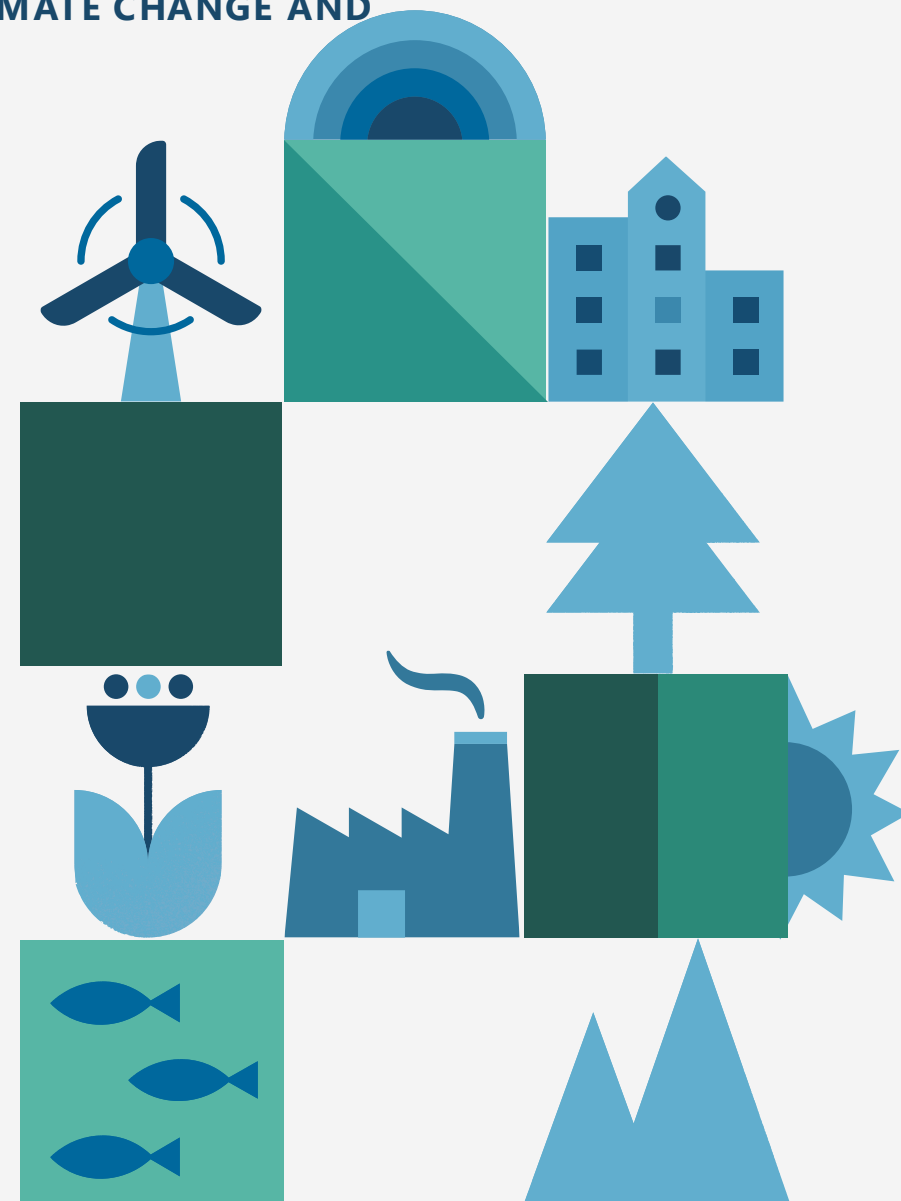


# ***THE ENERGY TRANSITION AND TRADEOFFS BETWEEN OLD/FOSSIL AND NEW/TECHNOLOGICAL DEPENDENCIES***

A Report On Energy Transition



# The dual level of the energy transition

## 1 Centralized System Transformation

Replace fossil fuel plants with large-scale renewable sources:

- Onshore and offshore wind farms
- Solar PV farms
- Hydro pumped storage
- Nuclear power

Continued centralized structure, but centered around renewable energy.

