

The Global Energy Transition and the 1.5°C target

GLOBAL ENERGY TRANSFORMATION

A ROADMAP TO
2050

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About IRENA

Established in 2011.

160+ Members

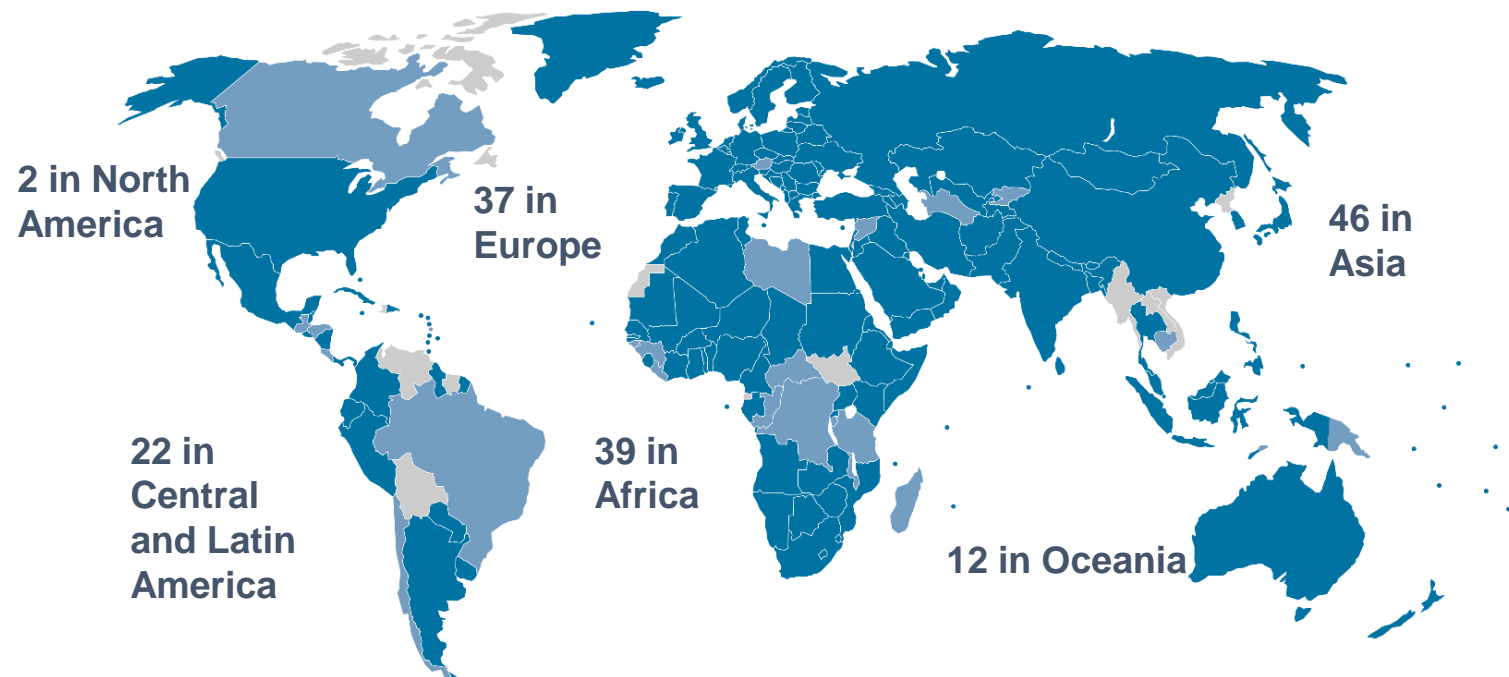
23 States in accession.

Mandate: to promote the **widespread adoption and sustainable use of all forms of renewable energy**

Scope: All renewable energy sources produced in a **sustainable manner**

IRENA serves as:

- Centre of excellence for knowledge and innovation
- Global voice of renewables
- Network hub
- Source of advice and support



