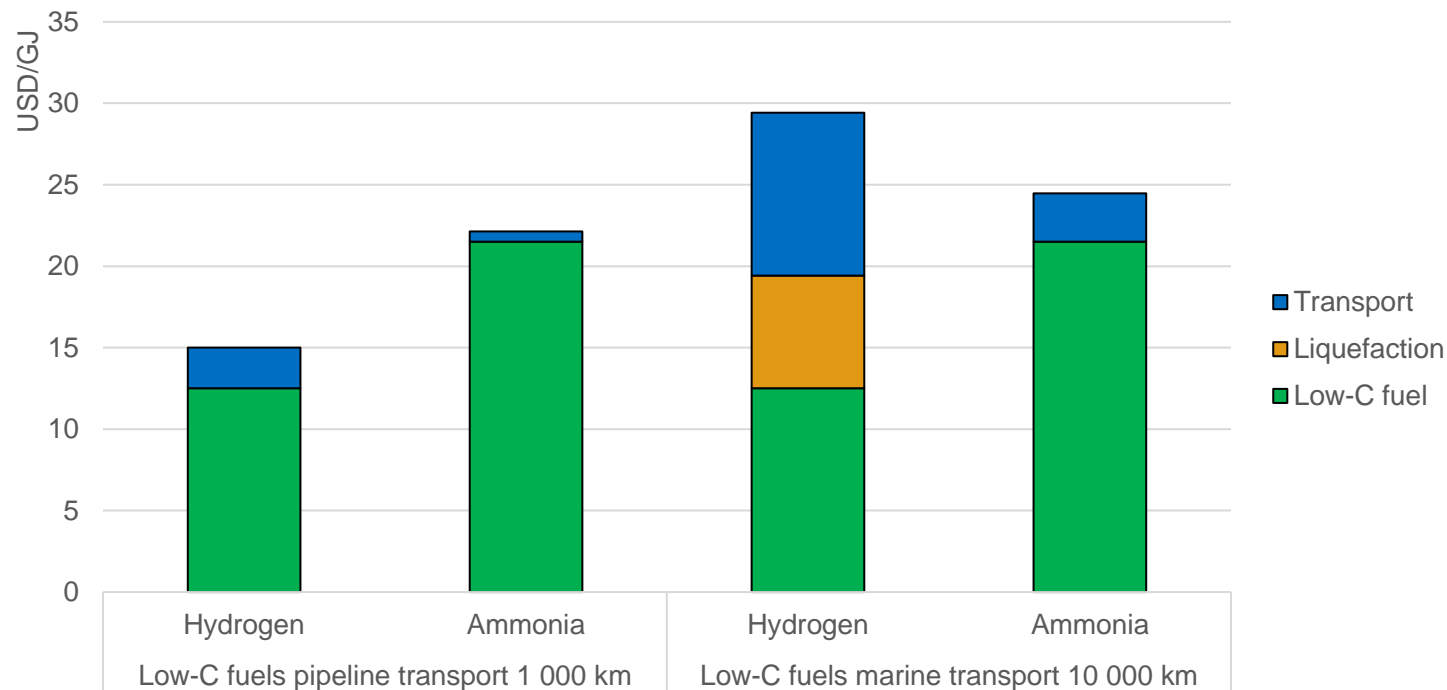
Energy demand for aviation, shipping and industry, IEA Net Zero Scenario, 2022 to 2050



**Sustainable fuels provide more than 75% of energy for aviation and shipping, and more than 25% of industry supply by 2050. The next decade is essential to commercialize the technologies necessary for future success.**

