



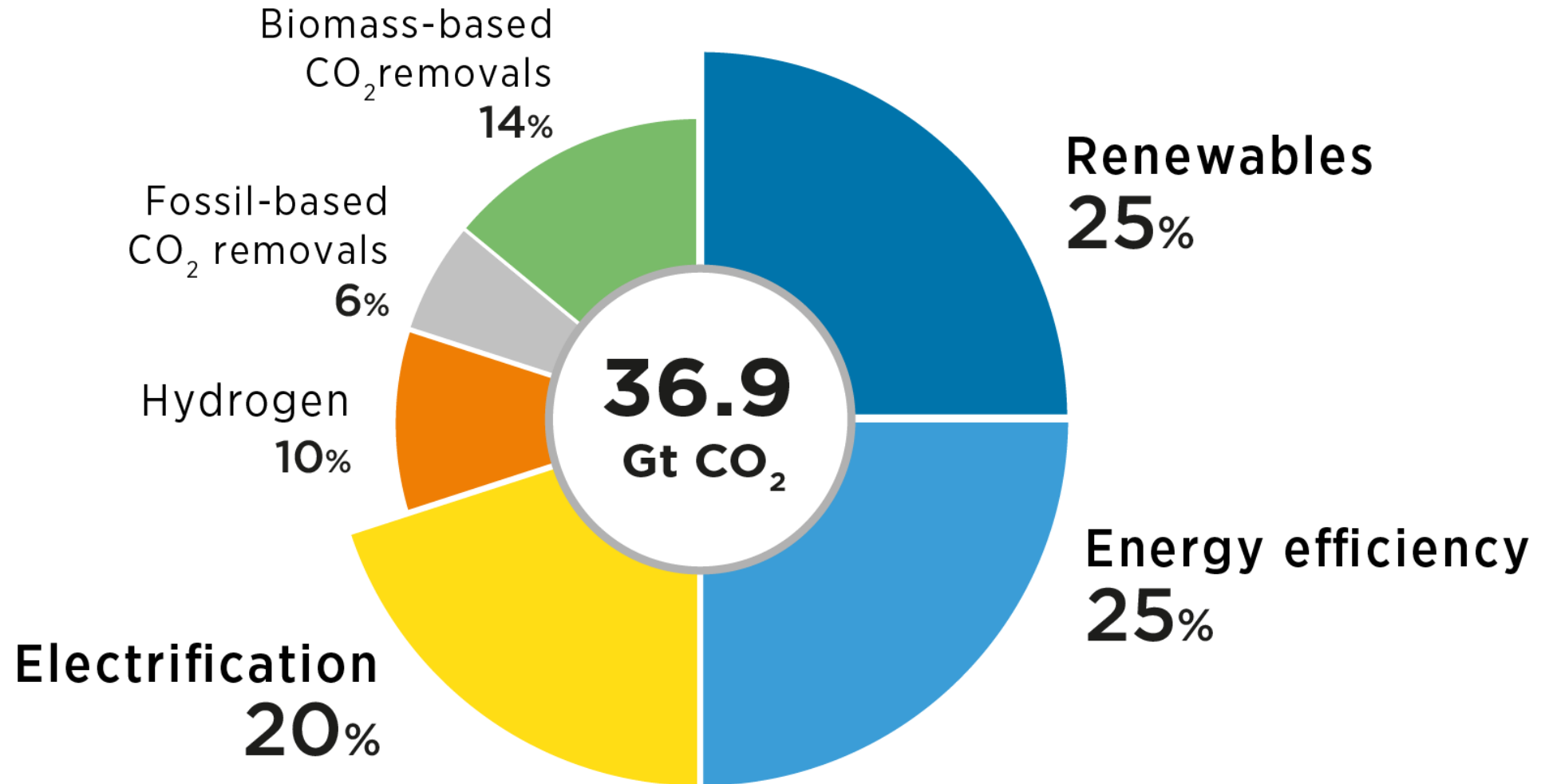
# WORLD ENERGY TRANSITIONS OUTLOOK

1.5°C Pathway

