



**4th Energy Panel
Vilnius, Lithuania**

Unlocking the Potential of Renewables in the Energy Sector

GLOBAL ENERGY TRANSFORMATION



A ROADMAP TO
2050

About IRENA

Established in 2011.

160+ Members

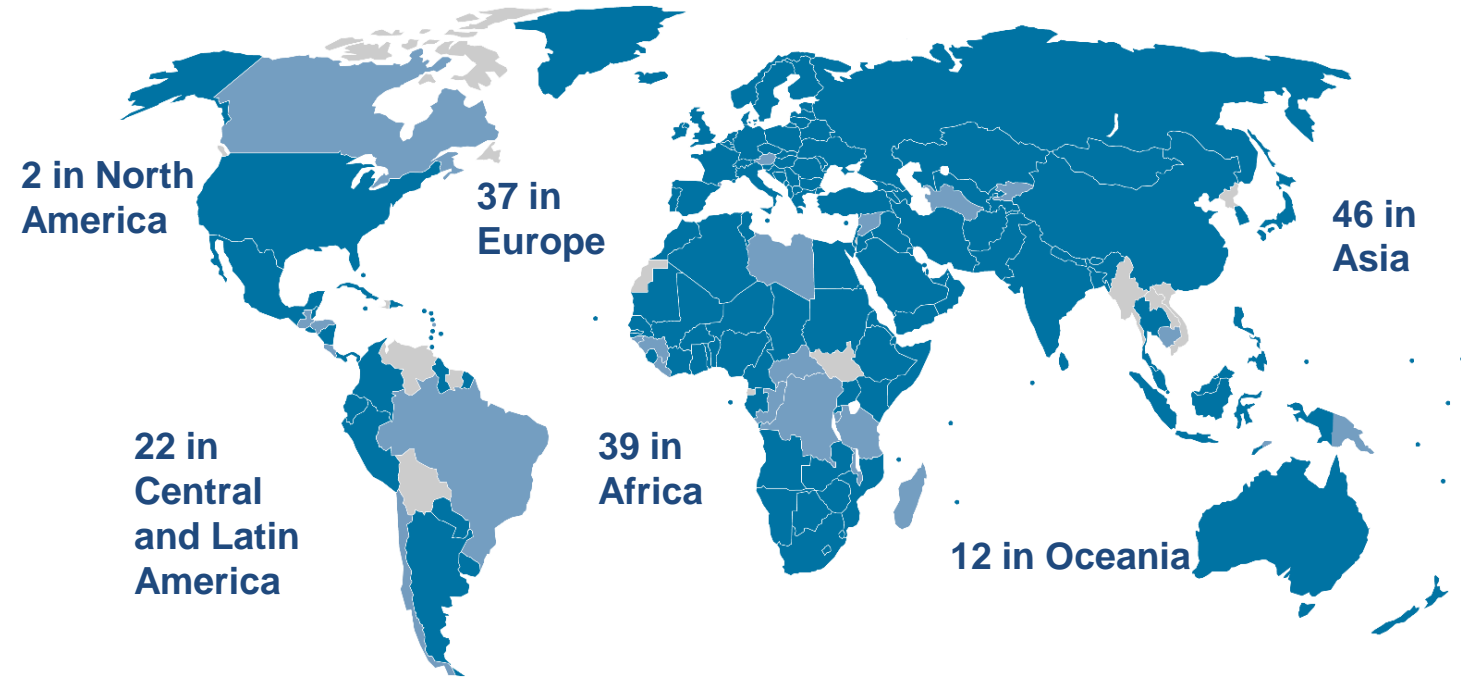
23 States in accession.

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



South East Europe Regional Initiative

Abu Dhabi **Communiqué** on Accelerating the Uptake of Renewables in South East Europe

Abu Dhabi, 13 January 2017

Action Areas

- Mapping renewable energy resources
- Long-term planning for RE deployment
- Enabling frameworks: technical, policy, regulatory, institutional
- Access to finance for renewable energy projects
- Integration of variable renewable energy sources to power system
- Socio-economic benefits of renewable energy

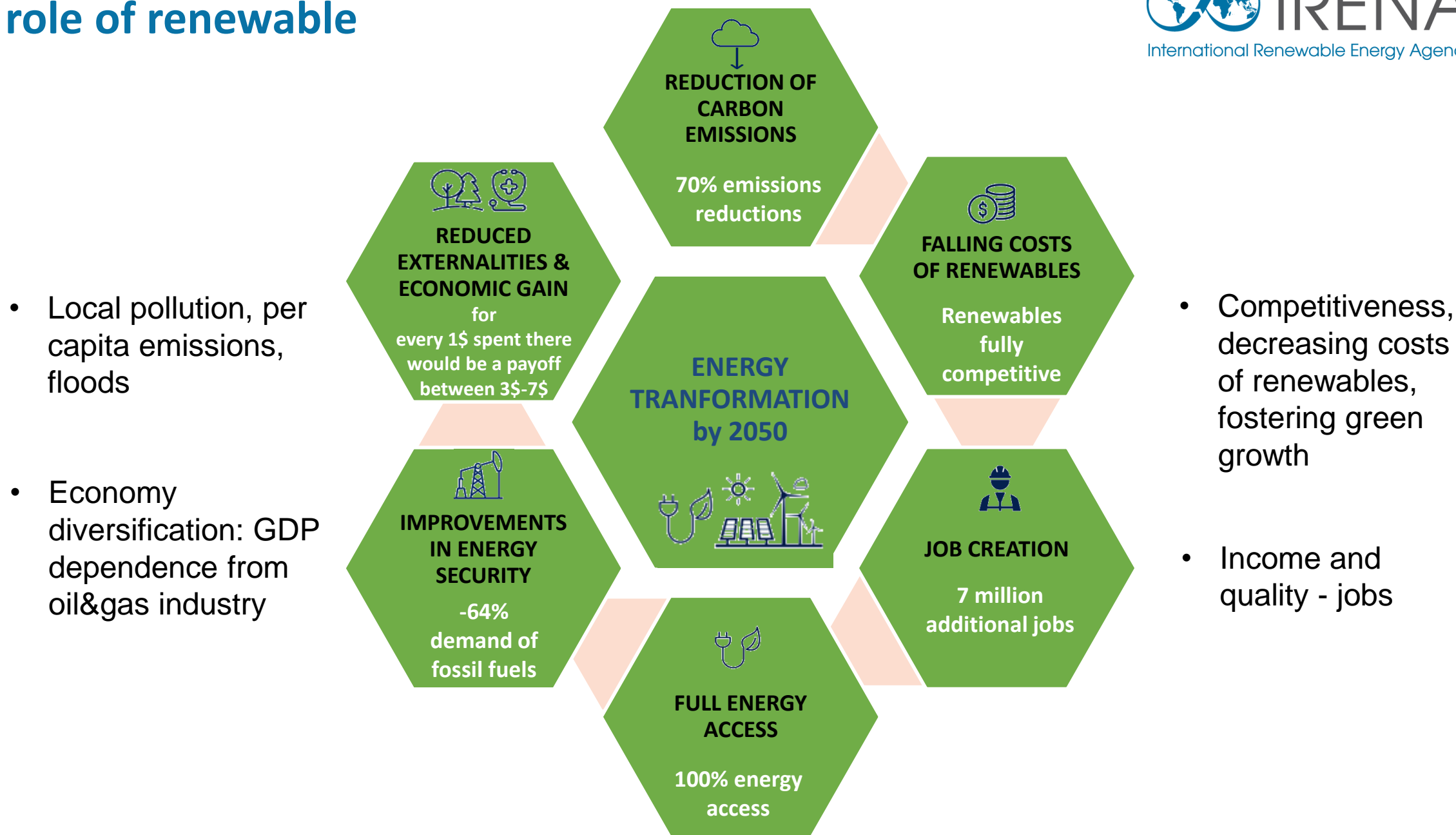


Overview of Regional IRENA Activities

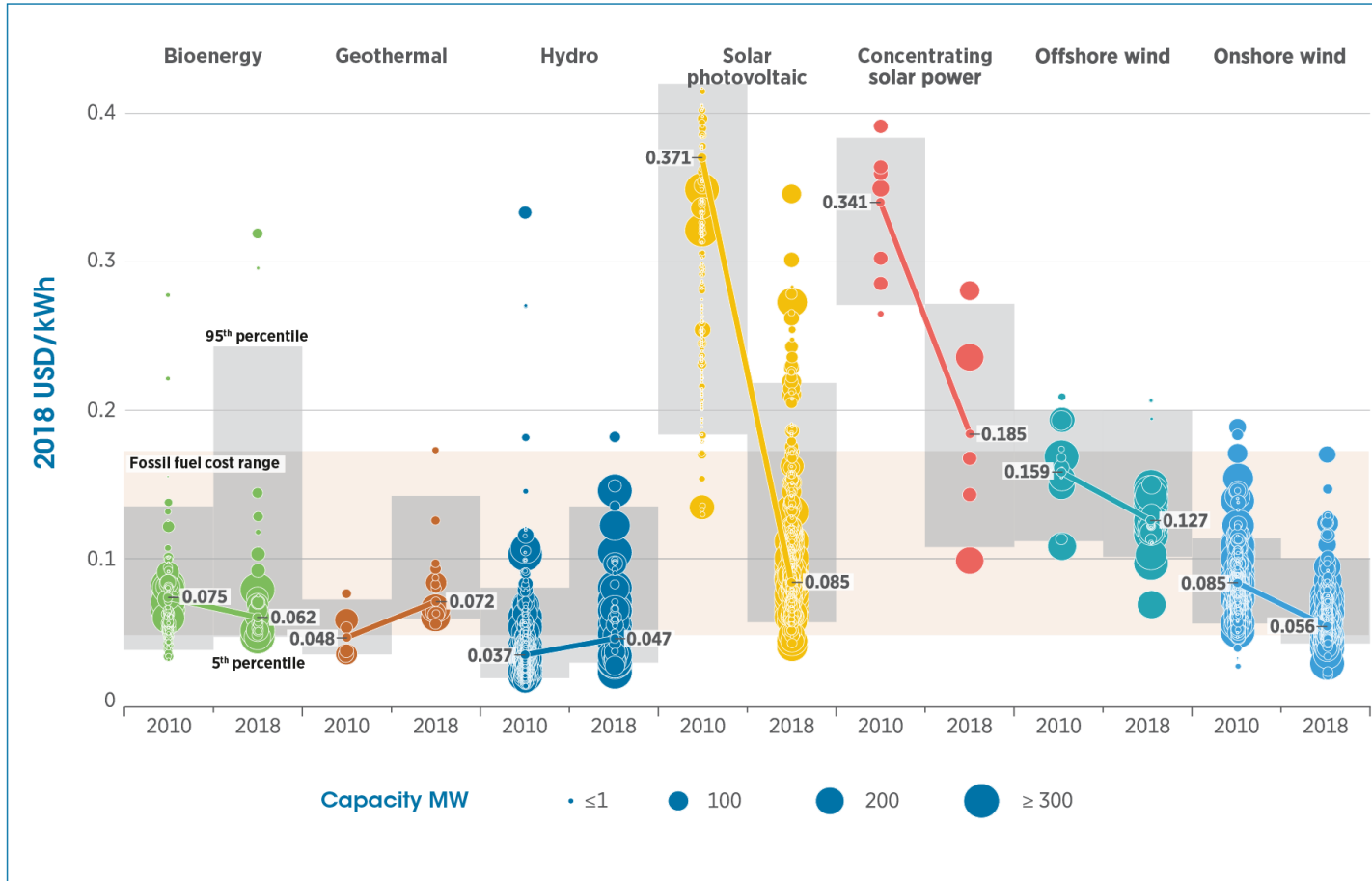
- Renewables readiness assessments (RRA):
 - Completed for Moldova
 - Near Completion for Azerbaijan and Albania
 - RRA for Belarus Confirmed (2020/2021)
- Renewable Energy Roadmap for Central and South Eastern Europe (REmap CESEC)
- Renewable Energy Market Analysis for South East Europe
- Supported Development of Auction Support Scheme in Ukraine for Renewable Energy Deployment