# Transport is a key component of total supply cost of low-emission fuels

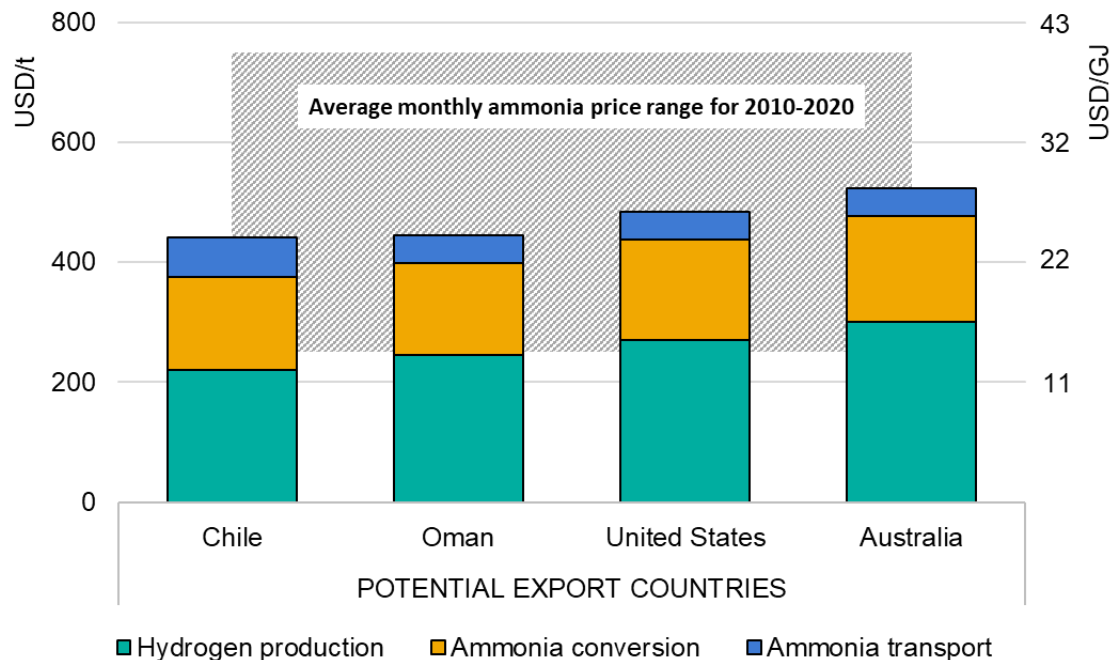
Supply cost of low-C hydrogen and ammonia based on pipeline or marine transport, 2030



**Ammonia is more expensive to produce than hydrogen, but its supply costs are lower if shipped over a long distance.**

# Renewable ammonia supply could be competitive by 2030

Renewable ammonia supply cost estimates from potential export countries in 2030

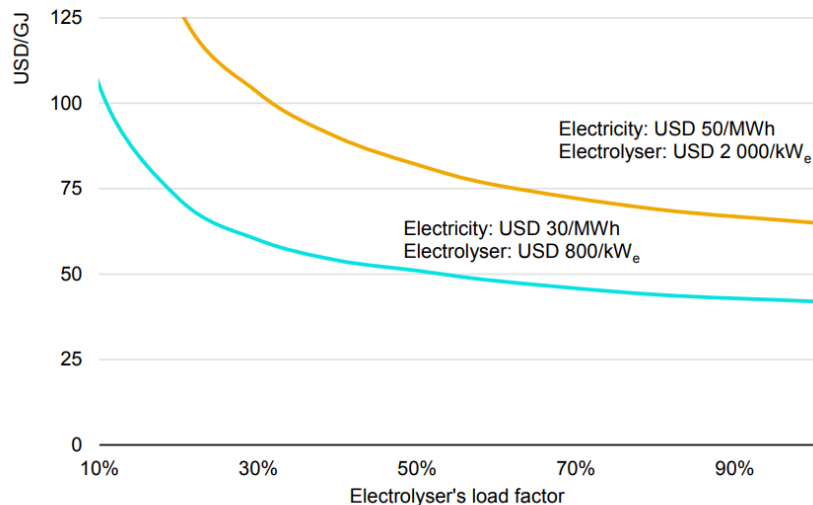


**Depending on the share of domestic H<sub>2</sub> use, Oman could need up to 20-30 times more ammonia export capacity by 2030. Given the long lead-times, planning and construction should begin in the next few years.**