**Gauri Singh**

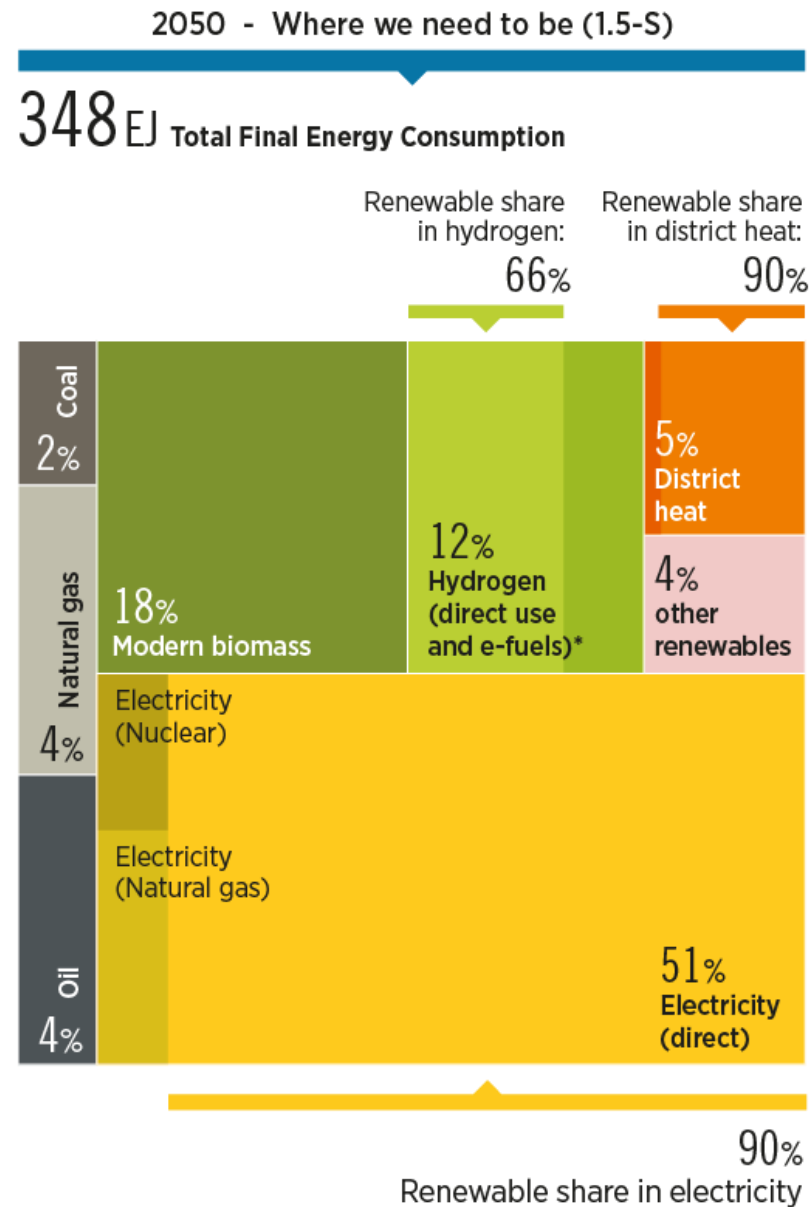
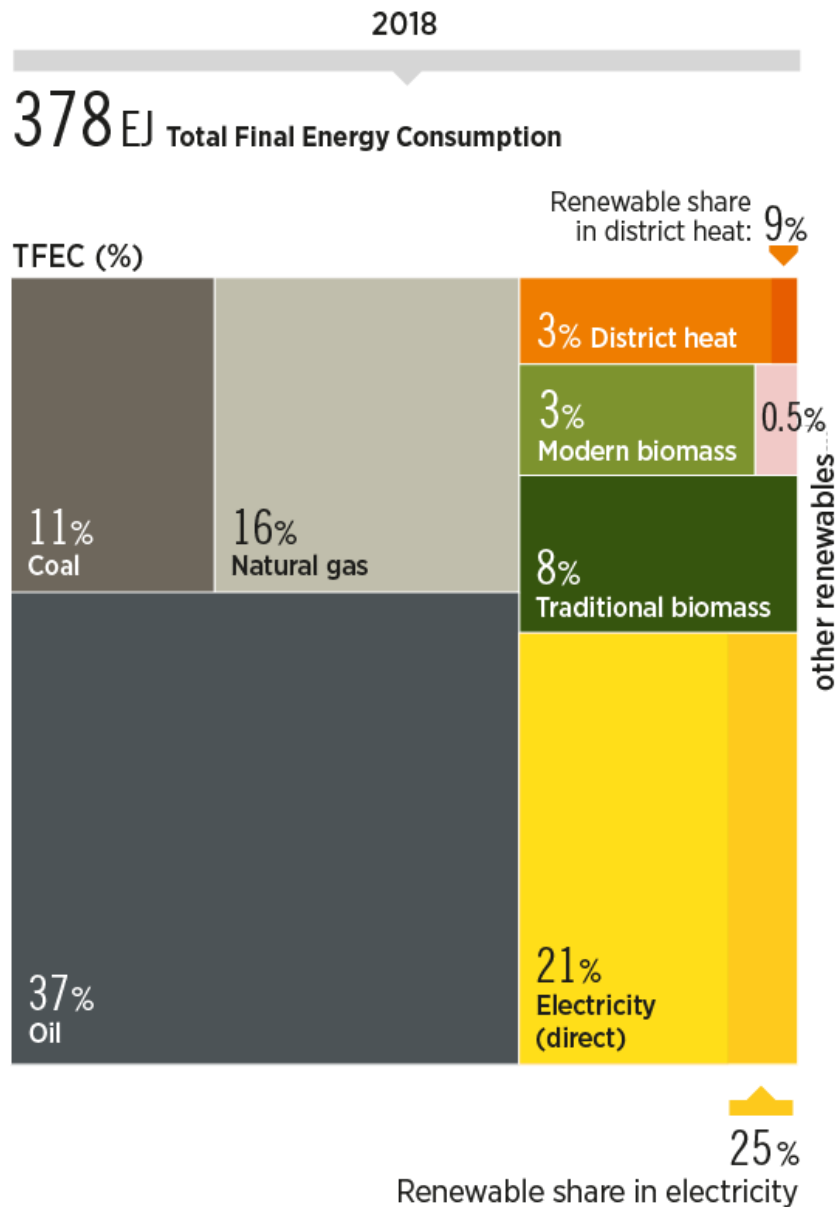
Deputy Director-General