Drives for the energy transition: the role of renewable

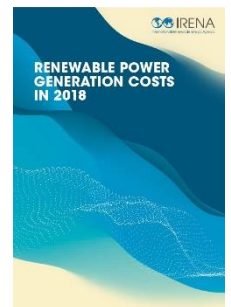


Renewable Energy: Recent cost evolution

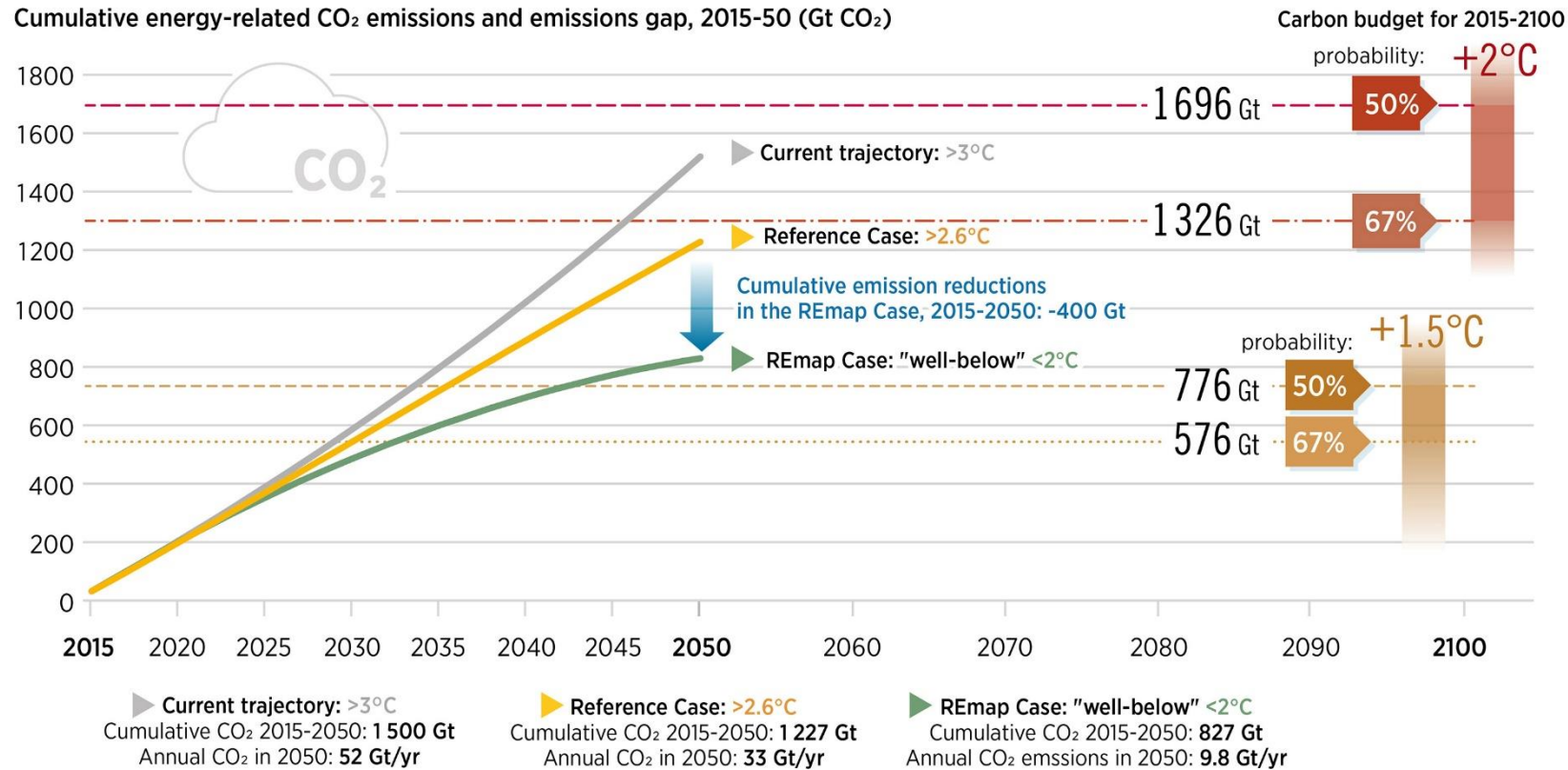


- Average LCOE of all renewable power generation technologies, except CSP fall in fossil fuel cost range
- Bioenergy, geothermal, hydro and onshore wind all at lower end of fossil cost range
- Solar PV rapidly falling towards lower end.
- Offshore wind and CSP have much lower deployment. Data suggests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

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.



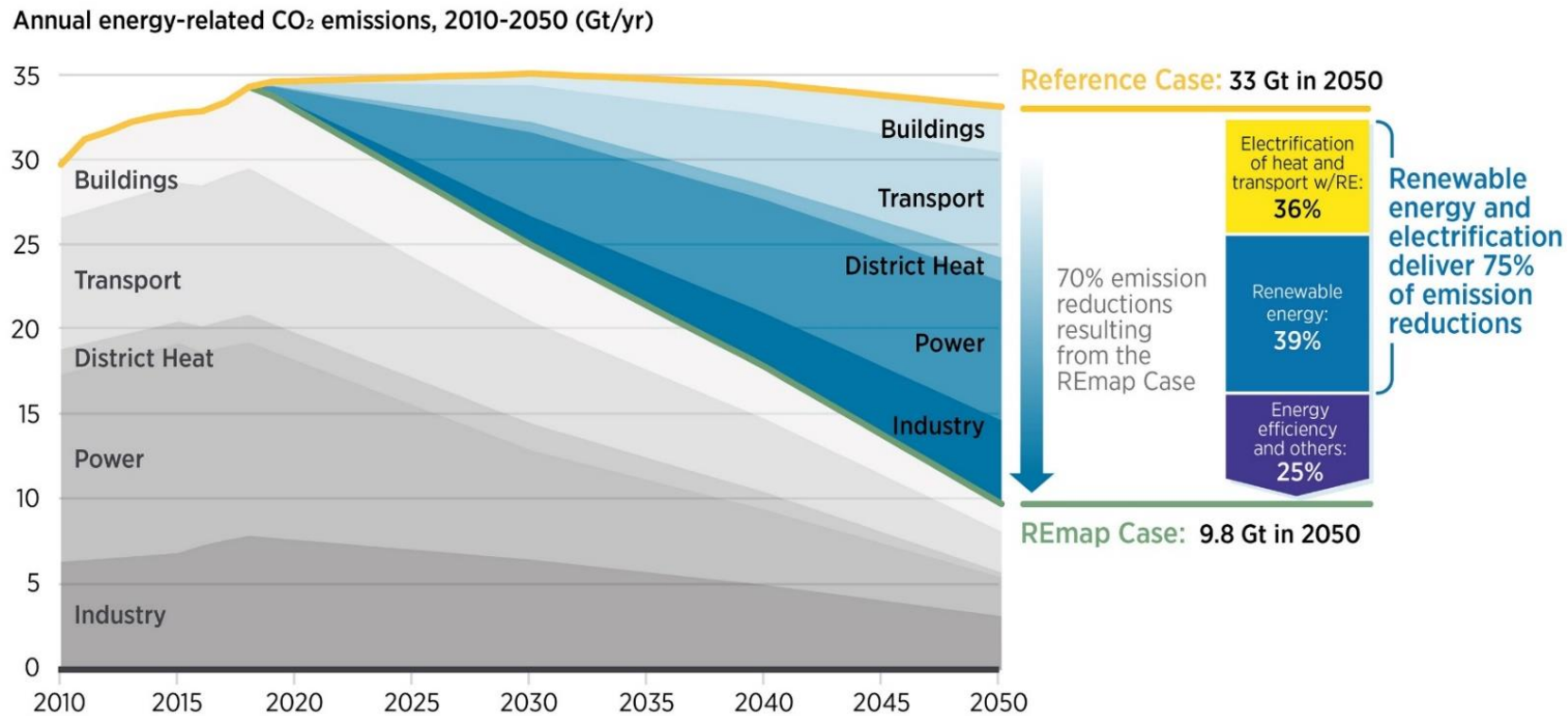
Bridging the gap: A pathway for a well-below 2°C climate target, towards 1.5°C



- 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.