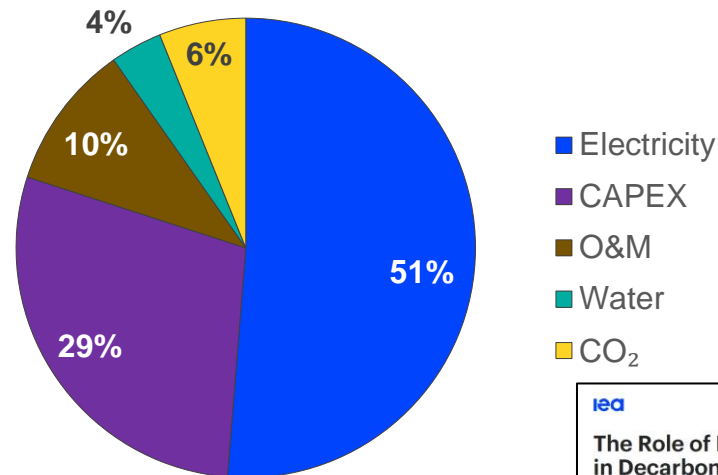
# Role of e-fuels in energy system diversification & transition

Cost breakdown of e-kerosene today (left), and sensitivity to capacity factor at different electricity and electrolyser price (right).

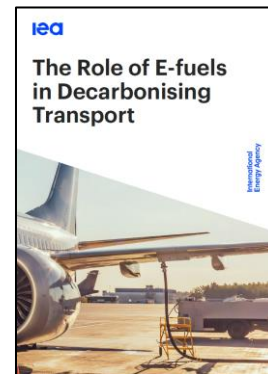
Figure 4.1 Impact of electrolyser's load factor on the levelised cost of e-kerosene at two different electricity and electrolyser prices