## Renewables, efficiency and electrification dominate energy transition



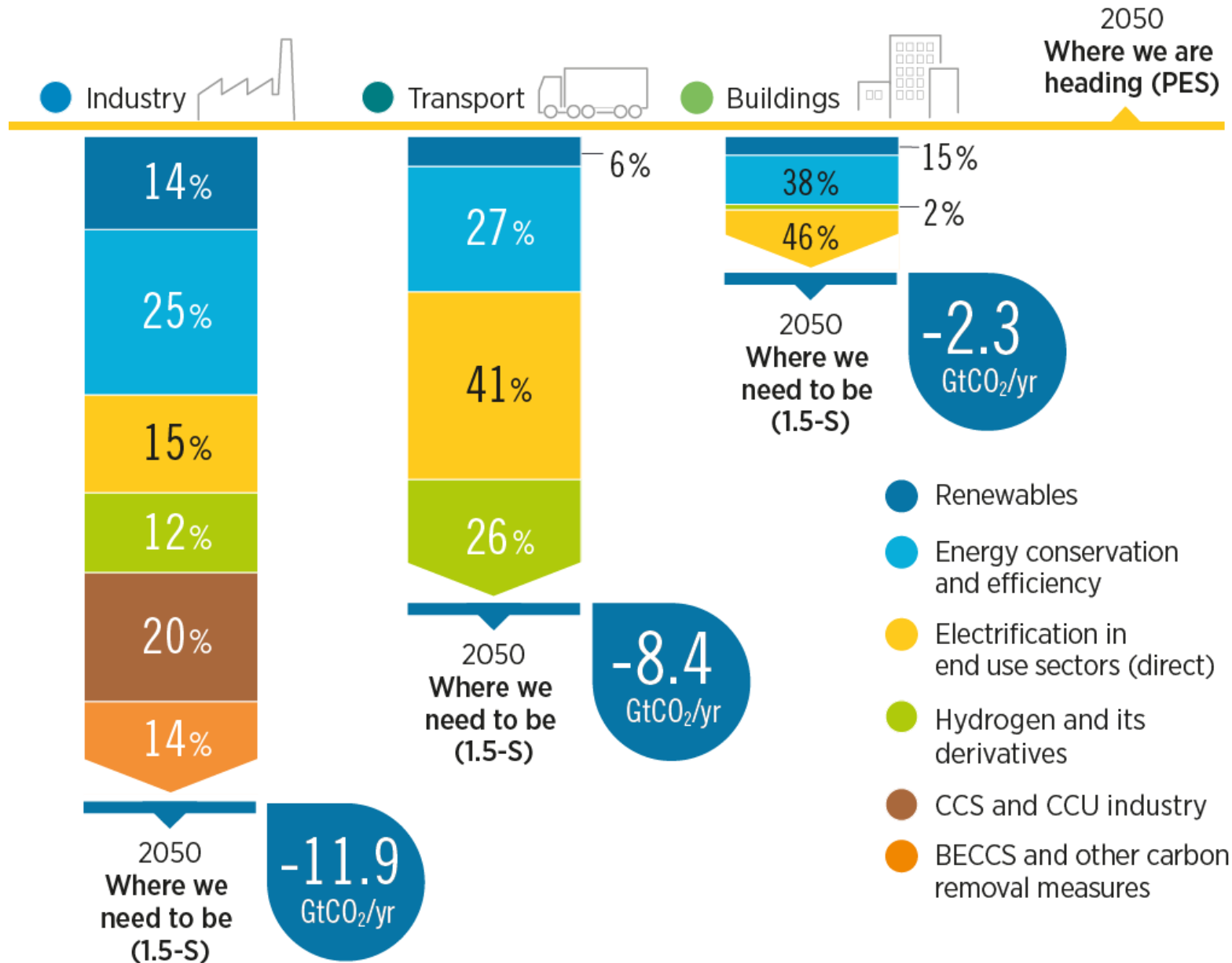
90% of all decarbonisation in 2050 will involve renewable energy through direct supply of low-cost power, efficiency, electrification, bioenergy with CCS and green hydrogen.