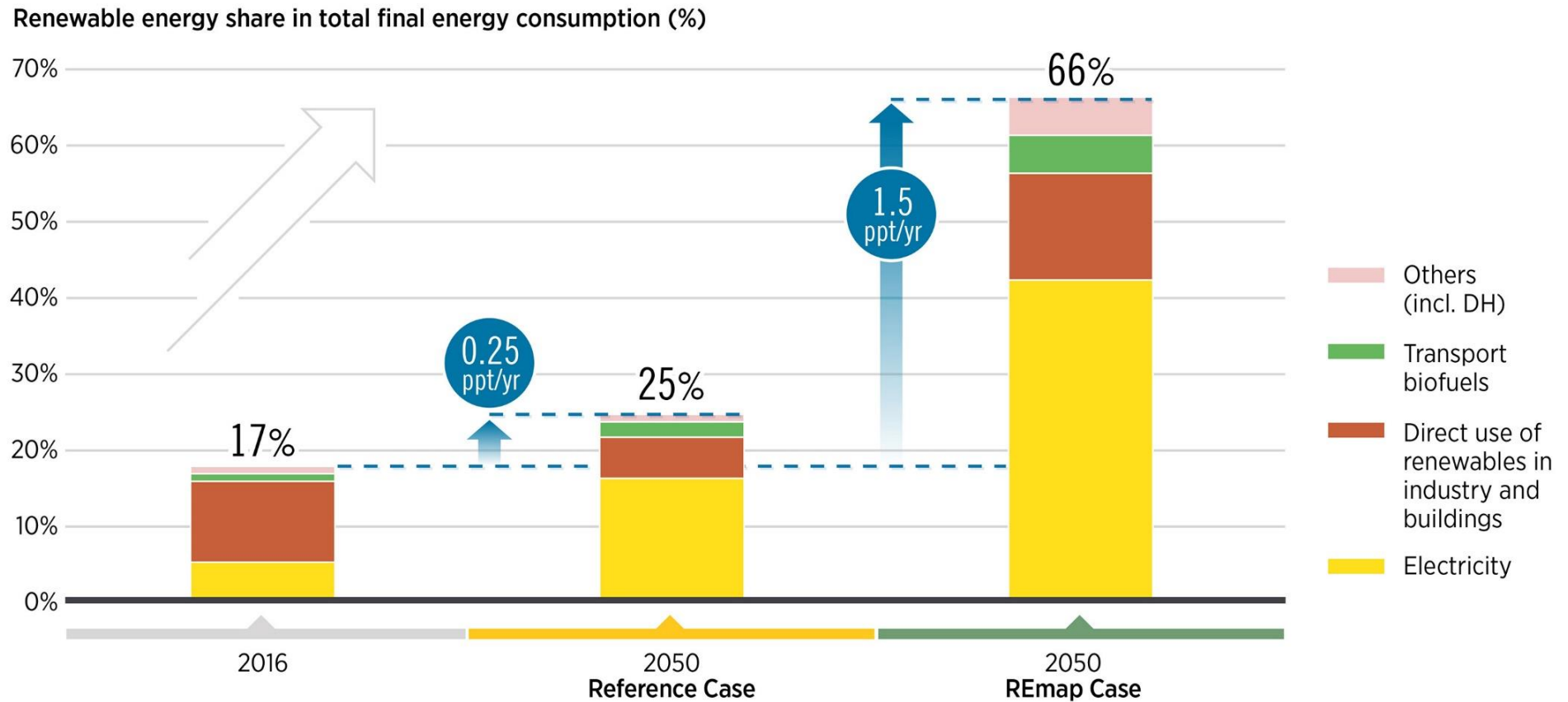
Notes: 1) Taking into account 2015-2017 emissions on top of the budget provided in IPCC (2018) (Table 2.2 – with no uncertainties and excluding additional Earth system feedbacks); 2) Budgets exclude industrial process emissions of 90 Gt; for this study, the assumption is that CO₂ emissions from land 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



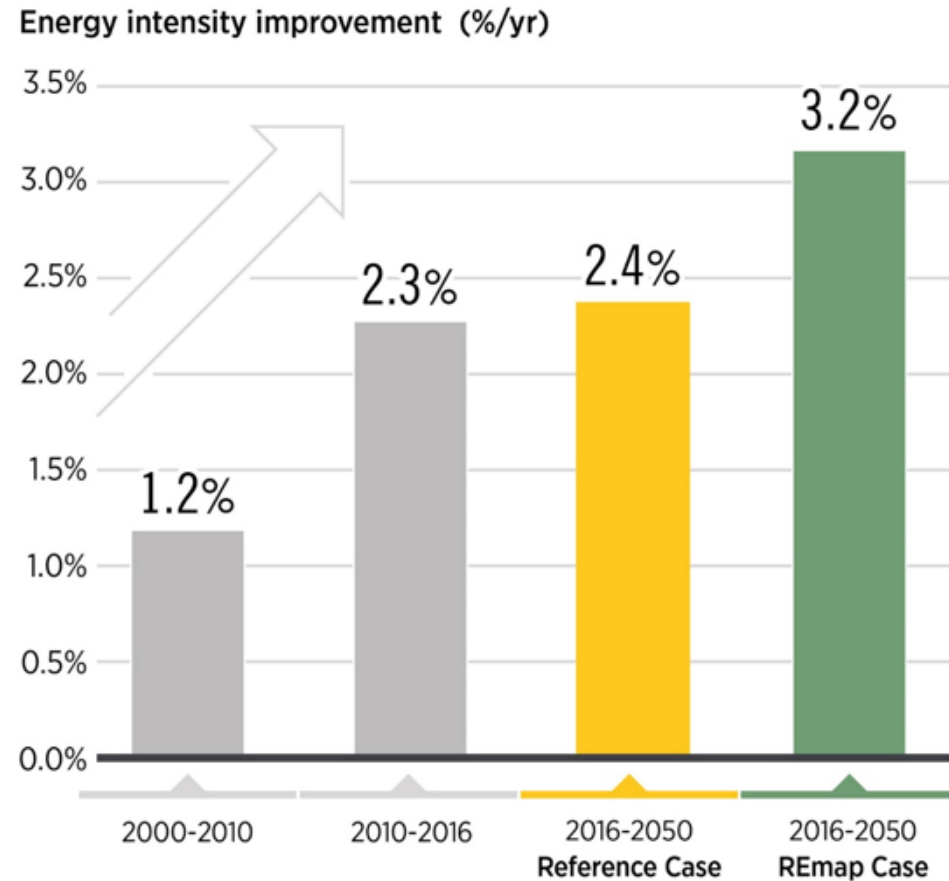
- Annual energy-related **CO₂ emissions under current and planned policies** – the Reference Case – are expected to remain **flat** but **must be reduced by 70%** to bring temperature rise to the **well-below 2°C climate goal**.
- Electrification, renewable energy and energy efficiency** measures provide over **90%** of the reductions required by **2050**. **Renewable power and electrification of heat and transport alone reduce emissions by 75%**.

A transformed energy system: Renewables growth must increase six-fold



- The share of renewables in the world's total final energy consumption has to increase six times faster to meet agreed climate goals.

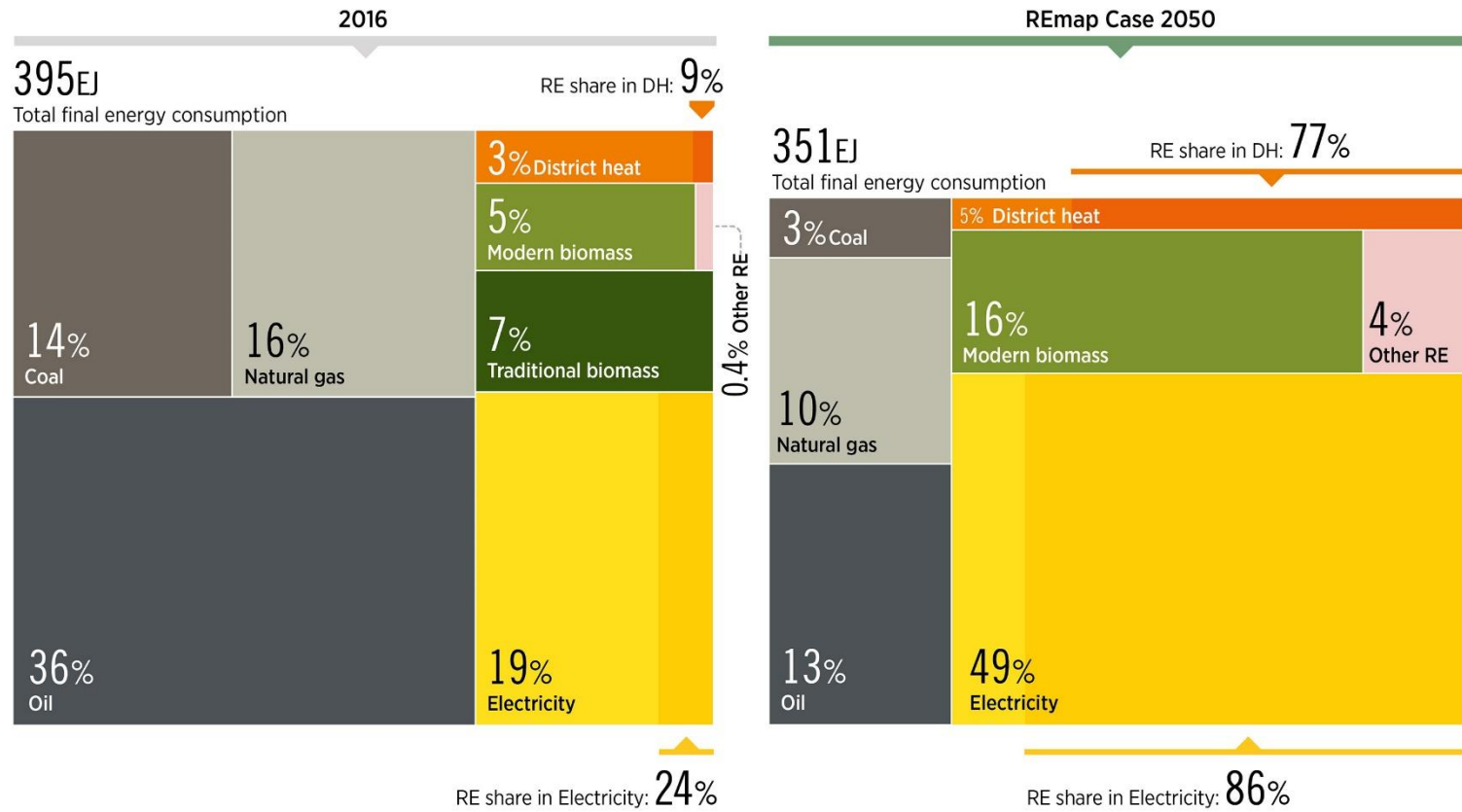
A transformed energy system: Energy intensity improvement needs to increase by a third, to 3.2% per year



- 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.