IEA. CC BY 4.0

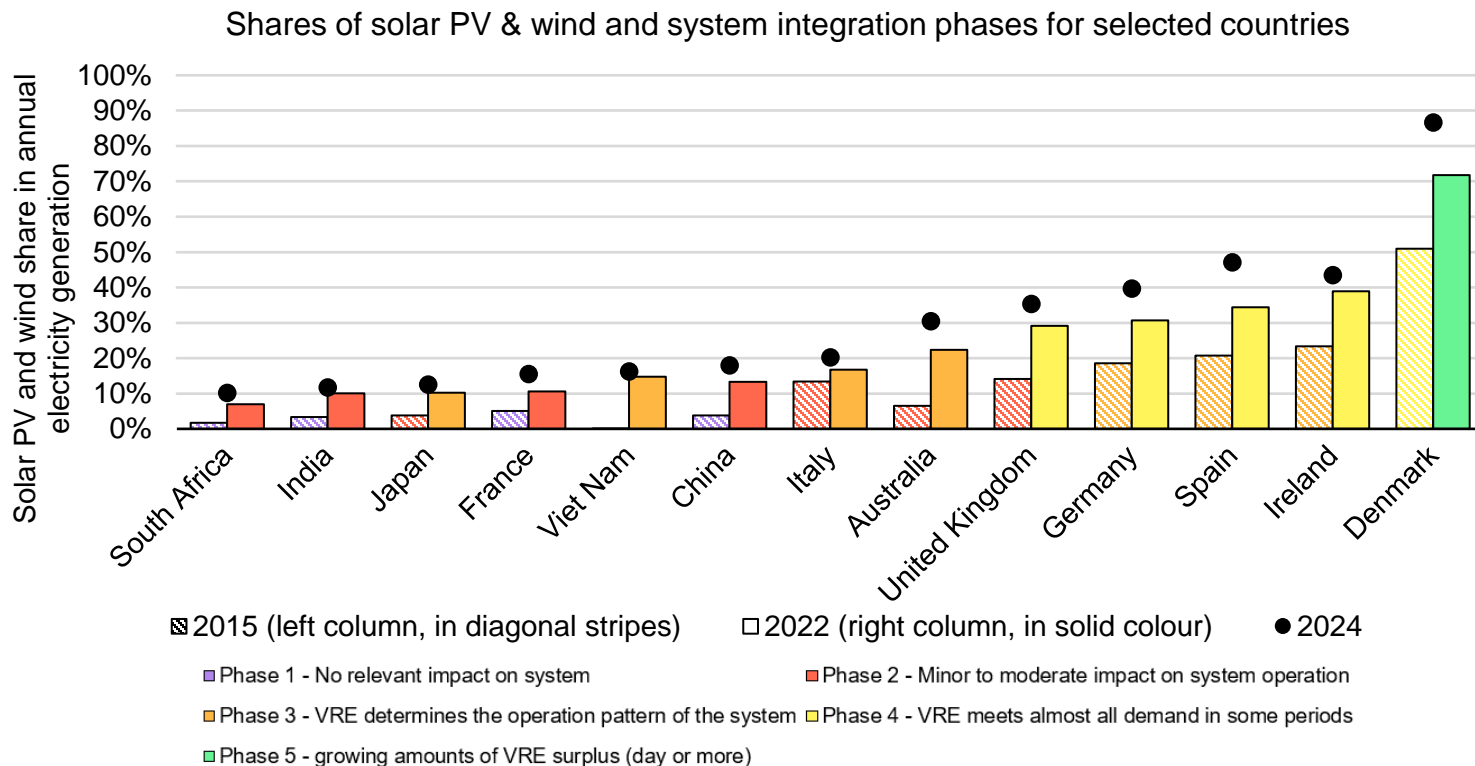


**Affordable e-fuels hinge on electrolyzer cost reduction, and availability of low-emission electricity and CO2 resources**



# Opportunities and challenges ahead

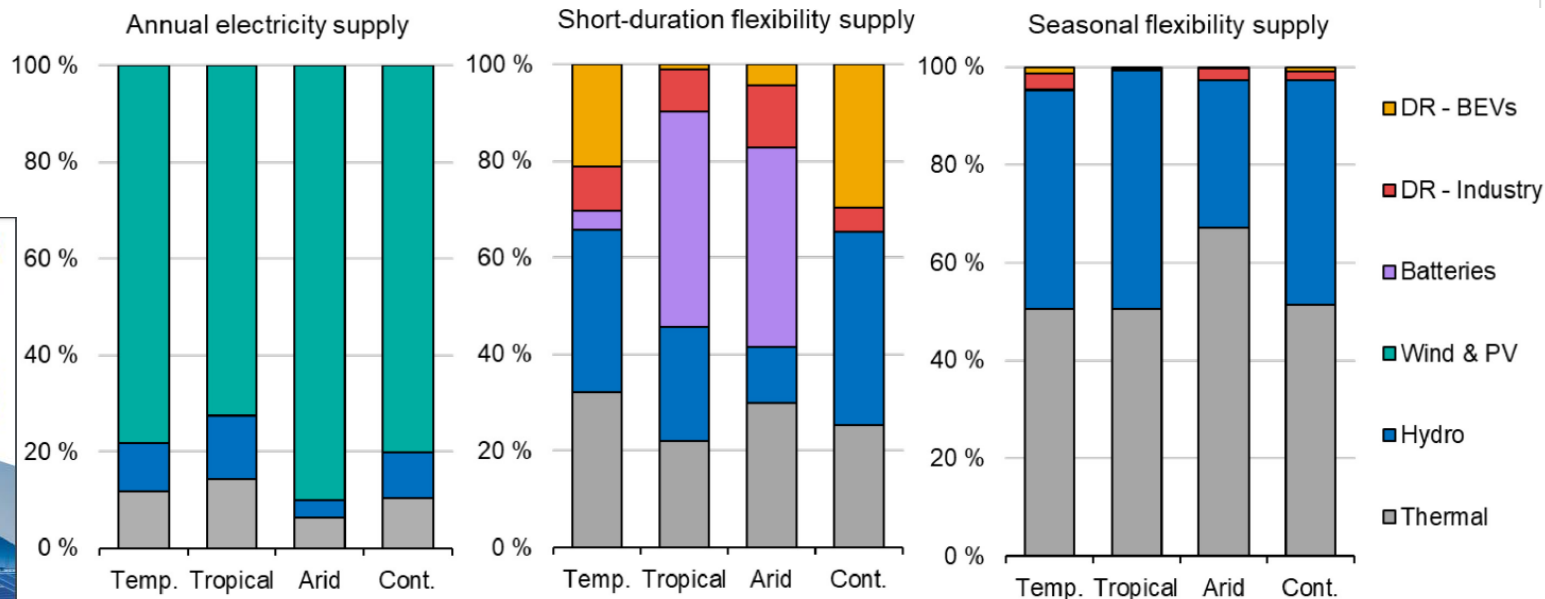
# Secure & cost-effective system integration of wind and PV is crucial