# Electricity is the central energy carrier in future energy systems



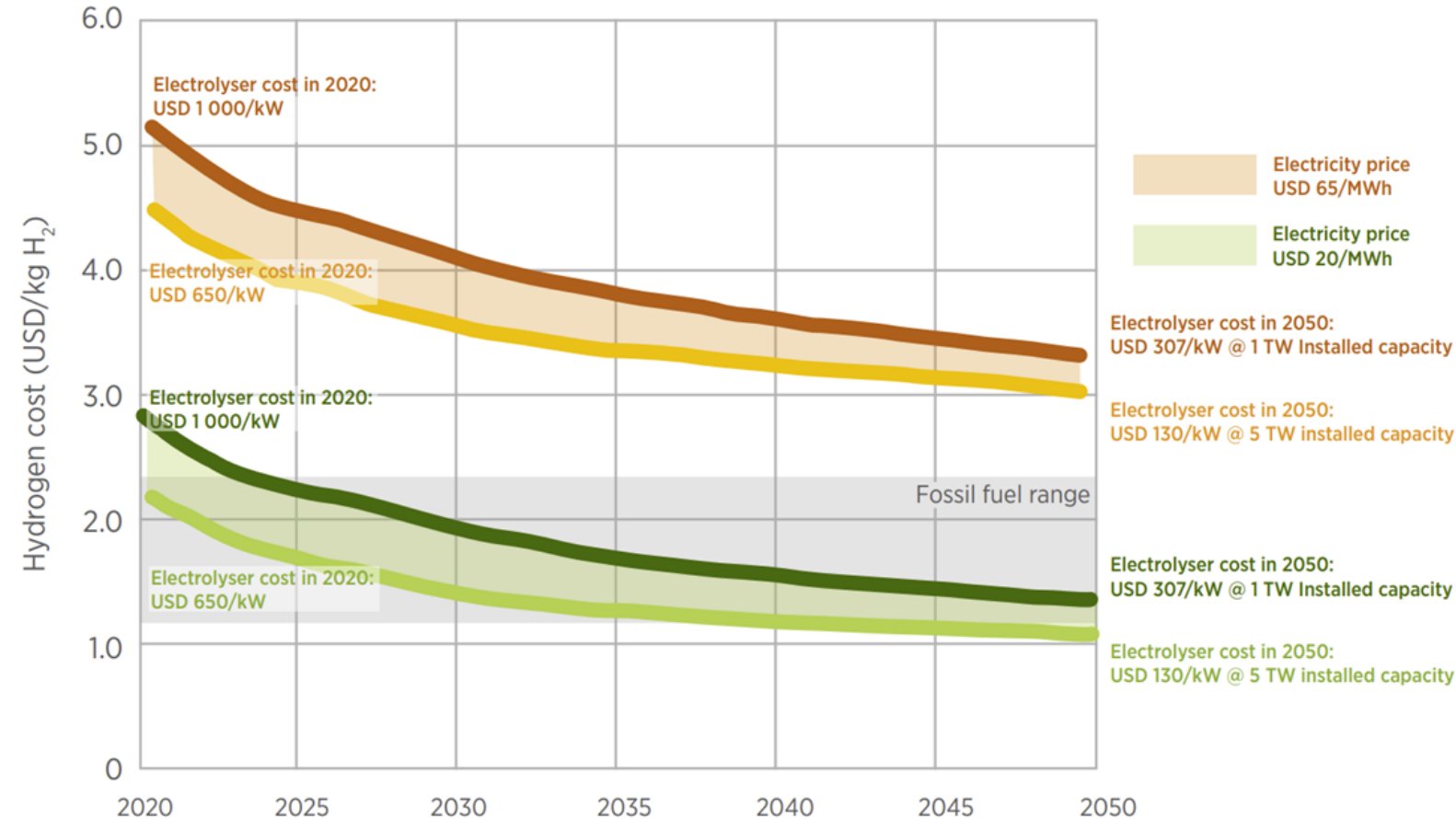
- By 2050, electricity would be the main energy carrier with more than a 50% direct share of total final energy consumption – up from 21% in 2018.
- By 2050, 90% of total electricity needs would be supplied by renewables followed by 6% from natural gas and the remainder from nuclear.
- Another 8% of final energy would come as indirect electricity in the form of e-fuels and hydrogen.

# All options are important in the mitigation effort



- In transport, 67% of emission reductions come from direct electrification and hydrogen.
- In industry, hydrogen and electrification combined contribute 27% of mitigation needs.
- In buildings, the key solutions are electrification, contributing close to half of the reduction needed, followed by energy efficiency.