An electrified future: Electricity becomes the central energy carrier

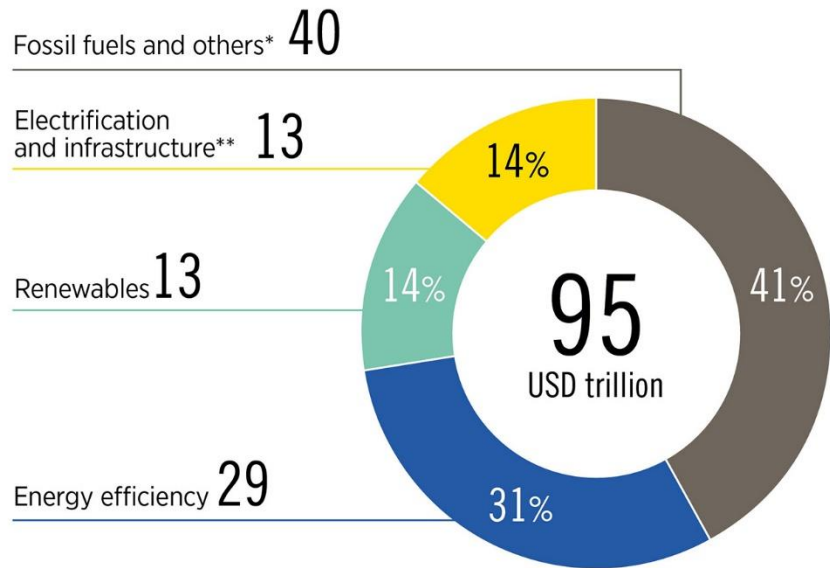
Total final energy consumption breakdown by energy carrier (%)



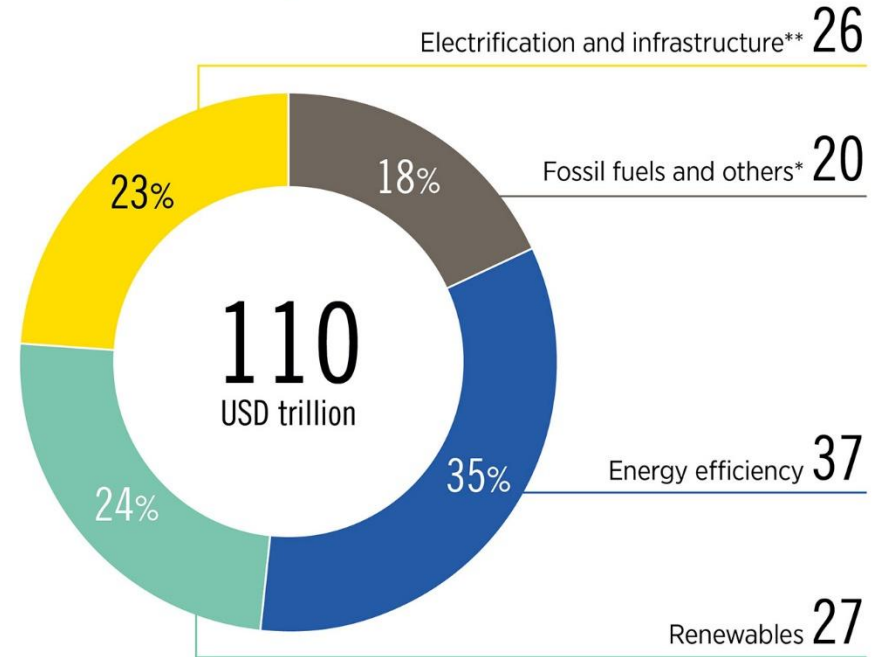
- **Scaling up electricity from renewables will be crucial for the decarbonisation of the world's energy system.**

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

Reference Case cumulative investments, 2016-2050
(USD trillion)

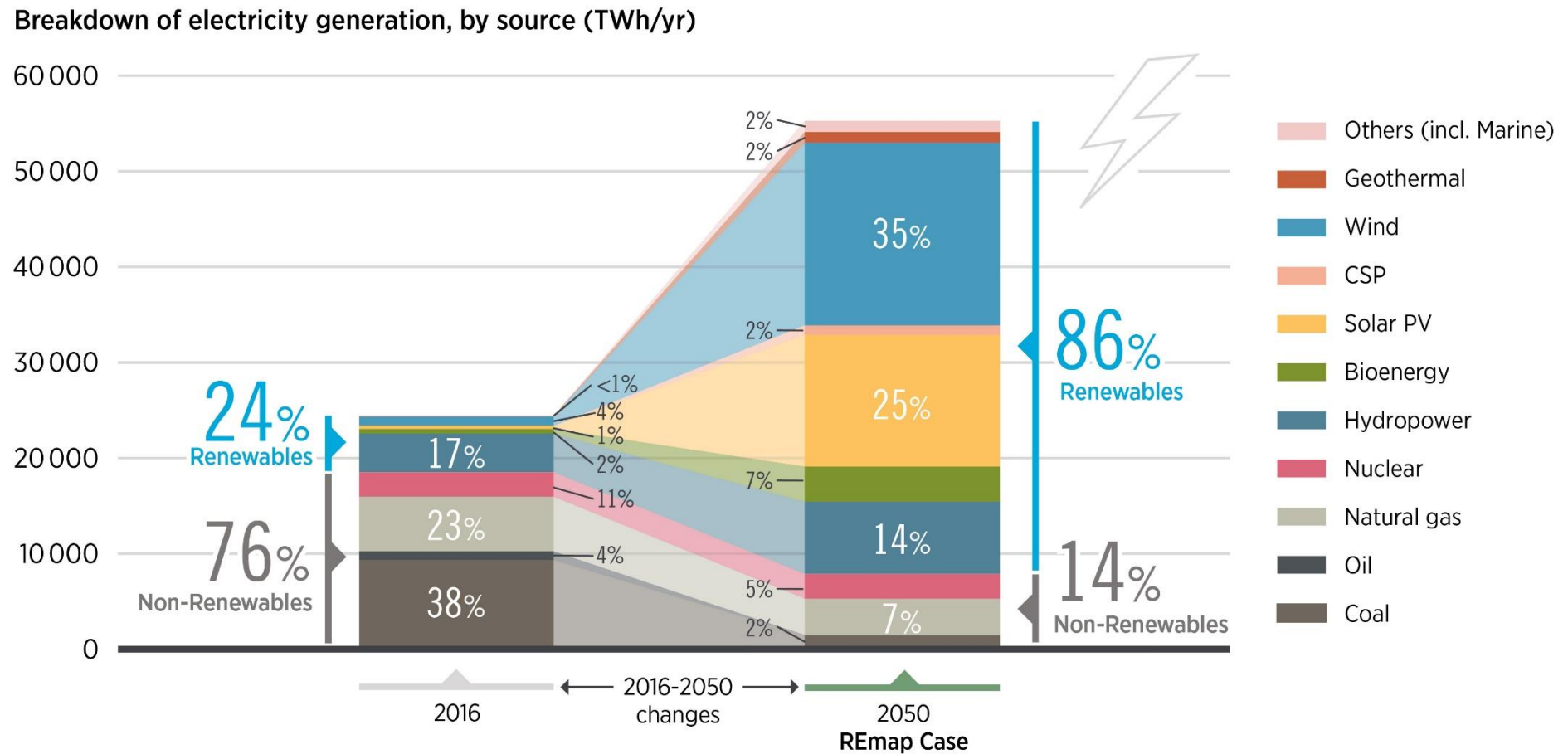


REmap Case cumulative investments, 2016-2050
(USD trillion)



- The REmap Case increases investments in the global energy system by USD 15 trillion, and shifts investment into electrification, renewable energy and energy efficiency technologies, which together, would make up four-fifths of the cumulative energy sector investments over the period to 2050.

The rising importance of solar and wind energy in the power sector



- Gross power generation would almost double, with 86% coming from renewables.