BIOENERGY



GEOTHERMAL
ENERGY



HYDROPOWER



OCEAN
ENERGY

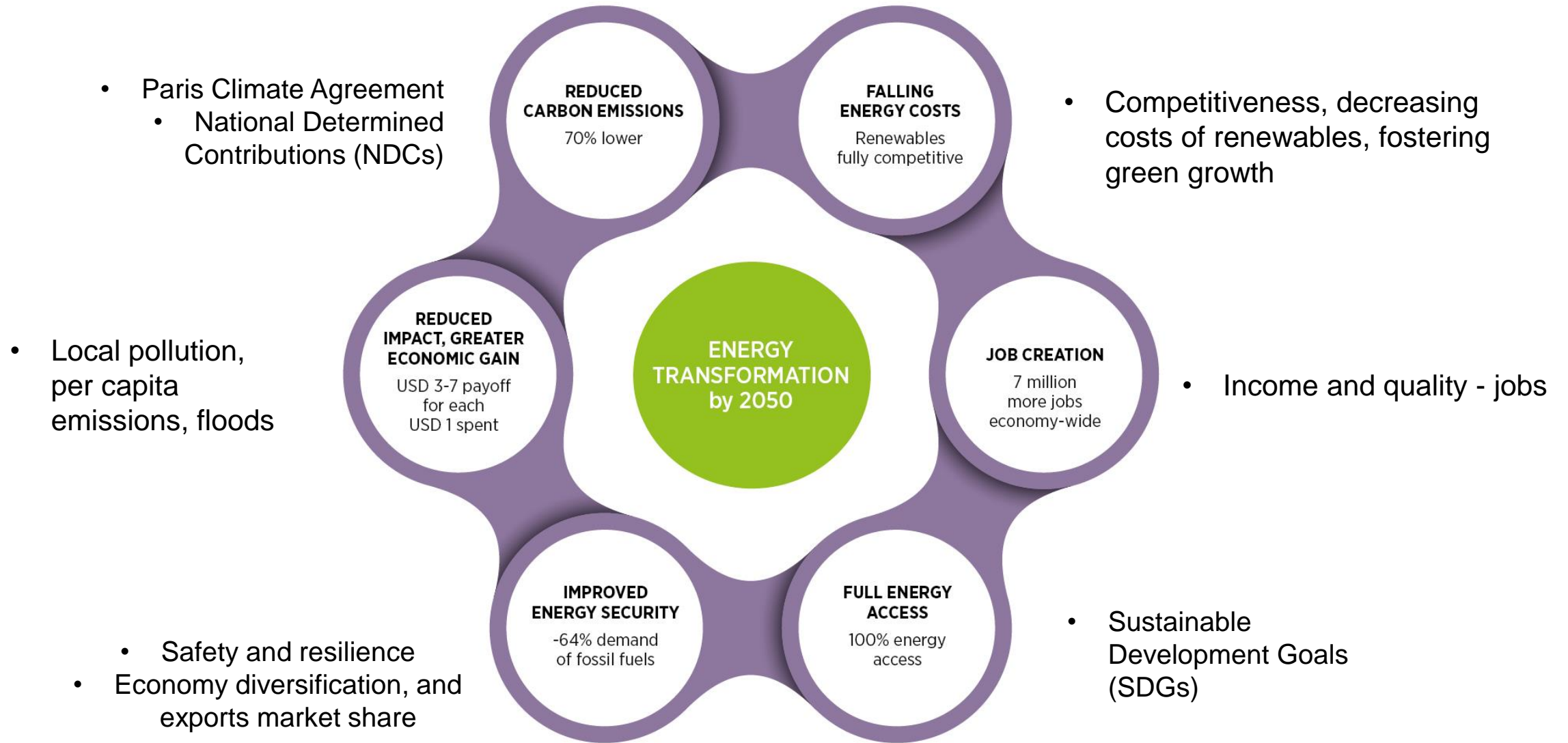


SOLAR
ENERGY

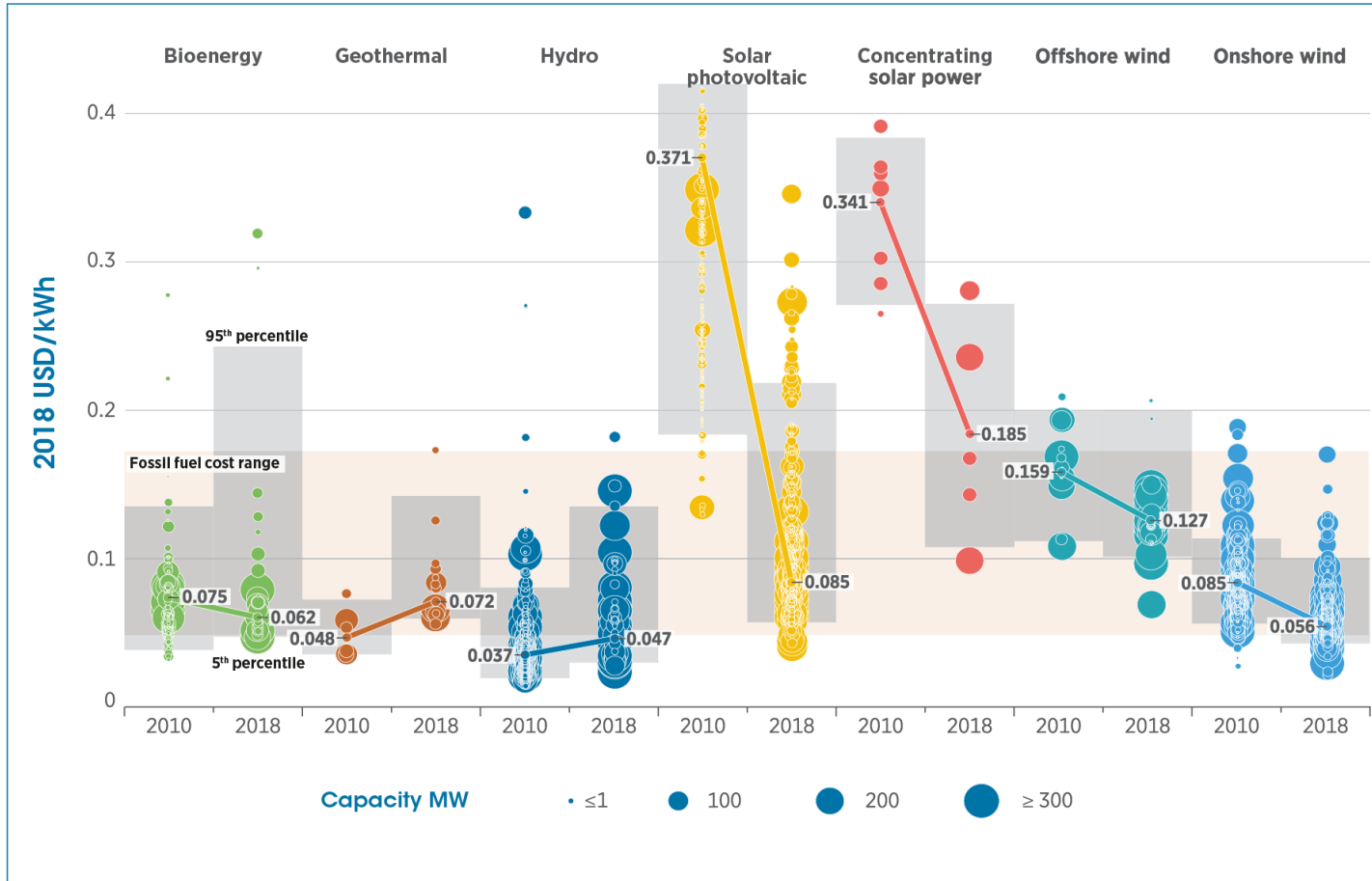


WIND
ENERGY

Drives for the energy transition: the role of renewables.

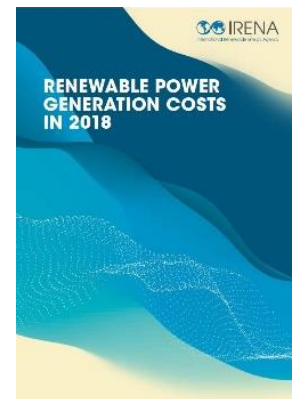


Renewables: The strong business case.