## 2 Decentralized System Transformation

Expand smaller-scale energy sources (e.g., rooftop PV)

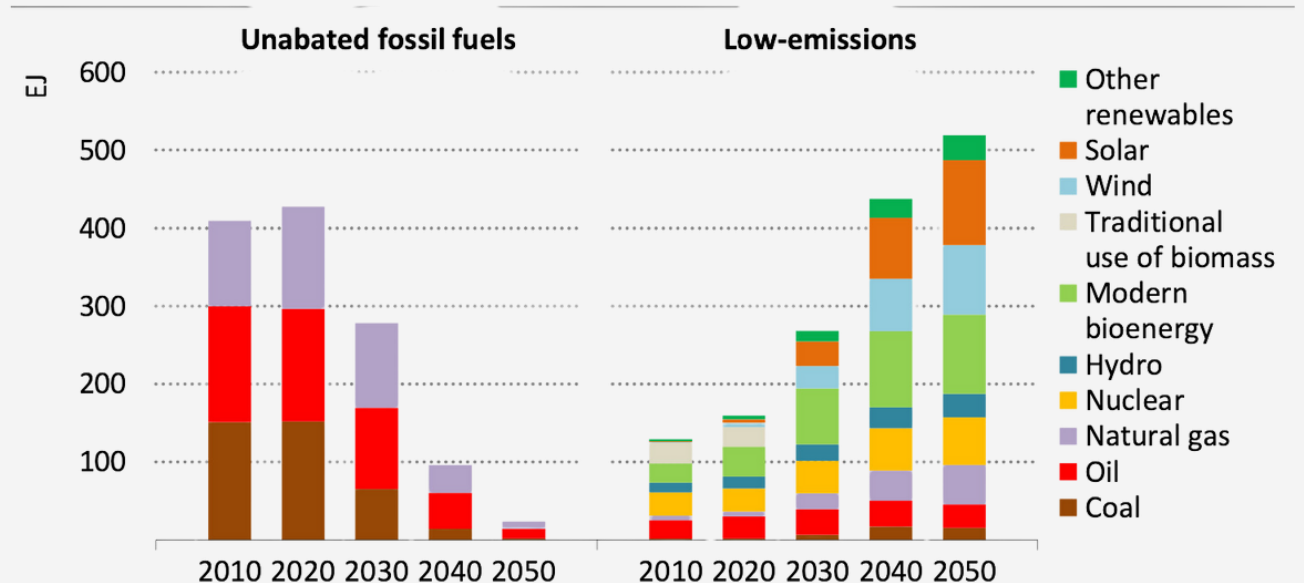
From a consumer model towards a "prosumer"

Electrification (industry, space heating, EVs)

Energy storage

The IEA in its report [\*"Net Zero by 2050: A Roadmap for the Global Energy Sector"\*](#), sets out a narrow but achievable pathway for the global energy sector to reach net zero emissions by 2050.

Total energy supply of unabated fossil fuels and low-emissions energy sources in the NZE proposed by the IEA



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*Some fossil fuels are still used in 2050 in the production of non-energy goods, in plants equipped with CCUS, and in sectors where emissions are hard to abate*

Note: Low-emissions includes the use of fossil fuels with CCUS and in non-energy uses.

# The Key Technological Enablers



Technological Enabler	Centralized Generation & Storage	Decentralized Generation & Storage
<b>Smart Grids &amp; Grid Optimization</b>	N/A	Enable prosumers to manage energy generation, storage, and consumption in real-time. Enable demand-side management, shifting load to non-peak hours through smart appliances and automation
<b>Renewable Energy Generation</b>	Onshore and offshore wind farms, solar PV and CSP farms, hydropower, and nuclear energy provide primary power generation	Rooftop solar PV and other small-scale renewables empower localized energy generation.
<b>Energy Storage Technologies</b>	Grid-Scale Storage: Dominated by pumped hydro with growing battery storage. Alternatives to lithium-ion batteries are growing. Thermomechanical storage systems will be critical.	Distributed Storage: Stationary batteries, electric vehicles (with Vehicle-to-Grid) and distributed thermal storage enhance grid resilience and load shifting. Thermomechanical storage systems will be critical

# Solutions for successful transition

## 1. Increasing Flexibility through diversification of energy vectors and technologies



Upscaling the number of long and medium-term storage solutions

Integrating Diverse Energy Sources

Need for affordability for the Global South

China is dominant in manufacturing capacity

Tech integration

In combination with the renewable energy sourcing this could be a solution for rural areas and support of the central grid

Adopt e-fuels, biofuels, hydrogen  
- Using the natural gas infrastructure for hydrogen

Create new technologies that are scalable and non-location specific

Focus on regional manufacturing strengths rather than competing in established sectors.

Smart grid systems, AI, and micro-cogeneration

# Placing Scientific Research at the Forefront of the Energy Transition

## 2. New technologies must be given the chance to develop into practical solutions

### Scientific Collaboration Forum Create a Platform for Research



A forum where students and young scientists can share early-stage ideas.

Collaboration and acknowledgment of concepts that could shape the future of energy.

### How it works



Scientists upload their papers or early-stage ideas.

Opportunities for funding and development based on merit and feasibility.

Researchers can network, exchange ideas, and accelerate progress in all stages of energy research.