



ASIA PACIFIC ENERGY RESEARCH CENTRE
APERC Annual Conference 2019

Accelerating renewables deployment in national energy systems

GLOBAL ENERGY TRANSFORMATION



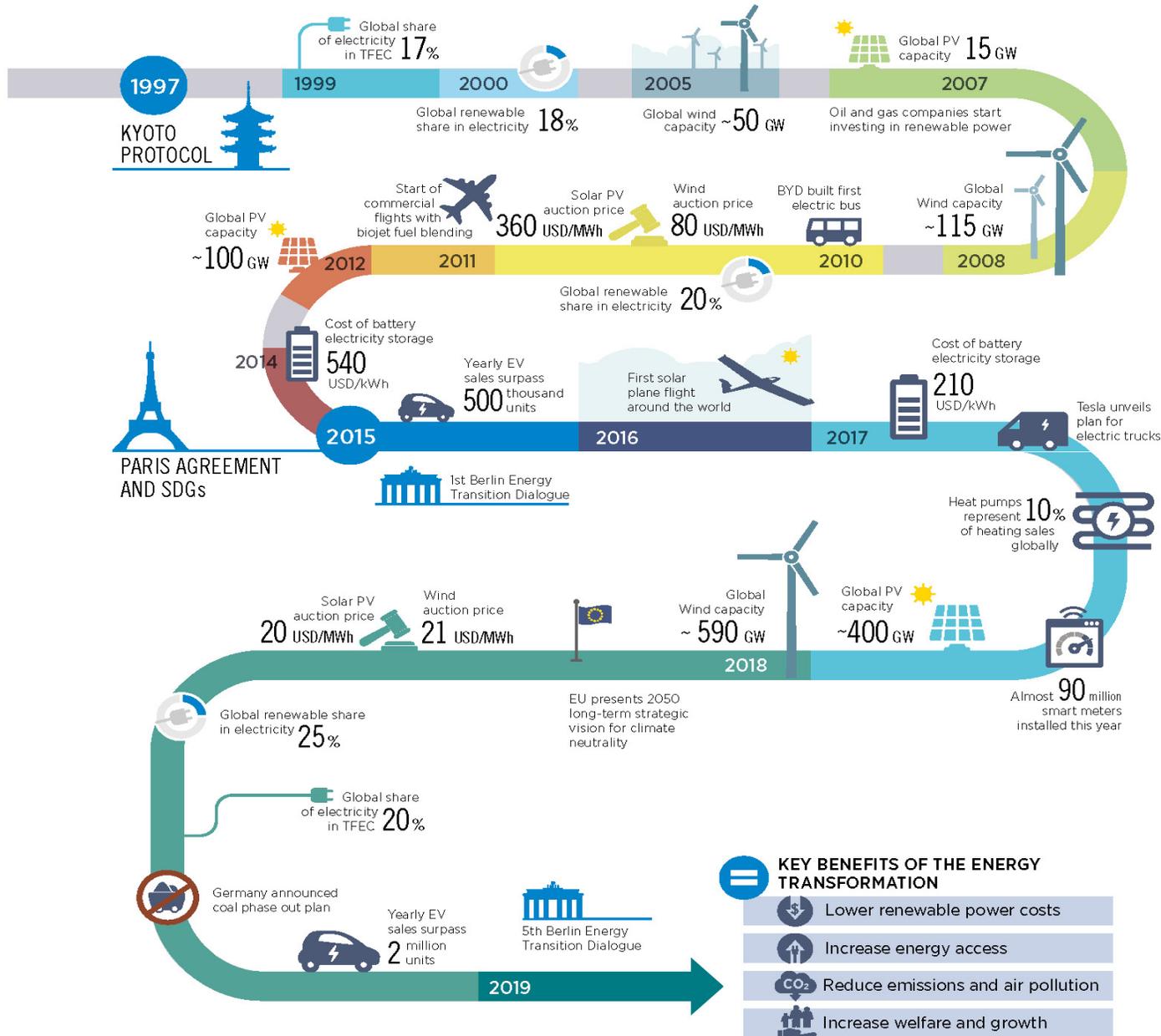
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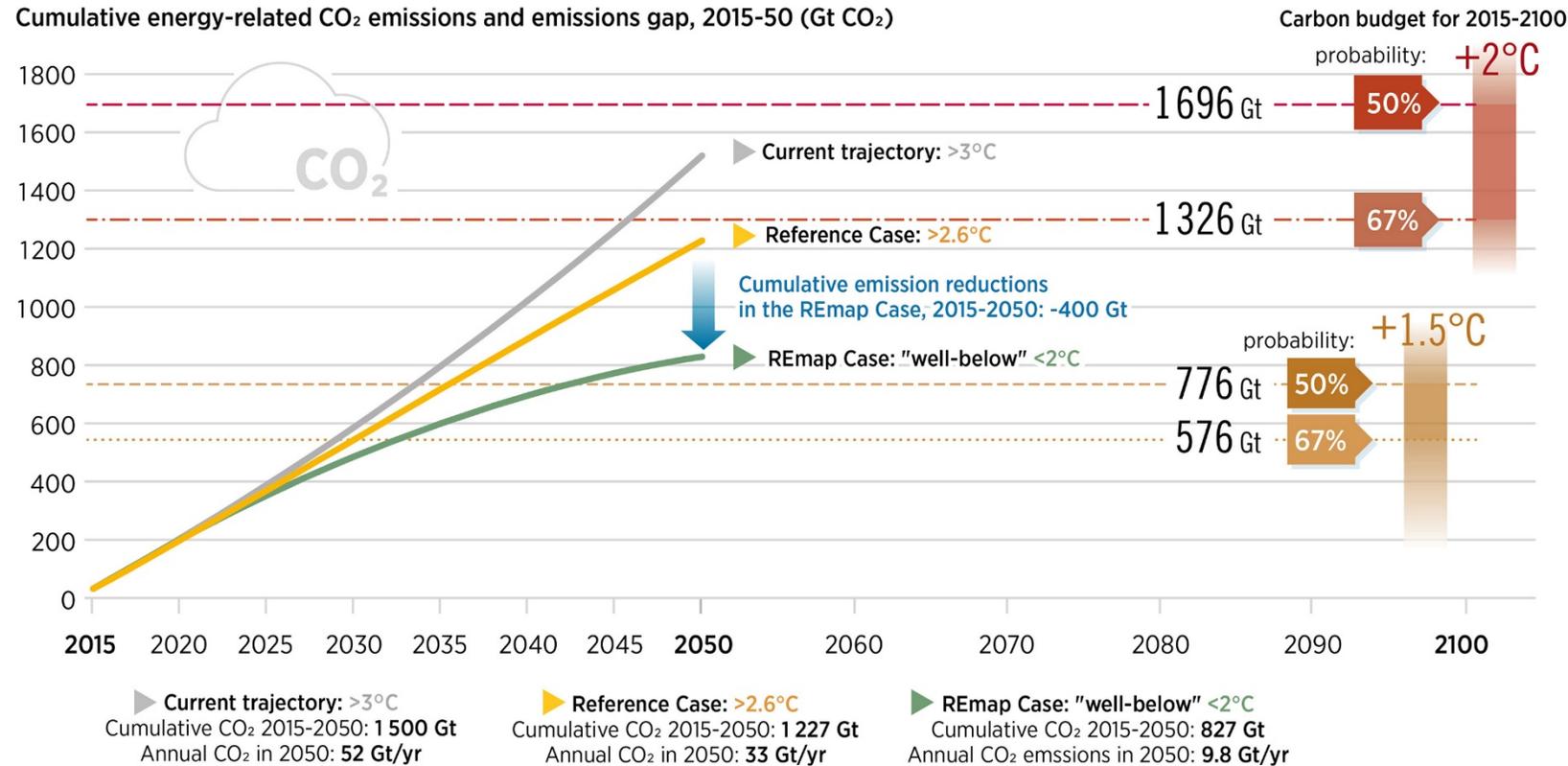
there are improvements in the energy transition