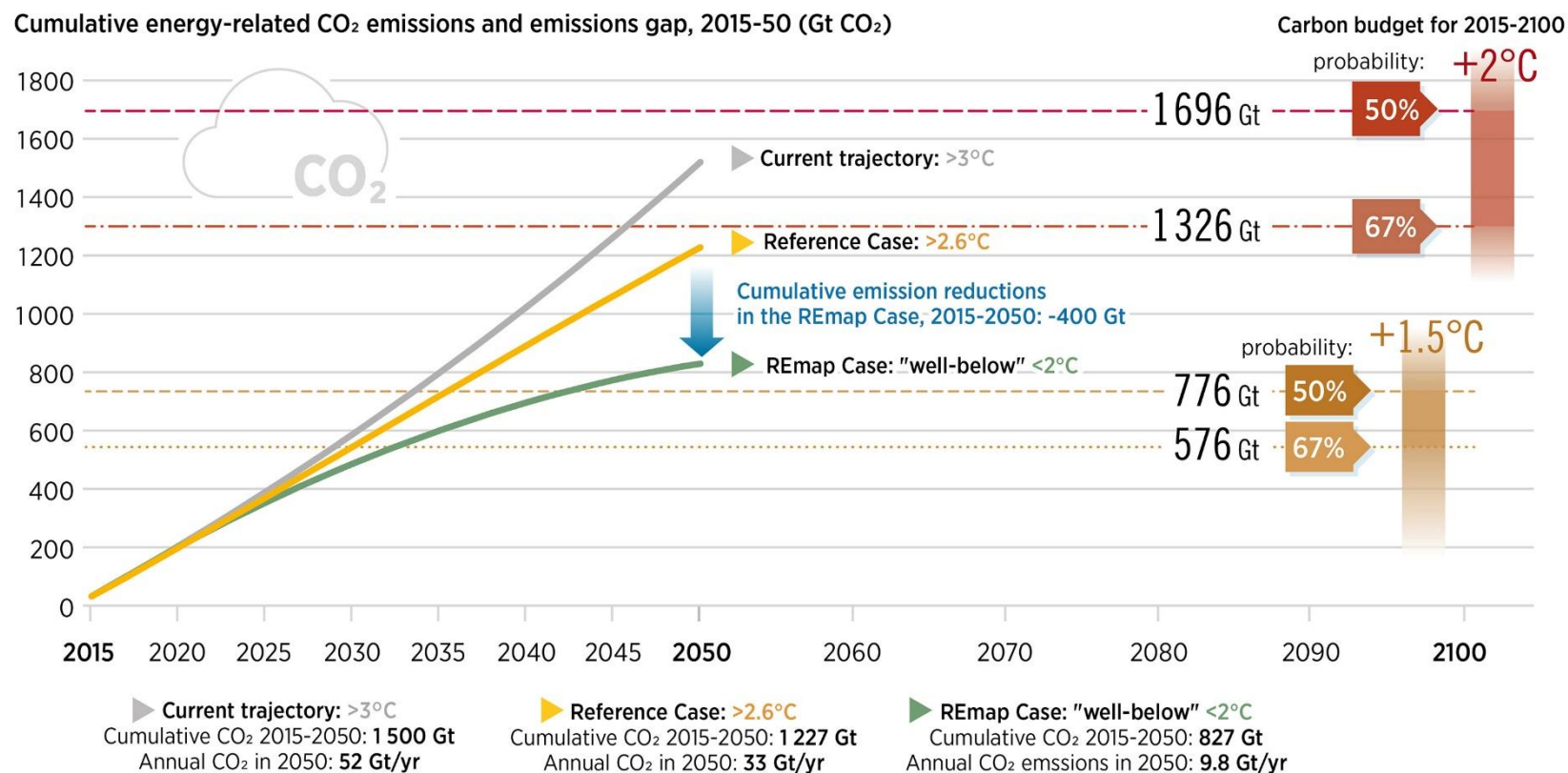


Note: This data is for the year of commissioning. The diameter of the circle represents the size of the project, with its centre the value for the cost of each project on the Y axis. The thick lines are the global weighted-average LCOE value for plants commissioned in each year. Real weighted average cost of capital (WACC) is 7.5% for OECD countries and China and 10% for the rest of the world. The single band represents the fossil fuel-fired power generation cost range, while the bands for each technology and year represent the 5th and 95th percentile bands for renewable projects.

- **Average LCOE of all renewable power generation technologies, except CSP fall in fossil fuel cost range**
- Bioenergy, geothermal, hydro and onshore wind all at lower end of fossil cost range
- Solar PV rapidly falling towards lower end.
- Offshore wind and CSP have much lower deployment. Data suggests costs will continue to fall.



Bridging the gap: A pathway for a well-below 2°C climate target, towards 1.5°C.



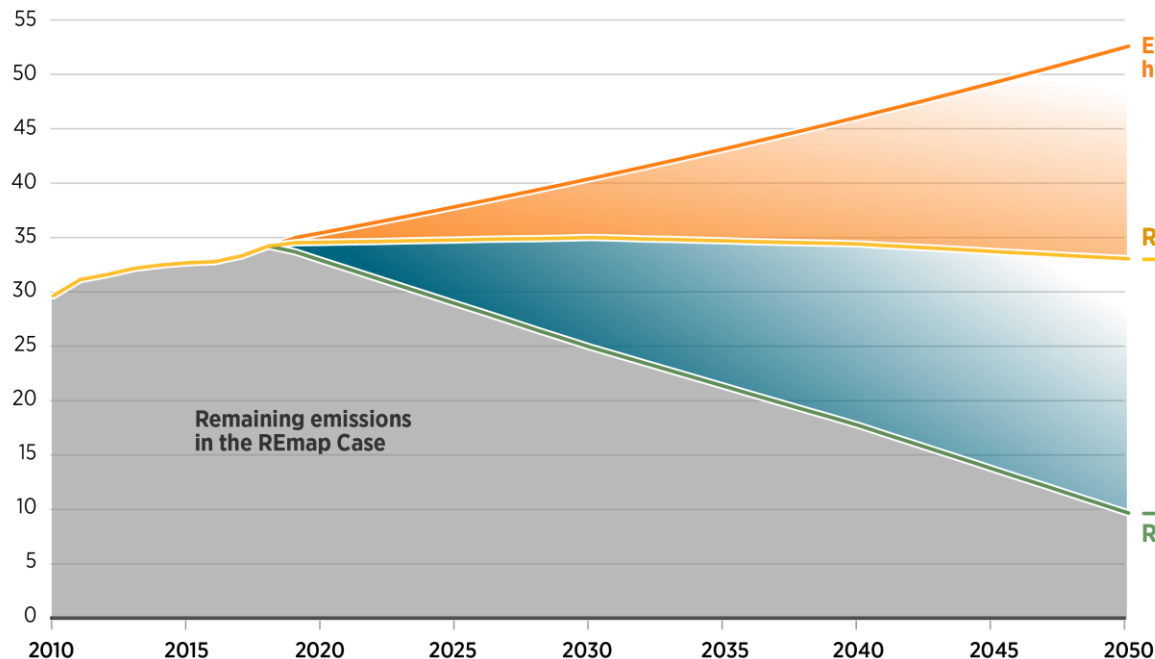
(Current policies and plans incl. NDCs)
(Energy transformation pathway – well below 2°C towards 1.5°C)

- The global carbon budget is set to run out by 2030 based on current and planned policies.
- Energy-related emissions would need to fall by 3.5% per year to the world to meet the Paris Agreement.