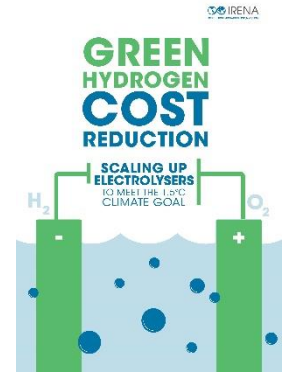
# Hydrogen production costs



Source: IRENA (2020)

## Strategies for cost reduction

- Innovation
- Scaling up manufacturing
- Scaling up modules
- Learning-by-doing

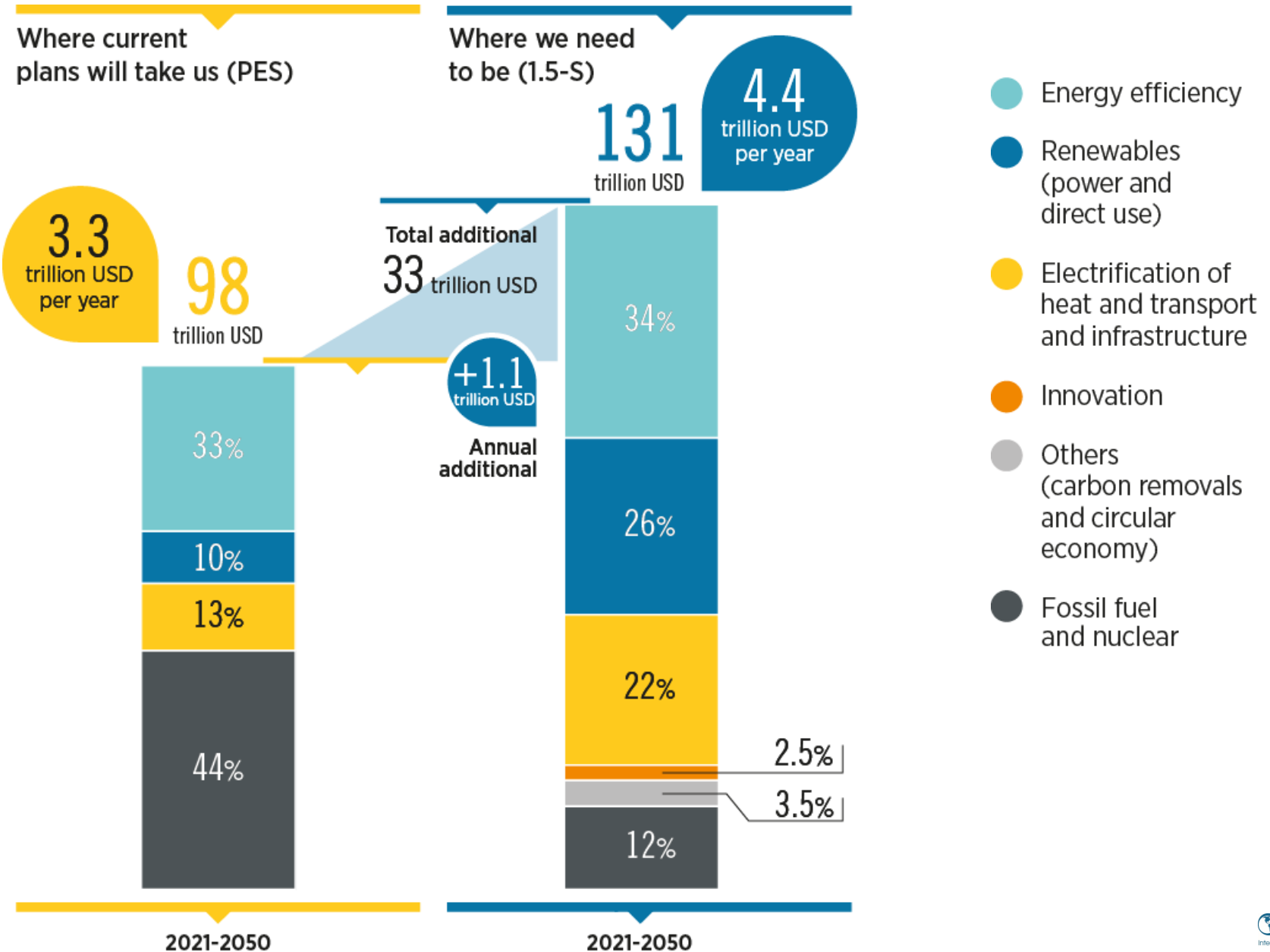


**Electrolyzers can become 40% cheaper in the short-term and up to 80% in the longer term**

**Key assumptions electrolyser:** Electricity price USD 20/MWh. Efficiency at nominal capacity: 65% in 2020 and 76% in 2050, Electrolyser investment cost (2020): USD 650-1000/kW (USD 130-307/kW as a result of 1-5 TW of capacity deployed by 2050).