- KEY BENEFITS OF THE ENERGY TRANSFORMATION**
- Lower renewable power costs
 - Increase energy access
 - Reduce emissions and air pollution
 - Increase welfare and growth

- Cost and price
- Innovations
- Markets
- Institutional frameworks

however global carbon budget is set to run out by 2030 based on current and planned policies.

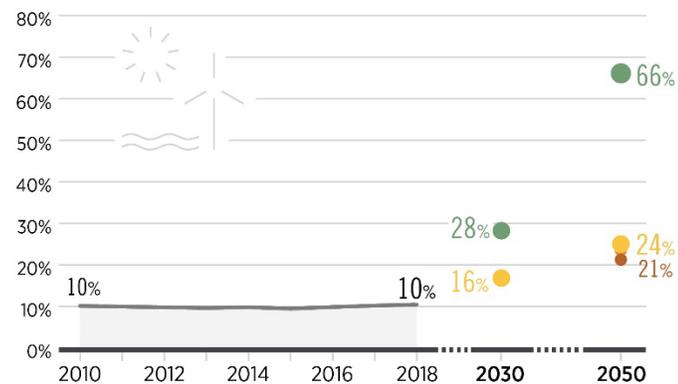


- A pathway for a well-below 2°C climate target, towards 1.5°C.

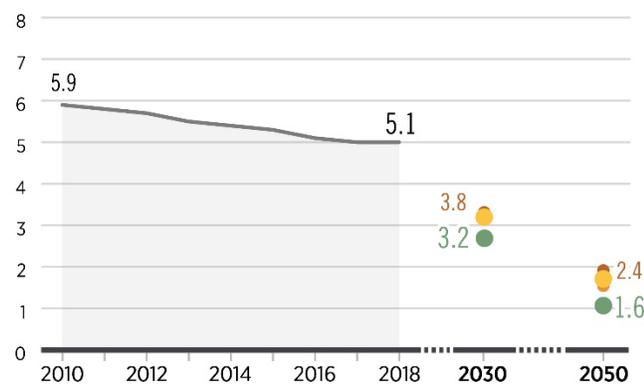
Notes: 1) Taking into account 2015-2017 emissions on top of the budget provided in IPCC (2018) (Table 2.2 – with no uncertainties and excluding additional Earth system feedbacks); 2) Budgets exclude industrial process emissions of 90 Gt; for this study, the assumption is that CO₂ emissions from land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

acceleration is needed

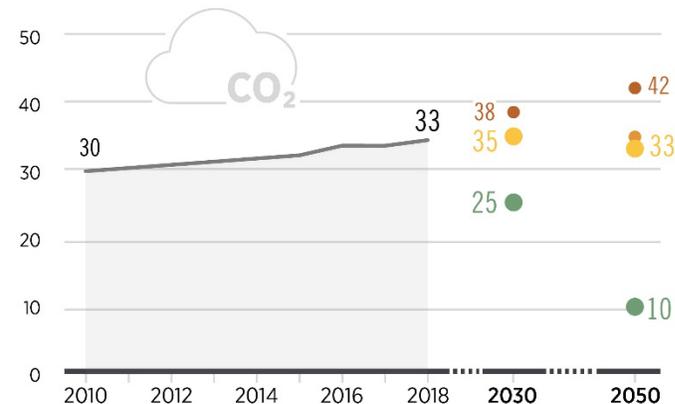
Renewable energy share in total final energy consumption (TFEC, %)



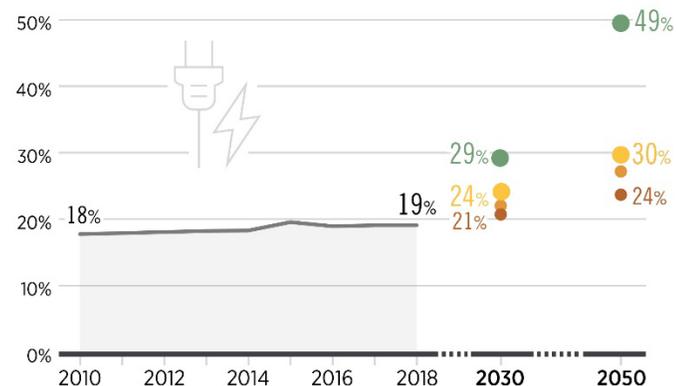
Energy intensity of GDP, based on TPES (MJ/USD-PPP, 2011)