Notes: 1) Taking into account 2015-2017 emissions on top of the budget provided in IPCC (2018) (Table 2.2 – with no uncertainties and excluding additional Earth system feedbacks); 2) Budgets exclude industrial process emissions of 90 Gt; for this study, the assumption is that CO₂ emissions from land use, land-use change and forestry (LULUCF) fall from 3.3 Gt in 2015 to zero by mid-century. LULUCF subsequently becomes a net absorber of CO₂ over the remainder of the 21st century, and, as a result, cumulative CO₂ emissions from LULUCF between 2015 and 2100 are close to zero; 3) Current trajectory shows the recent historical trend line, assuming the continuation of the annual average growth in energy-related CO₂ emissions from the last five years (2013-2018) of 1.3% compound annual growth up to 2050; 4) Emissions budgets represent the total emissions that can be added into the atmosphere for the period 2015-2100 to stay below 2°C or 1.5°C at different confidence levels (50% or 67%) according to the IPCC (2018) report.

Key enabling solutions: Renewables and energy efficiency, boosted by substantial electrification.

Annual energy-related CO₂ emissions, 2010-2050 (Gt/yr)



(Current policies and plans incl. NDCs)

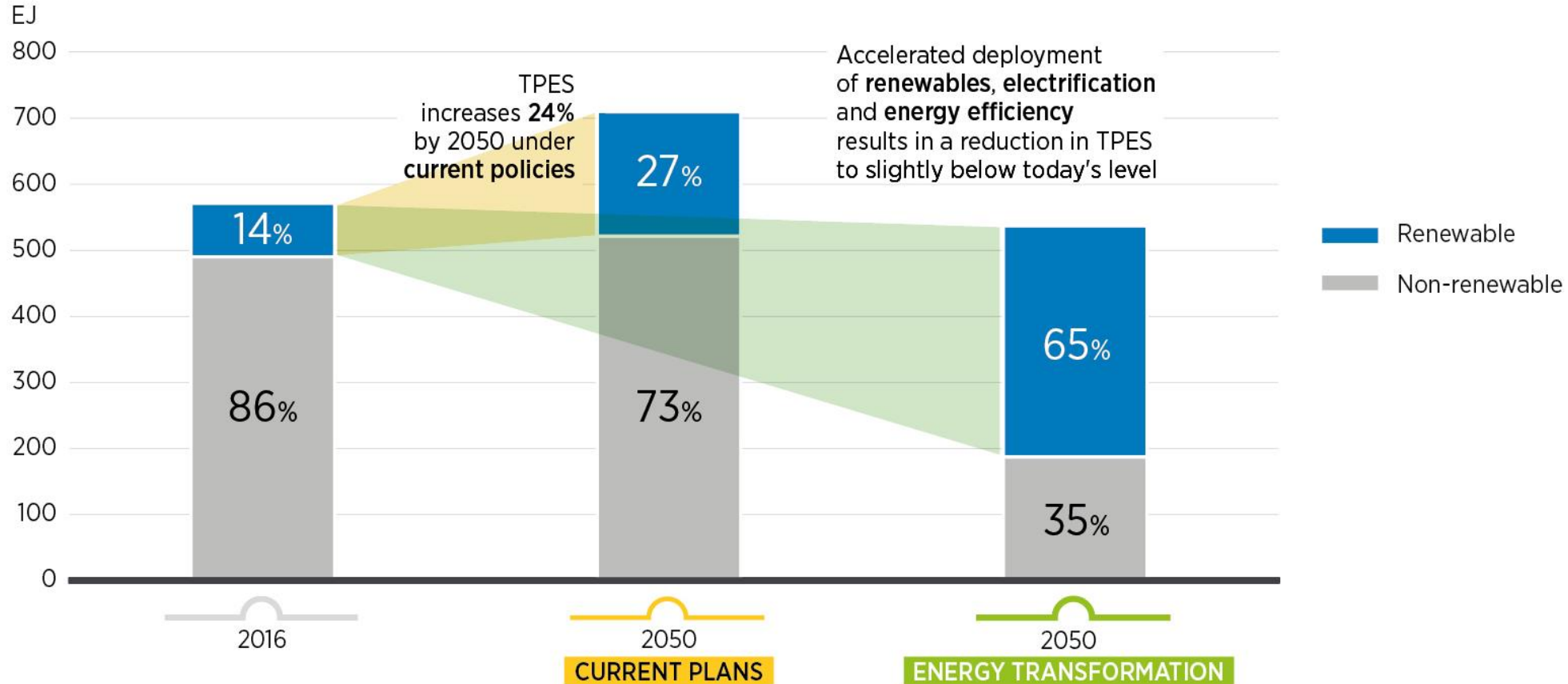
Renewable energy and electrification deliver 75% of emission reductions

(Energy transformation pathway – well below 2°C towards 1.5°C)

- Current plans and policies, including NDCs, result in a similar level of annual emissions in 2050 compared to today (a pathway of 2.6°C or higher after mid-century).
- Annual CO₂ emissions need to be reduced by 70% to bring temperature rise to the well-below 2°C climate goal as in the energy transformation pathway.
 - Renewables & electrification can deliver 75% of energy-related CO₂ emission reductions needed. With energy efficiency included, this rises to over 90%.