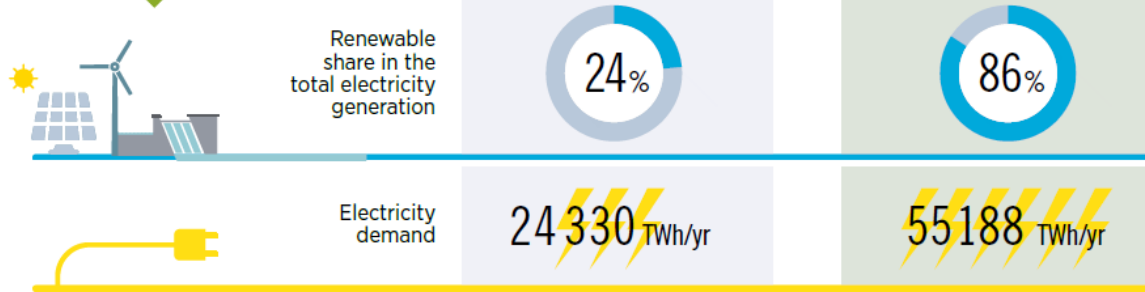
Power sector key indicators infographic



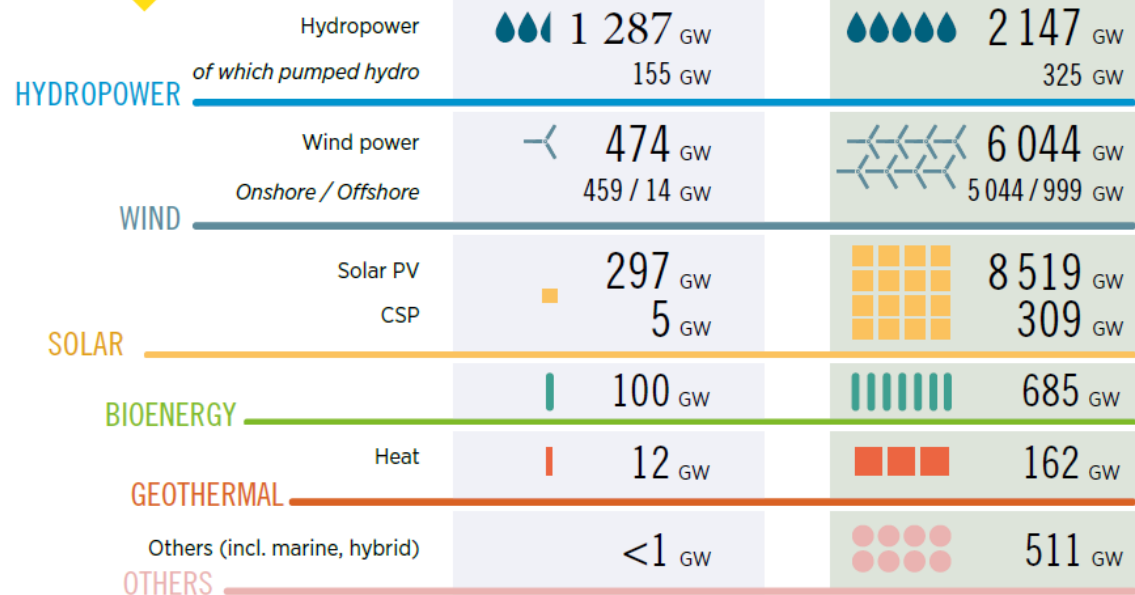
2016

REmap Case 2050

RENEWABLE ENERGY AND ELECTRIFICATION SHARES



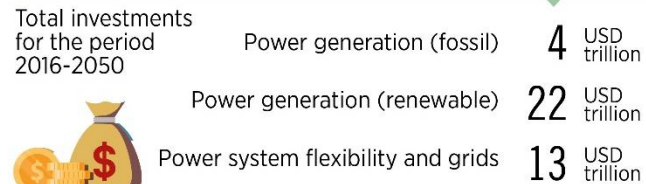
INSTALLED POWER GENERATION CAPACITY



ENERGY-RELATED CO₂ EMISSIONS



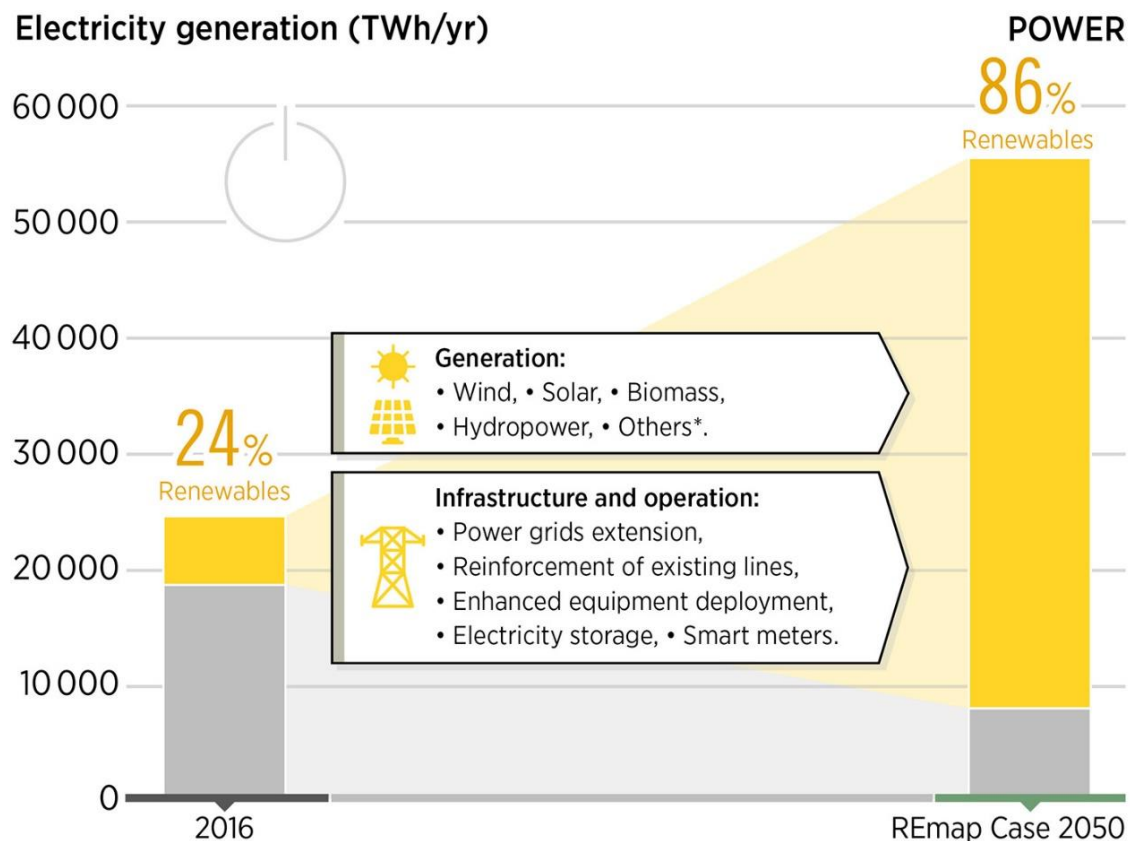
INVESTMENT



STRANDED ASSETS



Actions needed now - Power



ACCELERATE RENEWABLES CAPACITY ADDITIONS:

- Identify and map renewable energy resources and develop a portfolio of financeable projects.
- Construct no new coal power plants and plan and implement the phase-out of coal capacities approaching end of its lifetime.

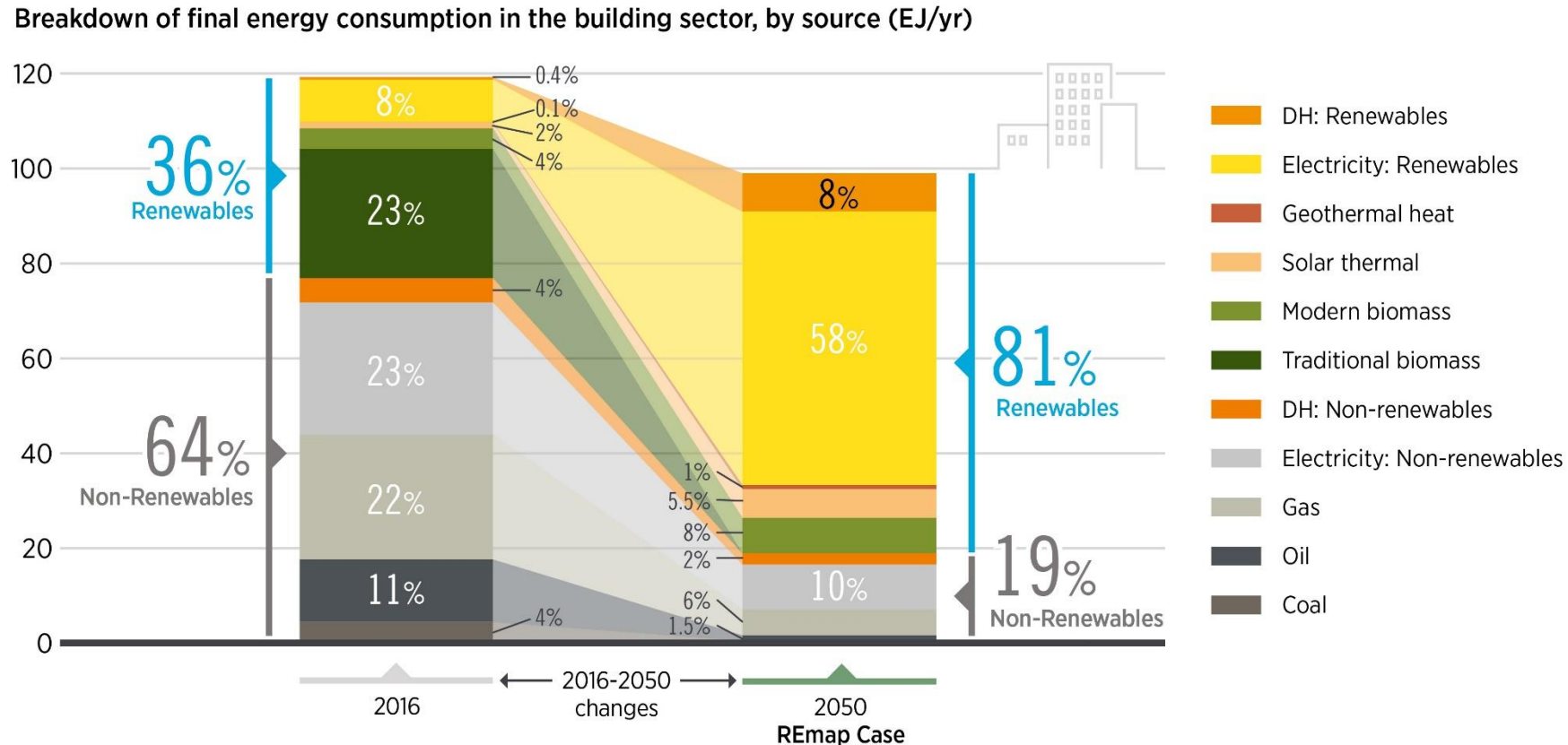
PLAN FOR THE POWER SECTOR TO ACCOMMODATE INCREASING SHARES OF VARIABLE RENEWABLE ENERGY:

- Prioritize to improve flexibility of power system (with flexible supply, storage, demand response, power-to-X, electric vehicles, digital and information and communication technologies technologies, etc.). Update grid codes.
- Deploy microgrids to improve resilience of the grid and energy access rate with renewable sources. Deploy super grids to strengthen the interconnections among countries within a region.
- Deploy cost-reflective tariff structures by properly readjusting the balance between volumetric charges (USD/kWh), fixed charges (e.g., USD/meter-month) and, where applicable, demand charges (USD/kW).

SUPPORT THE DEPLOYMENT OF DISTRIBUTED ENERGY RESOURCES:

- Incentivise energy consumers to become prosumers.
- Support regulatory and pricing policies including the right to generate and sell electricity, tariff regulation and grid-arrival policies.
- Enable energy aggregators to foster the deployment of distributed energy resources.

The increasing use of renewable electricity in buildings

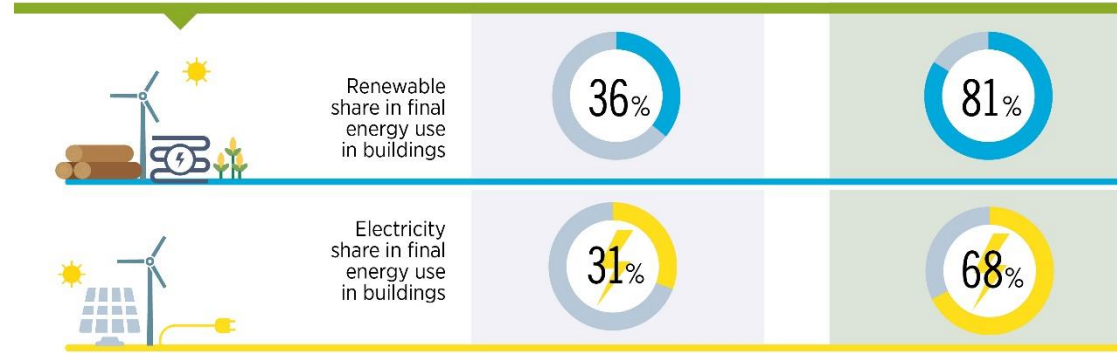


- Renewable electricity would reach a 58% share in the buildings sector by 2050.
- Together with modern biomass, solar thermal and district heating, overall renewables could ramp up to 81%, from 36% today.