**Rapid uptake of variable renewables requires accelerated and timely investment in all forms of flexibility, in particular for those which have longer lead times such as grids and interconnections**

# Thermal plants are a key source of flexibility in high-VRE systems

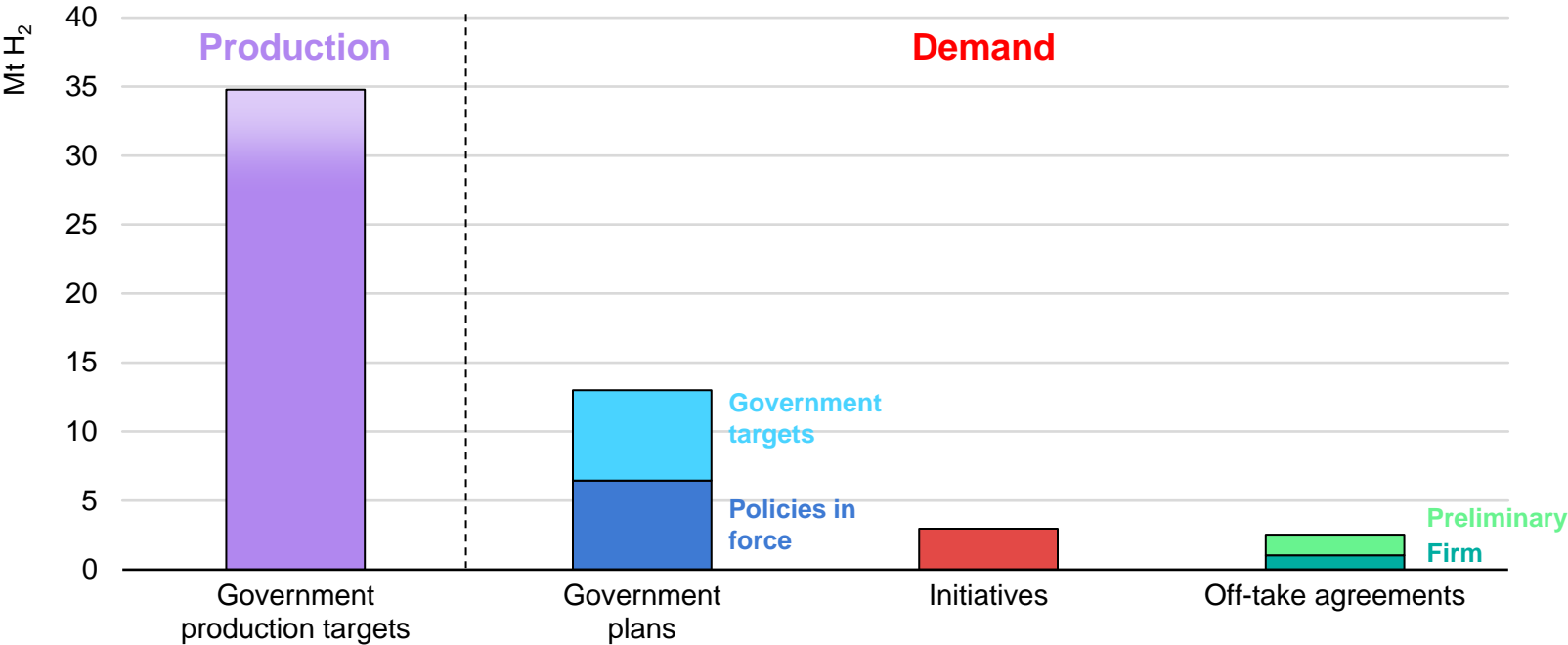
Electricity and flexibility supply by technology in different climatic conditions.