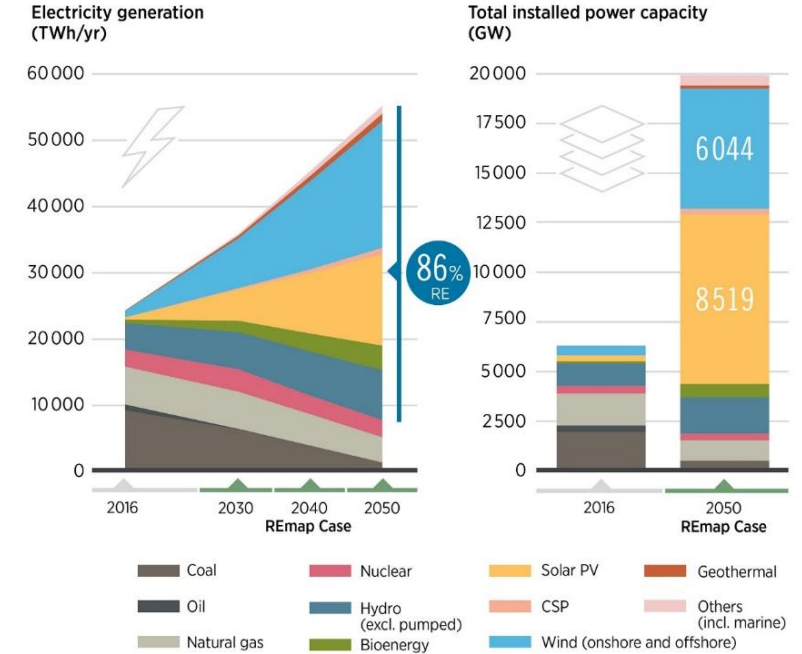
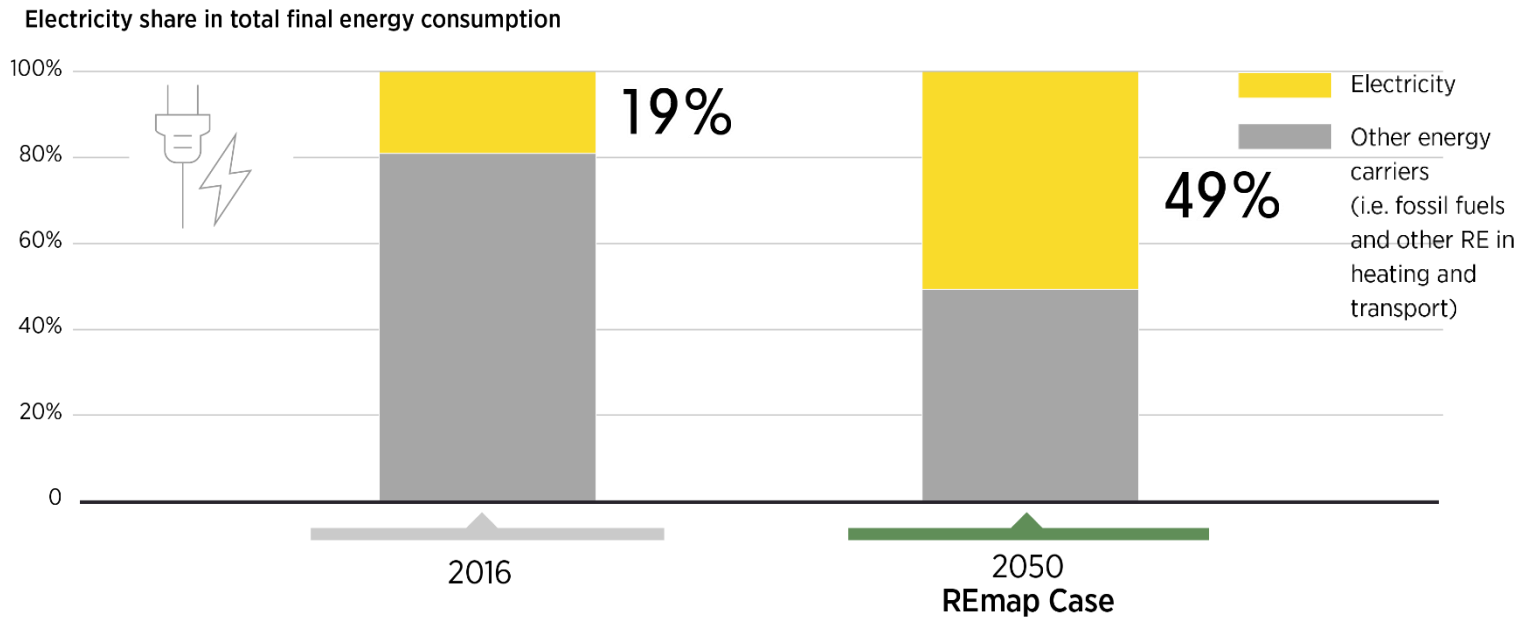
A transformed energy system with renewable energy, energy efficiency and electrification.

Renewable and non-renewable shares of total primary energy supply until 2050: Two scenarios



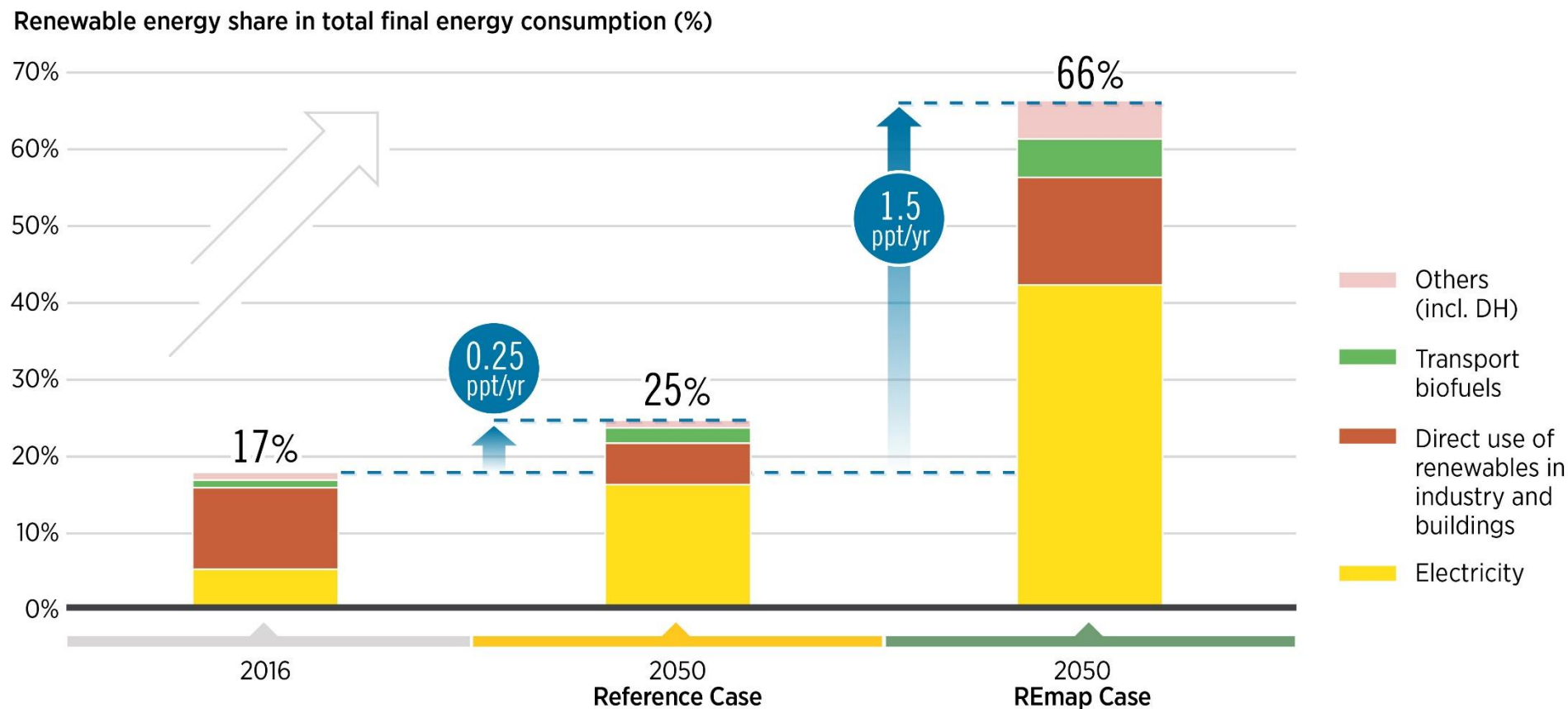
- It is **technically feasible and economically beneficial** to reduce the global level of energy consumption and increase renewable energy share.