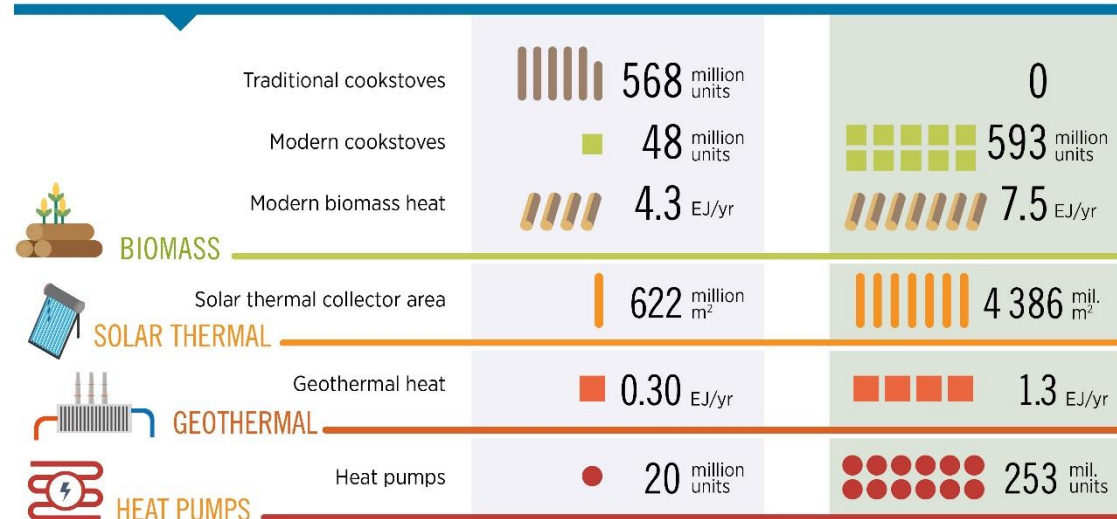
Buildings sector key indicators infographic



RENEWABLE ENERGY AND ELECTRIFICATION



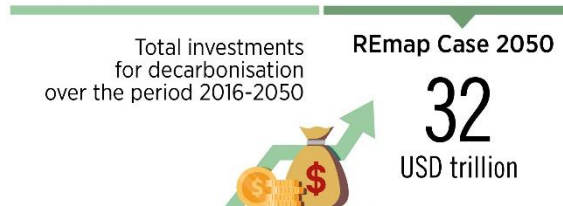
RENEWABLE ENERGY INDICATORS



ENERGY RELATED CO₂ EMISSIONS



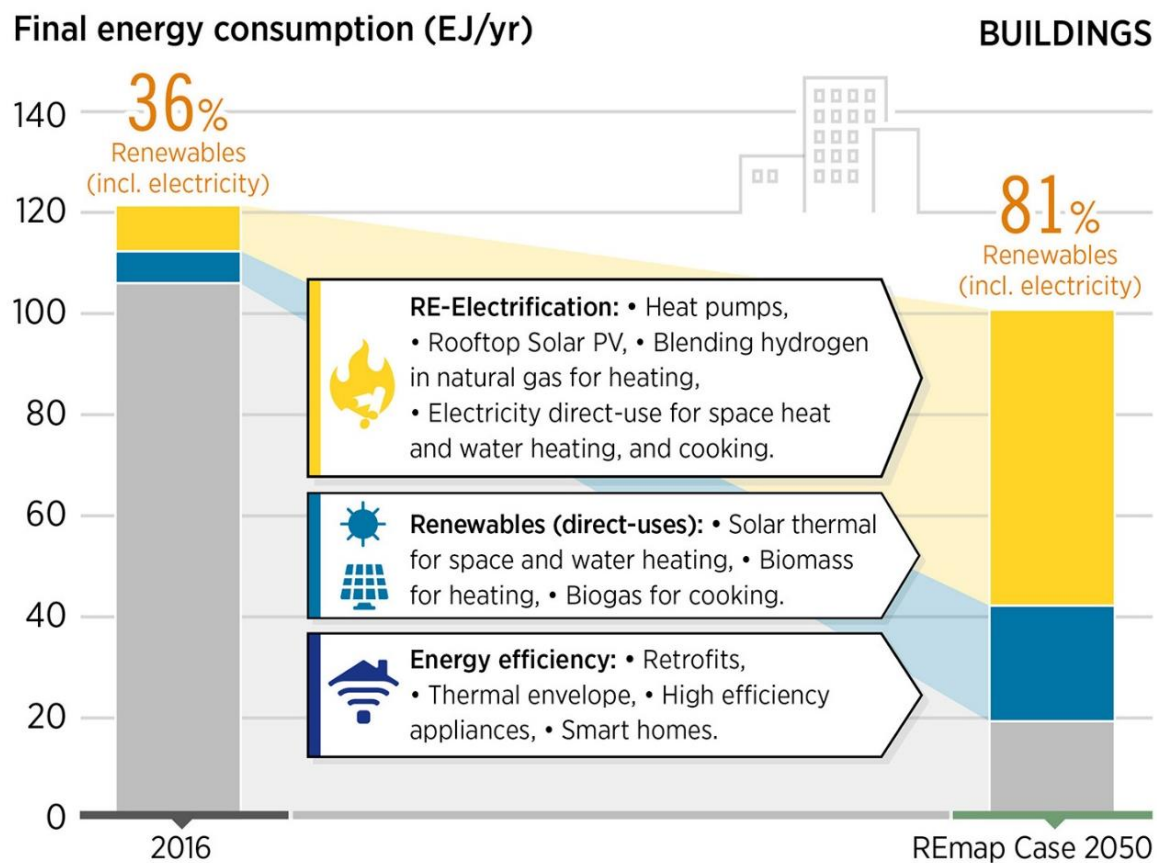
INVESTMENT



STRANDED ASSETS



Actions needed now - Buildings



REDUCE ENERGY CONSUMPTION IN BUILDINGS:

- Establish and improve energy efficiency building codes and standards (incl. appliances (eg. air conditioners), lighting (eg. LED lights) and equipment (eg. efficient boilers)).
- Adopt programmes for retrofitting/renovation including financing schemes.
- Align renewable heat and energy efficiency policies to leverage synergies and to accelerate the pace of energy efficiency improvements.

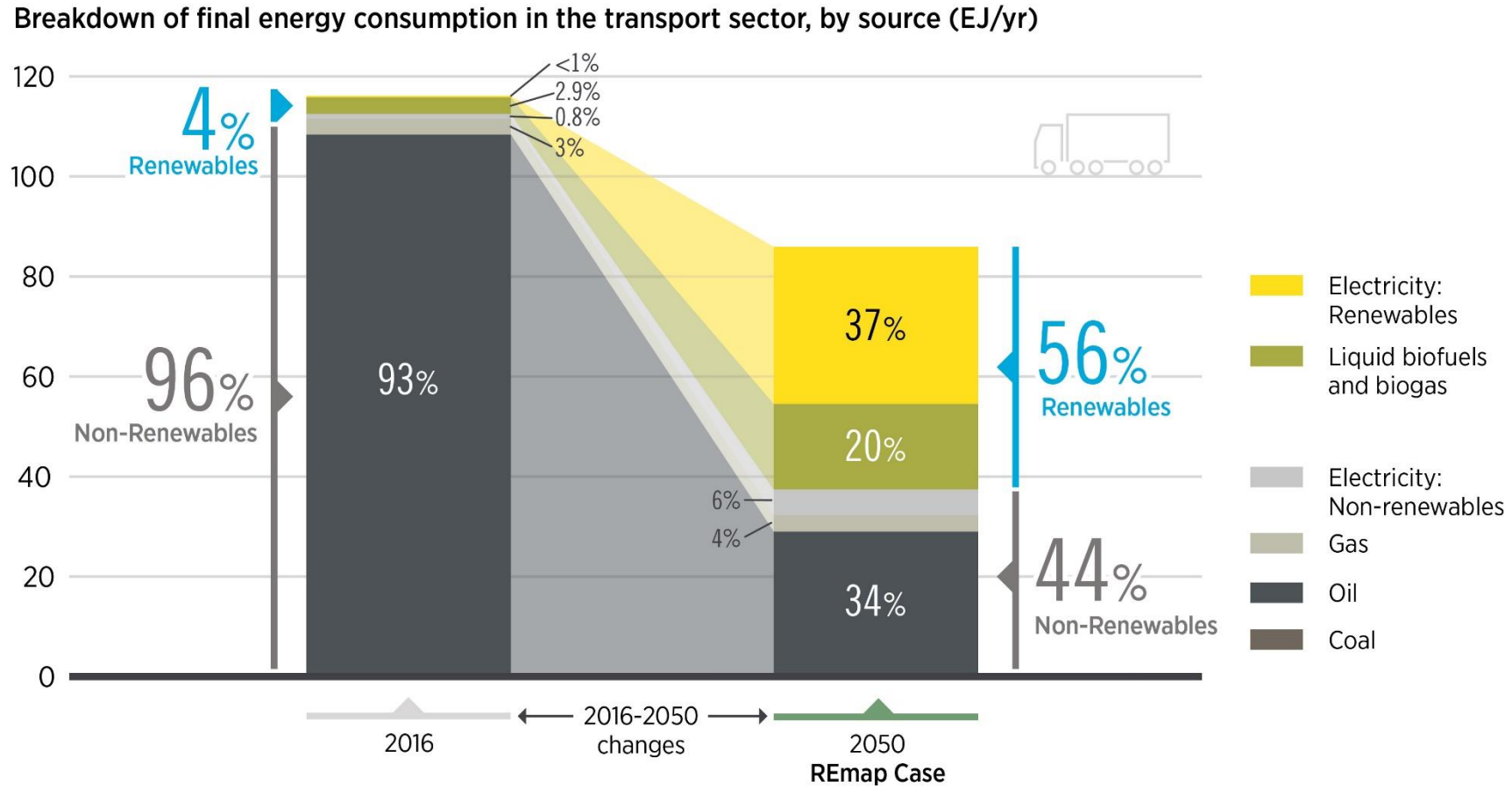
SUPPORT AND FOSTER THE DEPLOYMENT OF DISTRIBUTED ENERGY RESOURCES:

- Remove regulatory barriers for prosumers that restrict them from taking an active role in the energy system transformation. Capitalise on smart-homes and digitalisation to allow demand management.
- Promote community ownership models and innovative financing schemes.
- Accelerate rollout of smart meters.