# New investment priorities: renewables, efficiency and electrification



# Investment in power and end use sectors



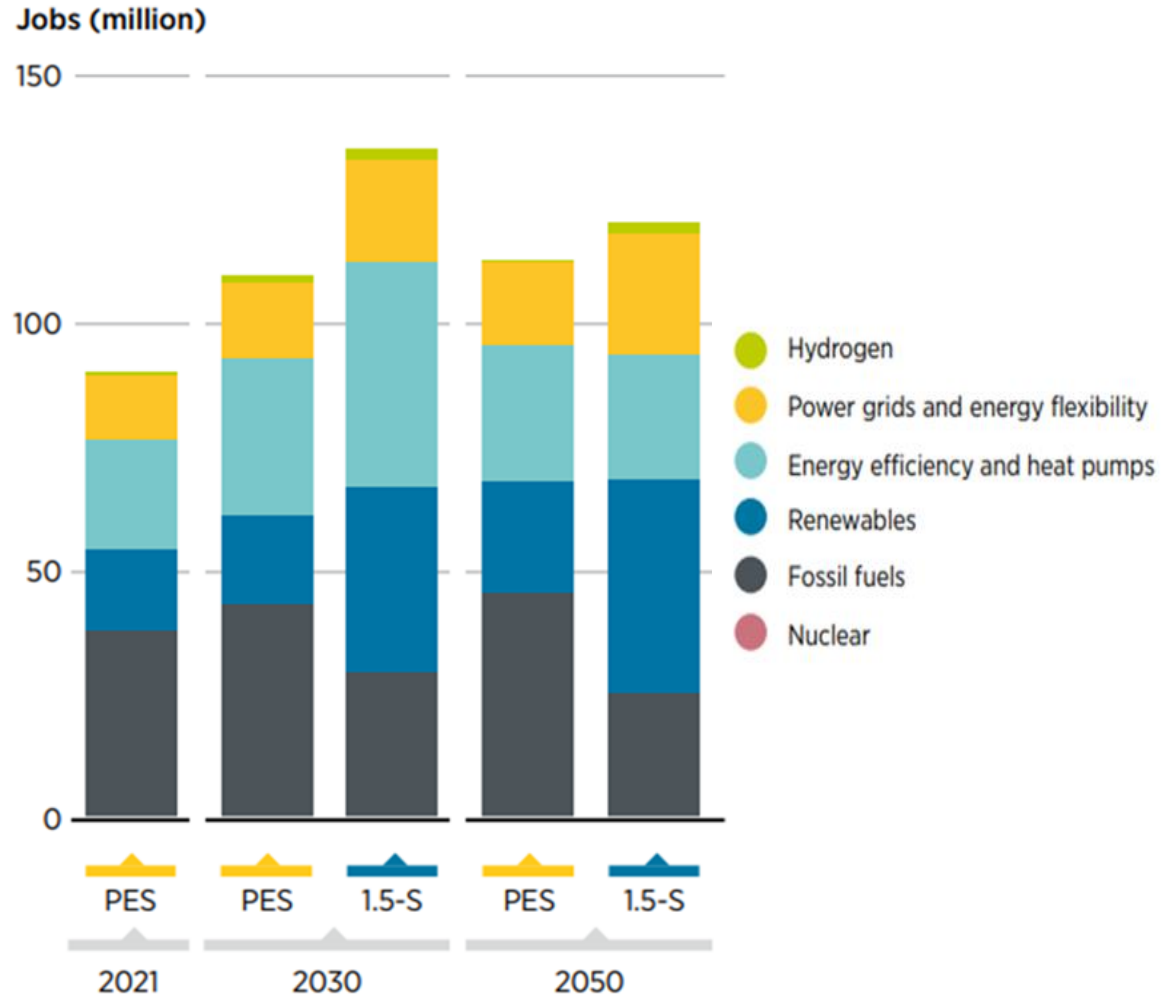
			Annual average investments USD billion/yr	
			Historical 2017-19	1.5°C Scenario 2021-50
Power generation capacity	Hydro - all (excl. pumped)		22	85
	Biomass (total)		13	69
	Solar PV (utility and rooftop)		115	237
	CSP		3	84
	Wind onshore		80	212
	Wind offshore		18	177
	Geothermal		3	24
	Marine		0	59
	Grids and flexibility	Electricity network		271
Flexibility measures (e.g. storage)			4	133

Total investment in **grids and flexibility** needs to increase from 275 billion USD annual average to 733 billion USD annual average.