Electrification paired with renewables is a major solution for decarbonisation.



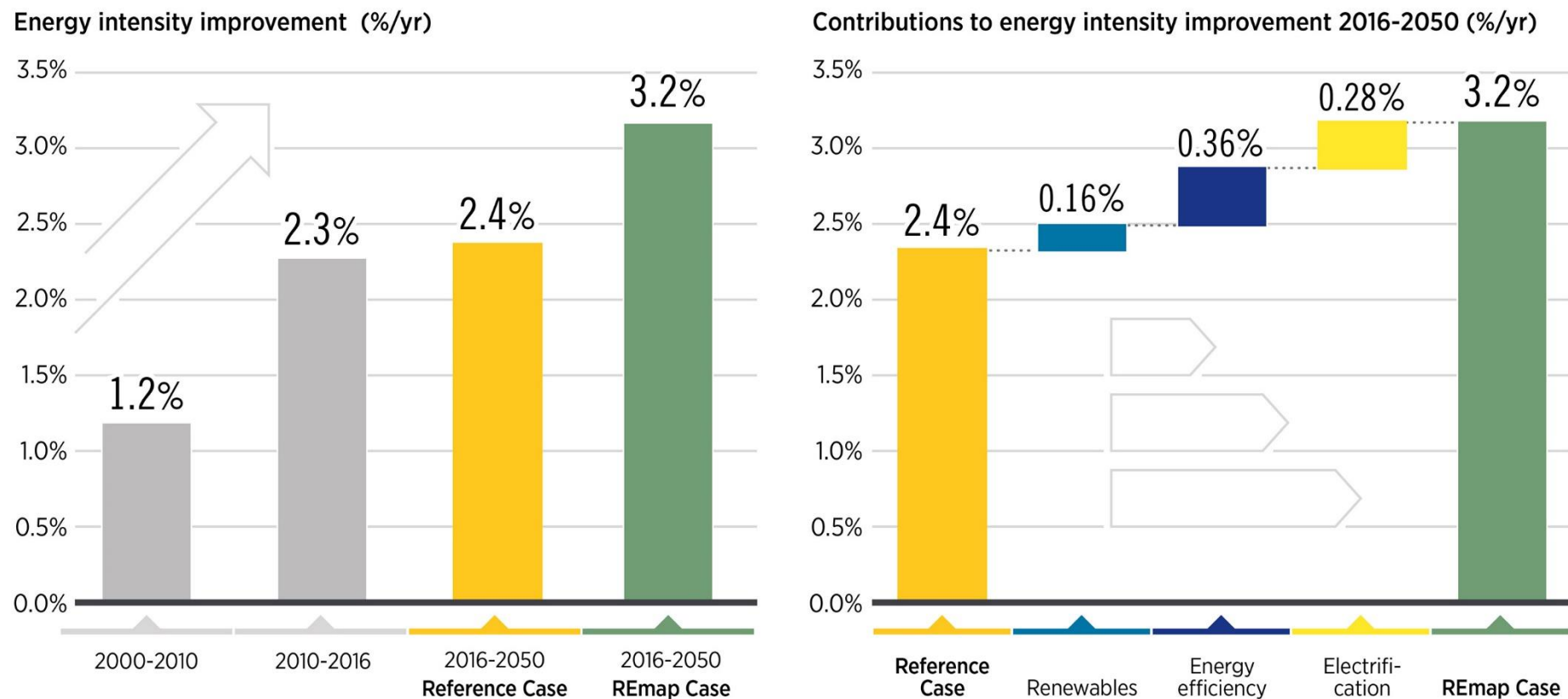
- By 2050, electricity will provide around 50% of the global final energy mix.
 - Electricity consumption in end-use sectors will more than double from today's level.
- 86% of electricity generation will come from renewables.
 - By 2050, **solar power**, with more than **8 500 GW** installed capacity, and **wind**, with more than **6 000 GW**, would account for **three-fifths of global electricity generation**.

Renewables growth must increase six-fold.



- 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.