SCALEUP RENEWABLE SHARE UPTAKE IN THE BUILDINGS SECTOR:

- Promote low-carbon heating technologies: heat pumps, solar heating, modern bioenergy for heating). Apply these renewable technologies for district heating.
- Establish a long term strategy for heat decarbonisation.
- Incentivise renewable based cooling solutions.
- Phase out traditional biomass as cooking fuel and replace with clean and efficient cookstoves (biogas, modern solid biomass and electricity).

Increasing electrification in the transport sector



- Renewable electricity use could increase significantly in the transport sector by 2050, providing 37% of total transport energy consumption and, due to higher efficiency, covering 60% of the overall transport activity.

Transport sector key indicators infographic



TRANSPORT

2016

REmap Case 2050

RENEWABLE ENERGY AND ELECTRIFICATION



Renewable share in final energy use in transport

3%

56%



Electricity share in final energy use in transport

1%

43%

ELECTRIFICATION

Electric passenger cars

1.2 million units



1 109 million units

Electric buses and light duty vehicles

0.02 million units



58 million units

Electric 2/3 wheelers

200 million units



2 402 million units



Battery Storage available to grid from EVsⁱ

0.5 GWh



14 065 GWh

BIOFUELS

Ethanol

94 billion litres



366 billion litres

Biodiesel

35 billion litres



180 billion litres

Aviation biofuel

0 billion litres



105 billion litres

Biomethane

0.4 billion m³



13 billion m³



ENERGY RELATED CO₂ EMISSIONS

8.5 Gt CO₂/yr

2.4 Gt CO₂/yr

Avoided CO₂ emissions in 2050 compared to Reference Case: 6.1 Gt CO₂/yr

INVESTMENT

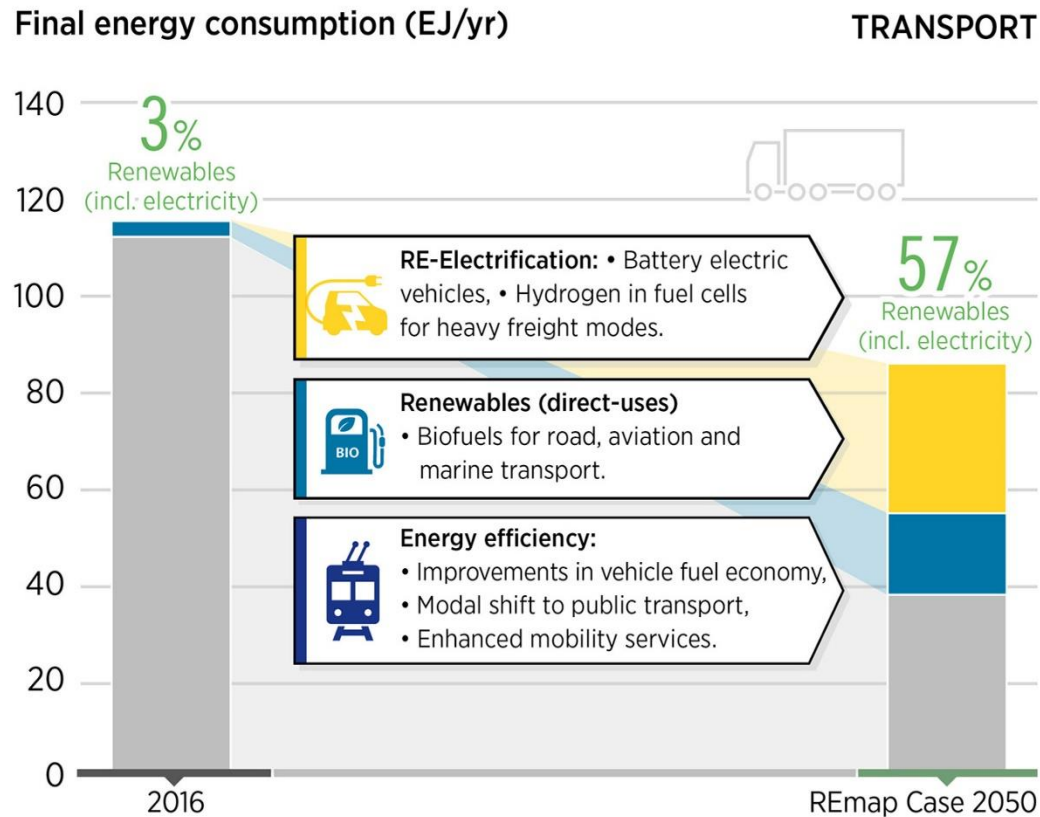
Total investments for decarbonisation over the period 2016-2050

14 USD trillion



ⁱ Considering 50% grid connected Electric passenger cars and 25% grid connected electric 2/3 wheelers by 2050

Actions needed now - Transport



REDUCE THE ENERGY NEED FOR TRANSPORT:

- Deploy advanced digital communication technologies to reduce the transport needs (eg. teleconferencing over traveling) and to improve efficiency of transport by better utilizing the assets (eg. re-routing due to traffic).
- Promote mobility services: Promote vehicle sharing and autonomous driving.
- Accelerate modal shift from passenger cars to public transport (electric railways or trams or electric buses).

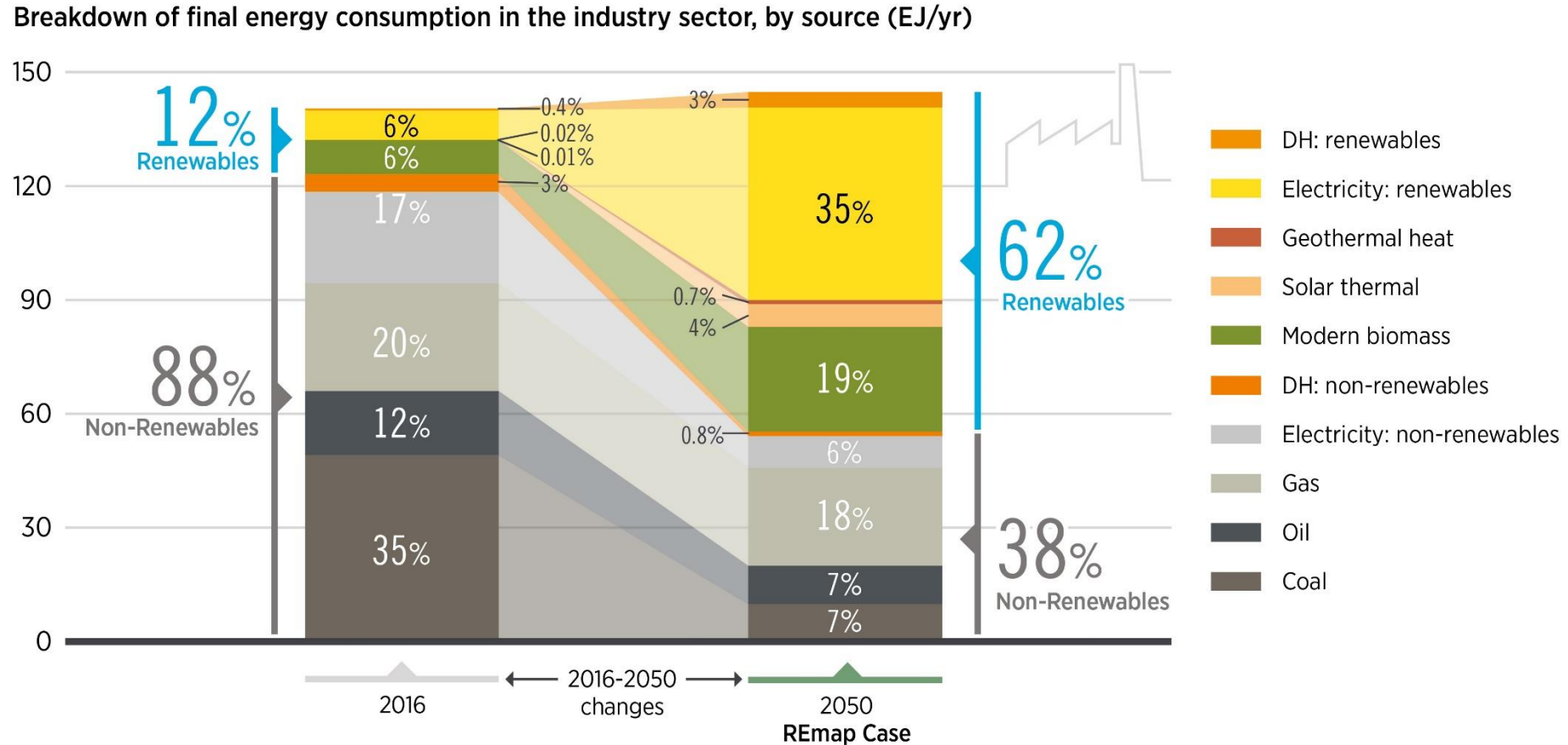
ACCELERATE THE UPTAKE OF ELECTRIC MOBILITY:

- Establish minimum standards for vehicle emissions. Give the priority for electric vehicles for city access.
- Incentivise charging infrastructure rollout.
- Strengthen link between the power and transport sectors for integrated planning and policy designs (vehicle-to-grid services).
- Deploy low-emissions city trucks.