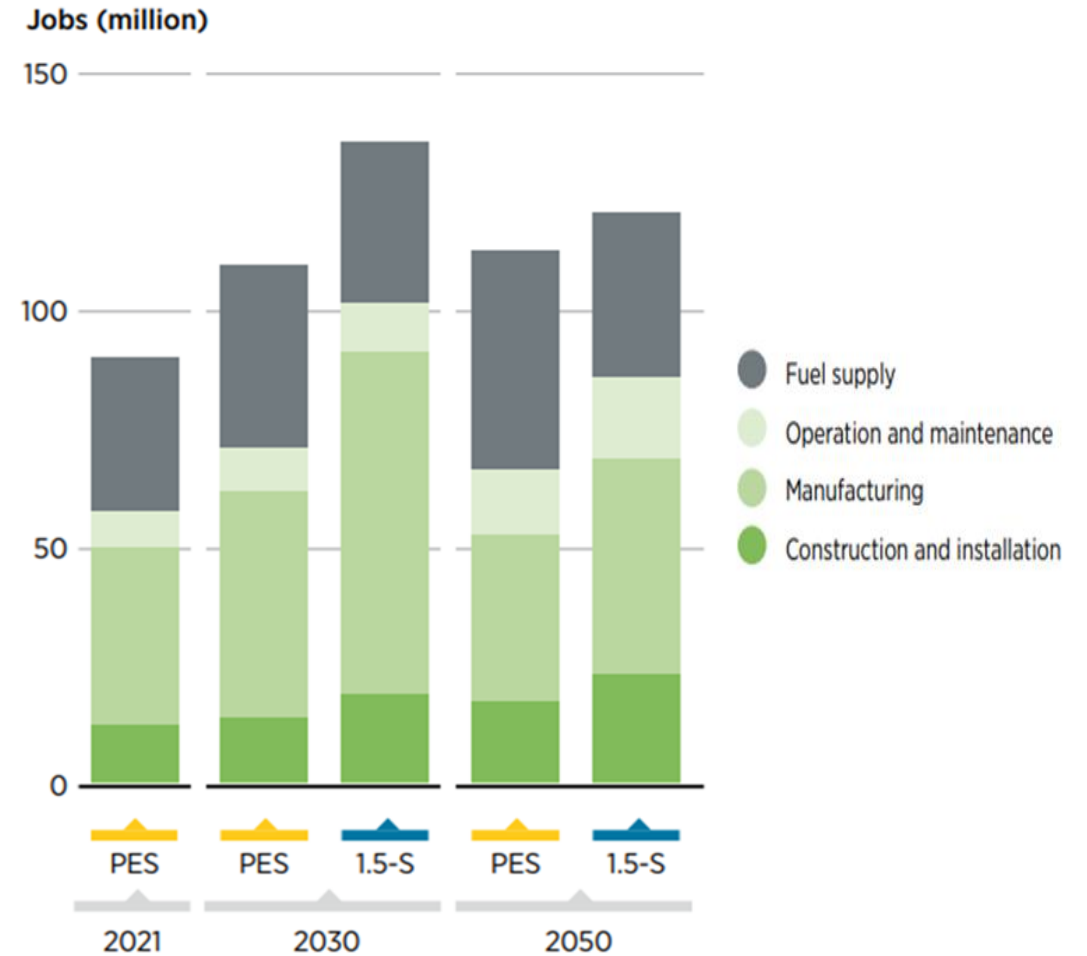
**Investment in the grid** alone stands for 600 billion USD annual average under the 1.5°C Scenario

# A transformed energy sector will have 122 million jobs in 2050

Energy sector jobs by technology under the PES and 1.5°C Scenario (million), global results



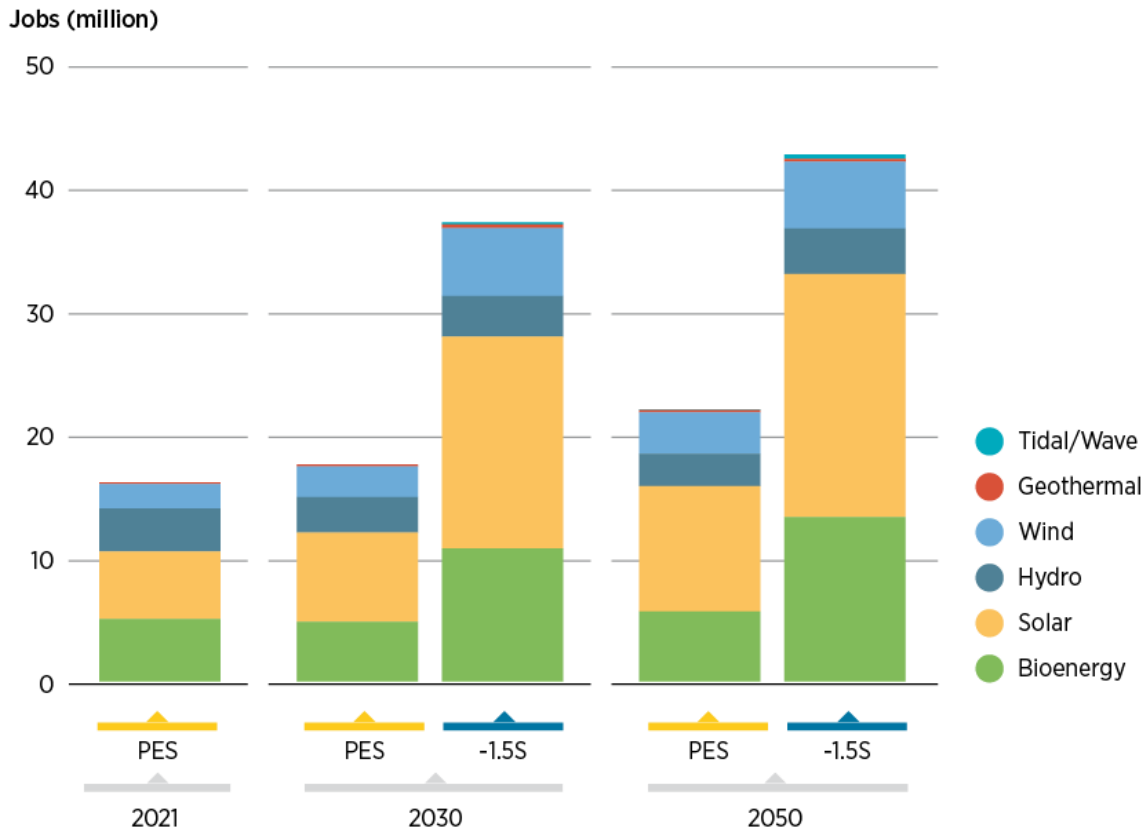
Energy sector jobs by segment of value chain in the PES and 1.5°C Scenario (excluding vehicles)