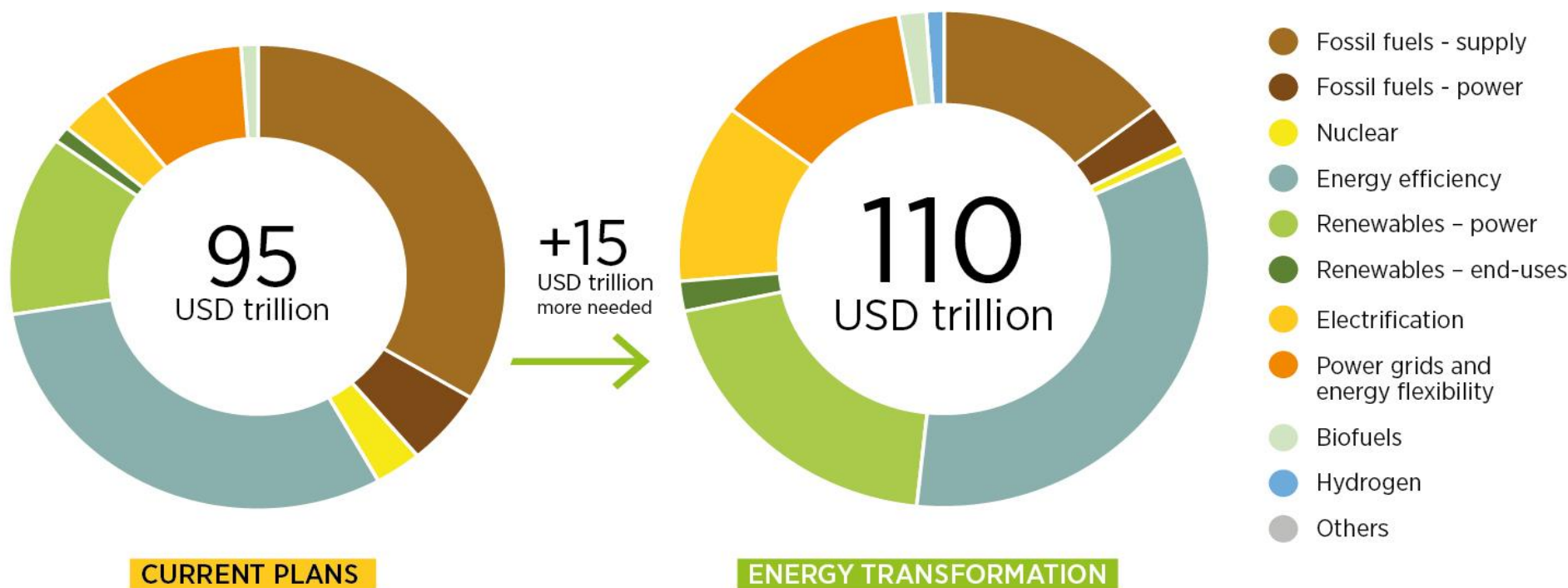
Energy intensity improvement needs to increase by a third, to 3.2% per year.



Energy intensity can be improved by: - Scaling up solar, wind and other renewables, - improving energy efficiency, - electrifying transport and heat, - structural change in transport and industry.

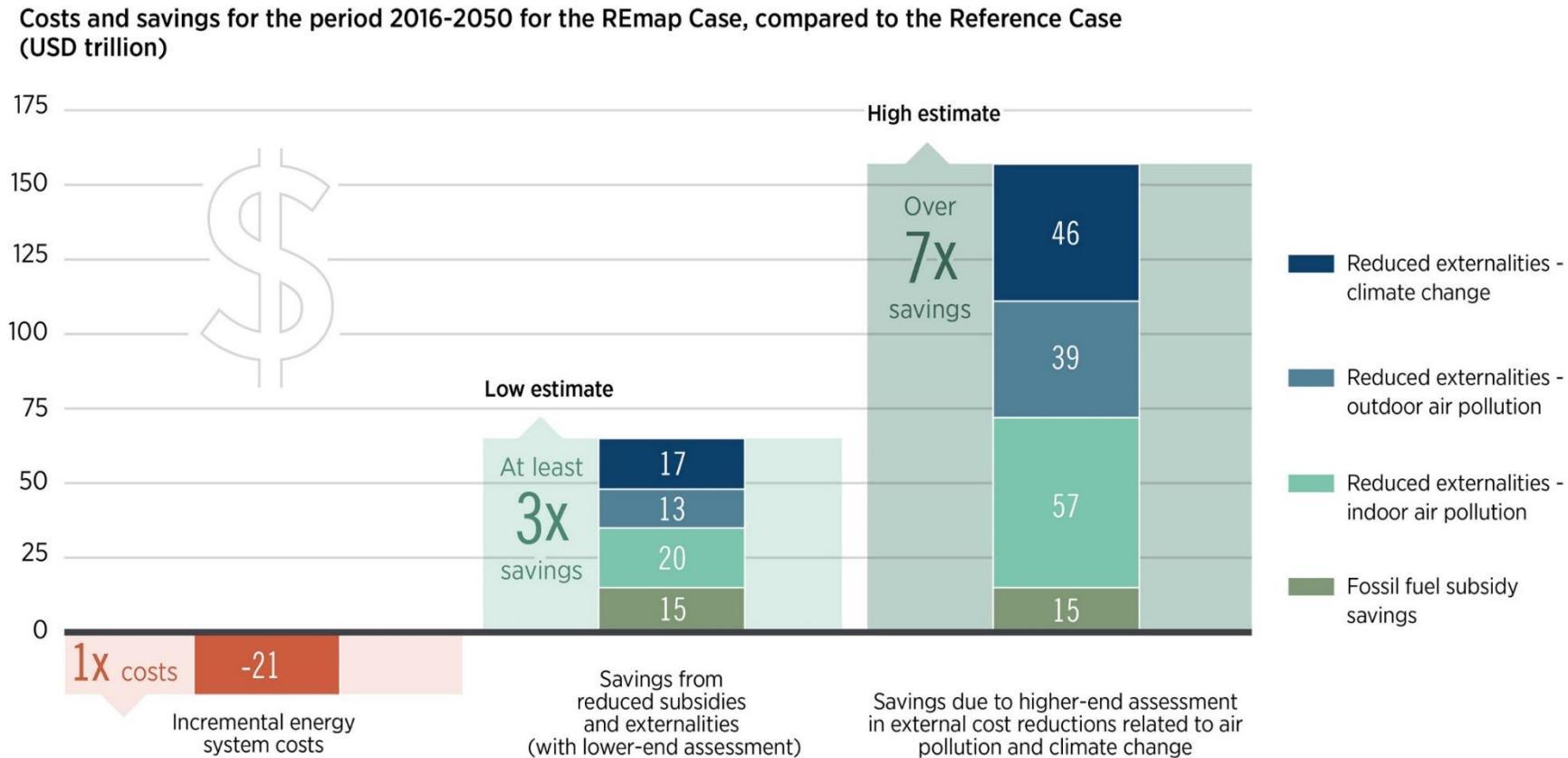
Shifting investments to energy efficiency, renewables and the electrification of heat and transport.

Cumulative Investment in Current Plans and Energy Transformation scenarios until 2050.