FOSTER BIOFUELS IN ROAD, AVIATION AND SHIPPING:

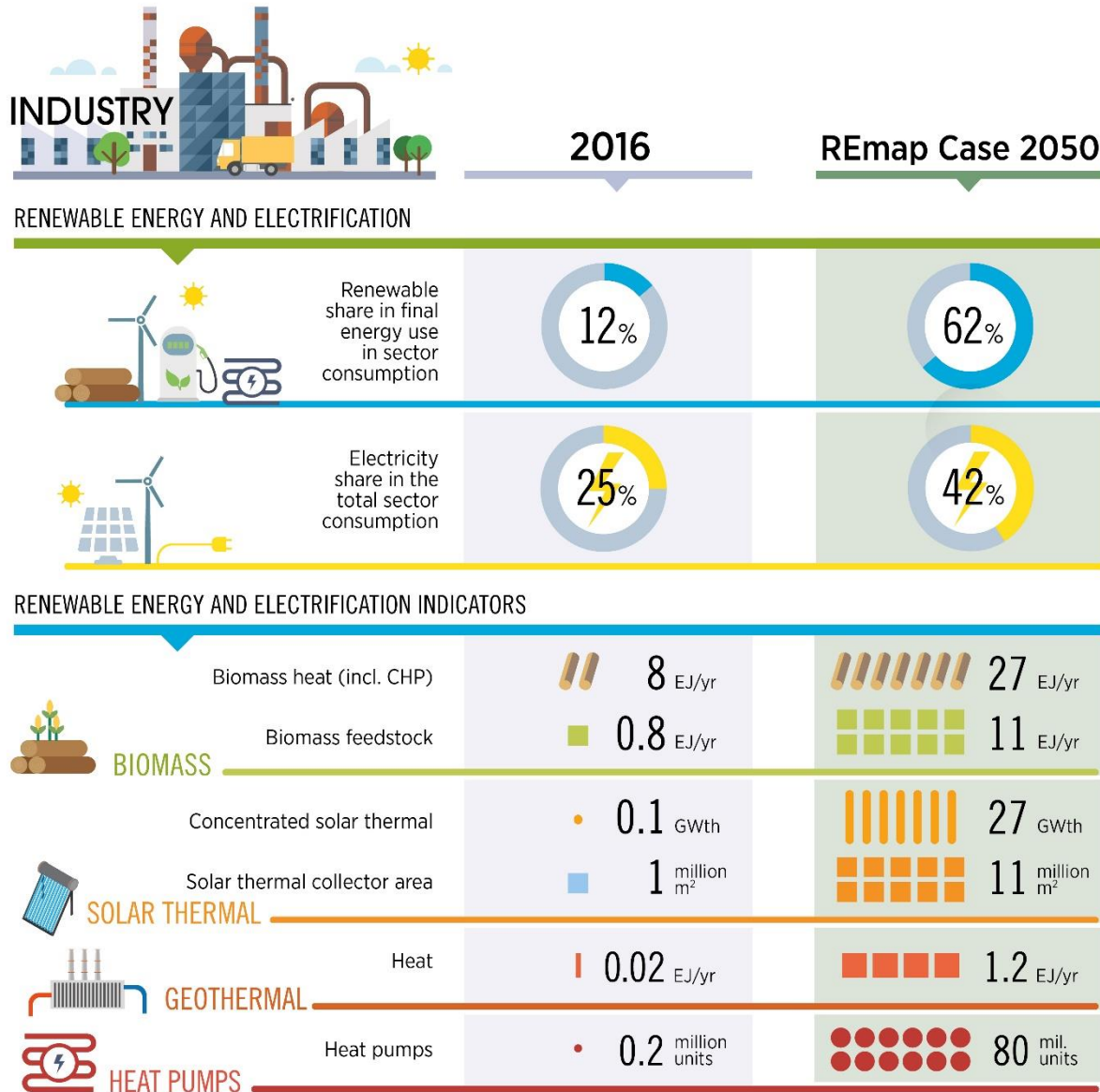
- Eliminate fossil fuel subsidies and implement carbon pricing to increase the competitiveness of renewable fuels in the shipping and aviation.
- Adopt supporting policies to scale up sustainable production of first- and second-generation biofuels. Introduce specific mandates for advanced biofuels and put in place direct financial incentives along with financial de-risking measures.

Renewable electrification and bioenergy taking the lead in the industry sector

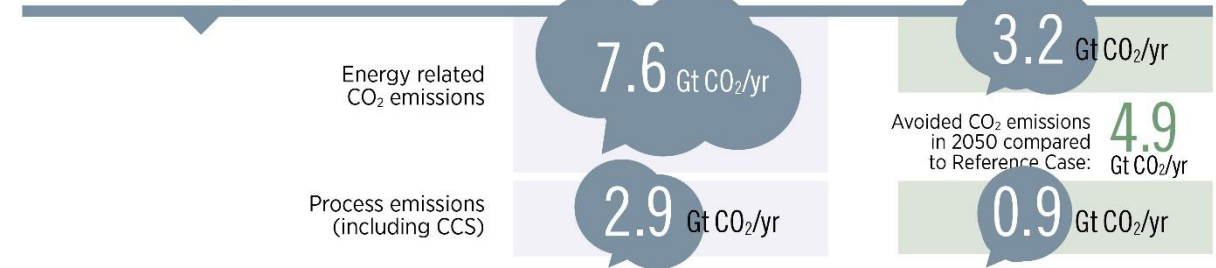


- By 2050 the share of renewables in the industrial sector needs to grow by more than 5 times. Renewable electrification would make up around 1/3 of the sector's energy demand, followed by biomass providing 1/5.

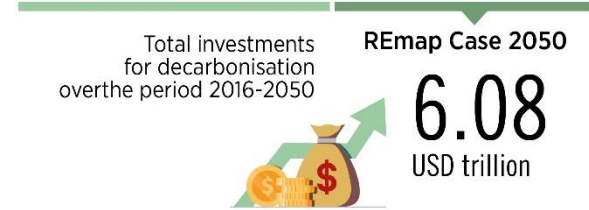
Industry sector key indicators infographic



ENERGY RELATED CO₂ EMISSIONS



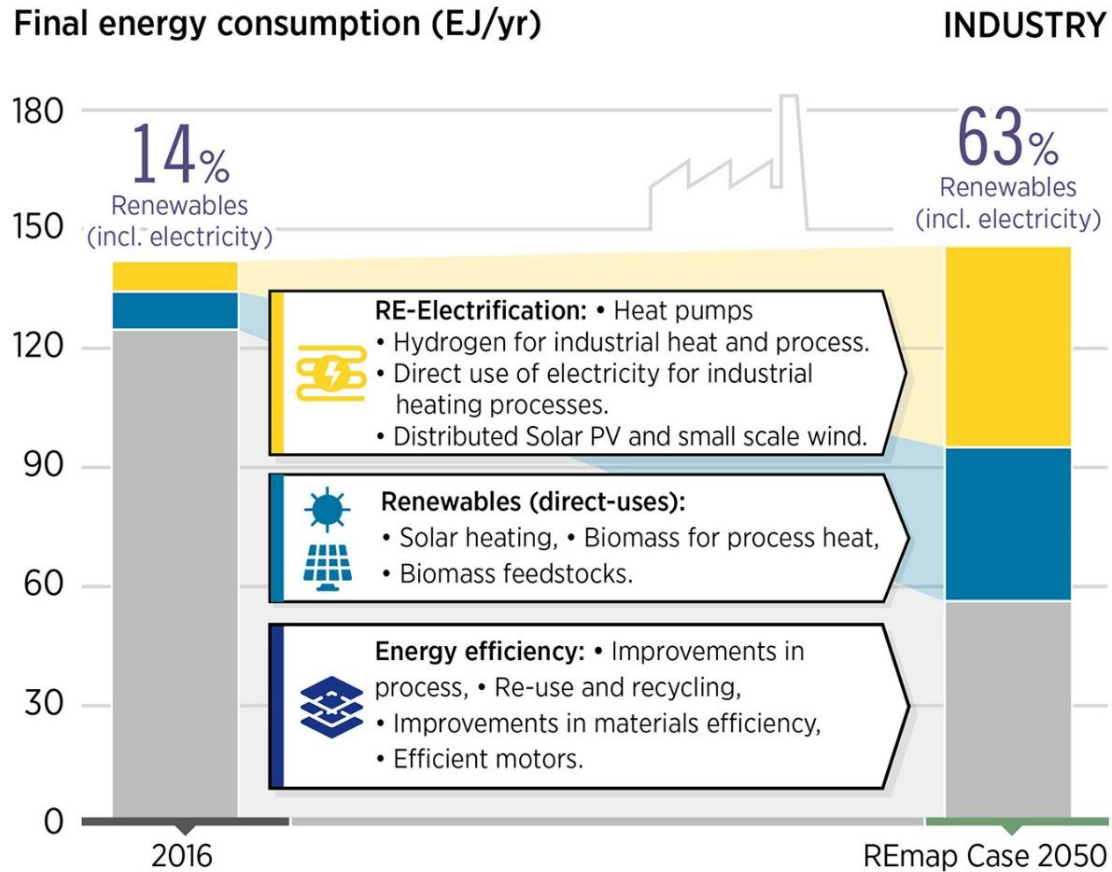
INVESTMENT



STRANDED ASSETS



Actions needed now - Industry



REDUCE ENERGY CONSUMPTION IN INDUSTRIES:

- Promote actions towards circular economy (material recycling, waste management, improvements in materials efficiency and structural changes such as reusing and recycling).
- Incentivise and adopt best available technologies (BAT) and efficiency standards.

ENABLE CORPORATE SOURCING OF RENEWABLES:

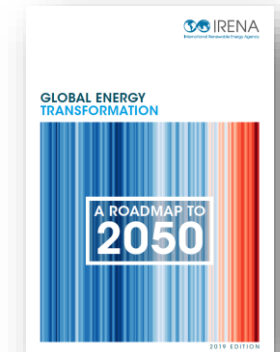
- Support a credible and transparent system for certification and tracking of renewable energy attributes.
- Consider an energy market structure that allows for direct trade between companies of all sizes and renewable energy developers – such as through PPAs.
- Work with utilities or electric suppliers to provide green corporate procurement options.
- Empower companies to engage in direct investment for self-generation.

ACCELERATE THE DEPLOYMENT OF LOW-CARBON TECHNOLOGIES IN INDUSTRIAL PROCESS HEATING:

- Remove existing barriers and incentivise low-carbon heating technologies deployment: Solar thermal heating/modern bioenergy and heat pumps.
- Support emerging technologies in biomass and hydrogen. Use renewable-produced hydrogen to replace fossil fuel-based feedstocks and process heat (e.g., iron and steel sub-sectors, ammonia production).
- Implement appropriate carbon pricing in line with the real costs of the externalities and the elimination of existing subsidies for carbon-intensive fuels (where those still exist).



Thank you!
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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

For further information or to provide feedback, please contact the REmap team at remap@irena.org



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