**At 70%-90% share of VRE from annual generation, thermal plants cover half to two-thirds of seasonal flexibility supply with hydropower covering most of the remaining needs.**

# Demand creation is falling behind production ambitions

Low-emission hydrogen production targets compared with potential demand



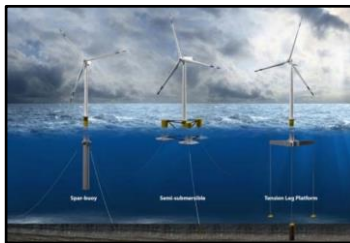
**Actions from governments, international co-operation initiatives and the private sector fall short of production ambitions.**

# Emerging Technologies

- ❑ Perovskites PV
- ❑ Floating wind offshore
- ❑ Ocean energy
- ❑ Enhanced geothermal energy



Perovskites PV  
Source: METI



Floating Wind Offshore  
Source: NEDO

- ❑ Electric thermal energy storage
- ❑ Synchronous condensers and grid forming technologies for integrating VRE
- ❑ Battery storage
- ❑ Advanced biofuels



Energy Storage Facilities(Li-ion Batteries and Heat Batteries)  
Source: NREL and RONDO



Renewable 12 TCPs  
under the umbrella of  
REWP

# **IEA 50<sup>th</sup> Anniversary and Ministerial Meeting**

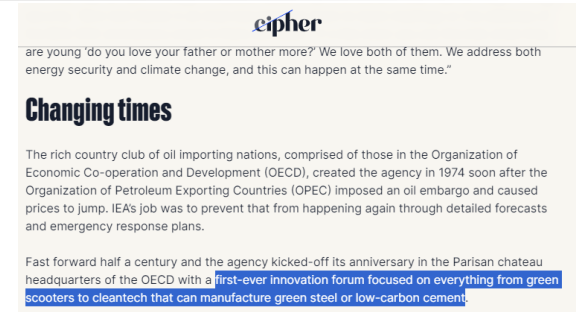
# IEA Energy Innovation Forum – 13 February 2024



- Held alongside the IEA Ministerial Meeting celebrating the IEA's 50<sup>th</sup> anniversary
- 250 engaged participants throughout the day, and 350 people present for the opening session
- >70 companies/start-ups, and 15 investors. 45 of which were represented by founders or CEOs.
- Around 45 countries were represented, from 6 continents
- In addition to many national delegates and international organisations, several IEA TCPs and CERT delegates participated



Innovation in all its forms in spotlight at first **Energy Innovation Forum** at IEA Ministerial



NEWS ANNOUNCEMENT | 12 February 2024 | Directorate-General for Energy

## President von der Leyen and Commissioner Simson in Paris to celebrate 50th anniversary of the International Energy Agency

This week, the European Commission is joining global energy and climate leaders in Paris to celebrate the 50<sup>th</sup> anniversary of the International Energy Agency at the annual [International Energy Agency Ministerial Meeting](#). This year, the event will be accompanied by a series of High-Level Dialogues and an [Energy Innovation Forum](#).



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CISION

## Minesto participates in roundtable at International Energy Agency's invite-only Energy Innovation Forum on Global Energy Transition

# 2024 IEA Ministerial Communiqué emphasised Renewables

- **Tripling renewable energy capacity** globally by 2030, taking into account national circumstances.
- The IEA to provide policy recommendations in priority intervention areas, including **investments in power grids, lowering costs of financing in developing states, and speeding up permitting**.
- To extend the resilience and reliability and increase the utilisation of renewable energy through measures such as **grid-scale batteries, pumped-storage hydropower and other storage technologies, grid reinforcements, smart grids, digitalised demand response, PV self-consumption, distributed generation, and the proactive role of consumers as prosumers**.
- Further developing clean energy technologies such as **renewables, low carbon and renewable hydrogen and its derivatives such as ammonia, and CCUS** particularly for hard to abate sectors.
- Commitment to support **energy RD&D to reach the 2050 objectives, including through the IEA's Technology Collaboration Programmes (TCP)**.
- Welcome the upcoming opening of the **IEA's Regional Cooperation Centre in Singapore**