- Cumulative investment of USD 110 trillion must be made between 2016-2050 predominantly in low-carbon technologies, **averaging around 2% of global GDP per year.**

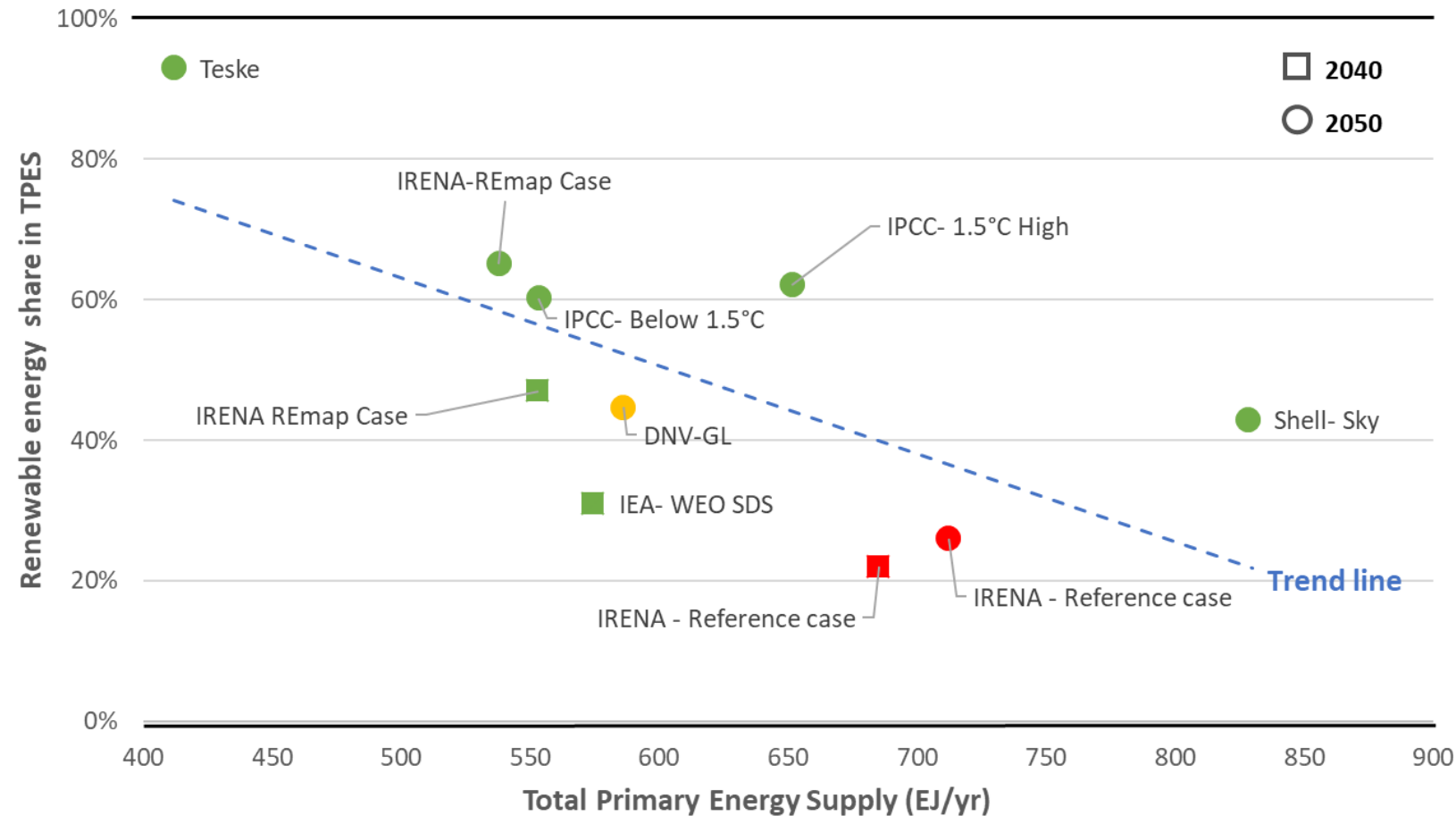
Investing in the energy transition is beneficial for society.



- Every dollar spent in the global energy transformation saves 3 to 7 USD.
- Half of the USD 21 trillion in additional expenditures, including investment and operational costs, could be covered by the savings on avoided subsidies.

There is a correlation between renewable energy share and energy demand.

Renewable energy share and total primary energy projections in 2040 and 2050 in various climate scenarios



- Scenarios with higher renewable energy shares also have higher energy efficiency, resulting in lower overall energy demand and emissions.

Key actions needed now to accelerate the energy transition.



- The power sector needs to be transformed to accommodate growing shares of variable renewables.
- Digitalisation is a key enabler to amplify the energy transformation.



- Accelerating the electrification of the transport and heating sectors is crucial for the next stage of energy transformation.



- Hydrogen produced from renewable electricity could help to reduce fossil-fuel reliance.

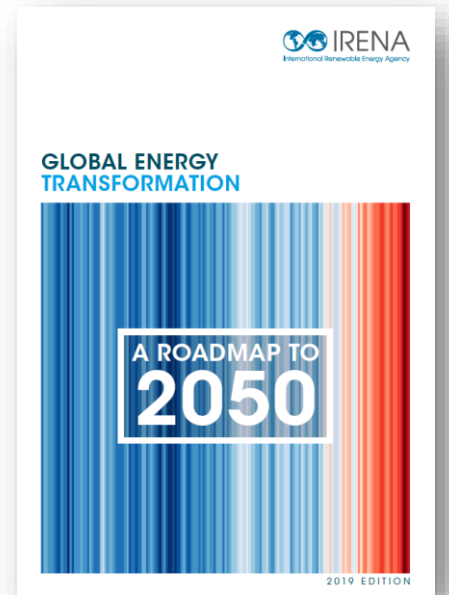


- Supply chains are key to meet growing demand for sustainable bioenergy.



- Decarbonising the global energy system requires swift and decisive policy action.
 - *With best of available technologies, policies should create right conditions to accelerate clean energy investments.*
 - *Foster innovations and technology advancements.*
 - *Need for better alignment and co-ordination between energy and climate policies (SDGs, NDCs).*
 - *Close co-operation between the public and private sectors will be key.*

Thank you!



This presentation has been prepared based on the report: IRENA (2019), Global energy transformation: A roadmap to 2050 (2019 edition), International Renewable Energy Agency, Abu Dhabi.

More about the Global Energy Transformation and other IRENA publications are available for download from www.irena.org/publications

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