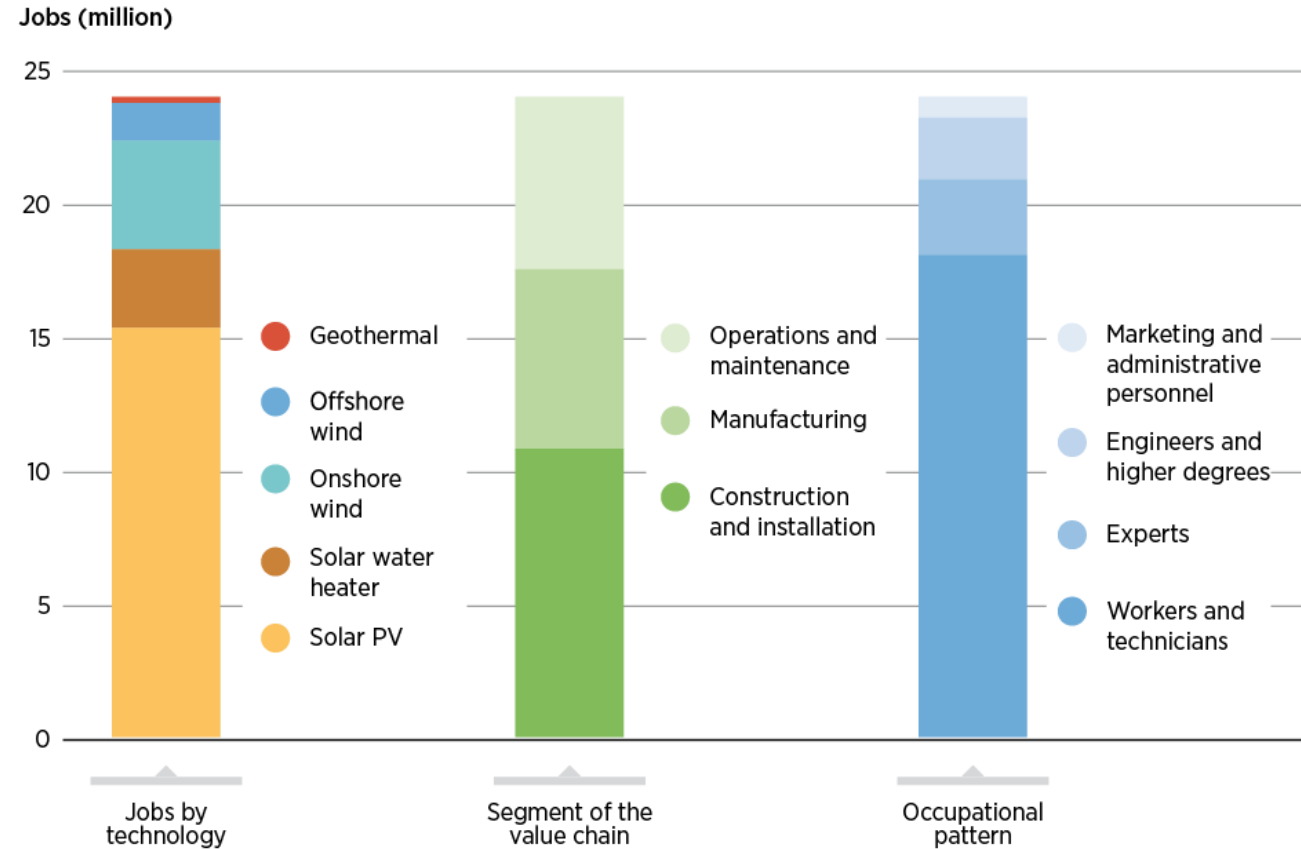


# Renewable energy jobs will increase to 43 million in 2050

Jobs in renewable energy, by technology, in the 1.5°C Scenario and PES (million)



Structure of jobs in the 1.5°C Scenario by 2050 for a subset of renewable technologies by technology, segment of value chain and occupational requirements





# **WORLD ENERGY TRANSITIONS OUTLOOK**

**1.5°C Pathway**

**Thank you!**