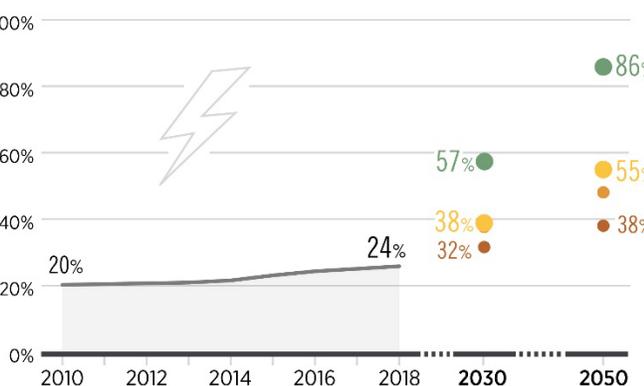
Annual emissions from the energy sector (Gt CO₂/year)



Electricity share of TFEC (%)



Renewable energy share in electricity generation (%)



- Historical
- REmap
- Reference Case - 2019 analysis
- Reference Case - 2018 analysis
- Reference Case - 2017 analysis

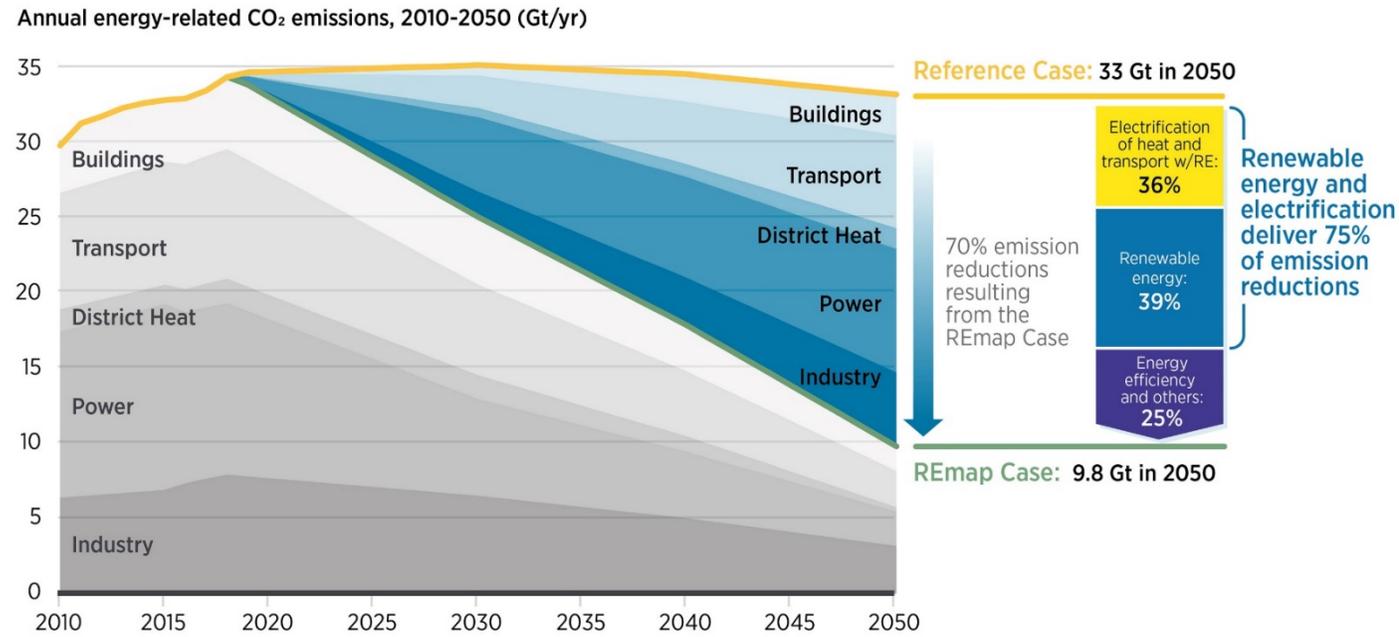
Current plans – as reflected in Nationally Determined Contributions to meet climate goals – point in the right direction yet still fall short of what is needed to meet international climate goals. Serious action is needed to accelerate the energy transition.

and it makes sense: renewables bring benefits

- **increasing competitiveness and accelerating market growth.**
 - The renewable energy technologies are reaching the tipping point and becoming increasingly competitive.
- **role improving welfare and energy security**
 - Investing in the energy transition is beneficial for society
- **increasing access, affordability and sustainability in different contexts**
 - Access in Africa, rural areas
- **emissions reduction: investing less and later in renewable is too costly**
 - Stranded assets increase significantly if action to decarbonise the energy sector is delayed

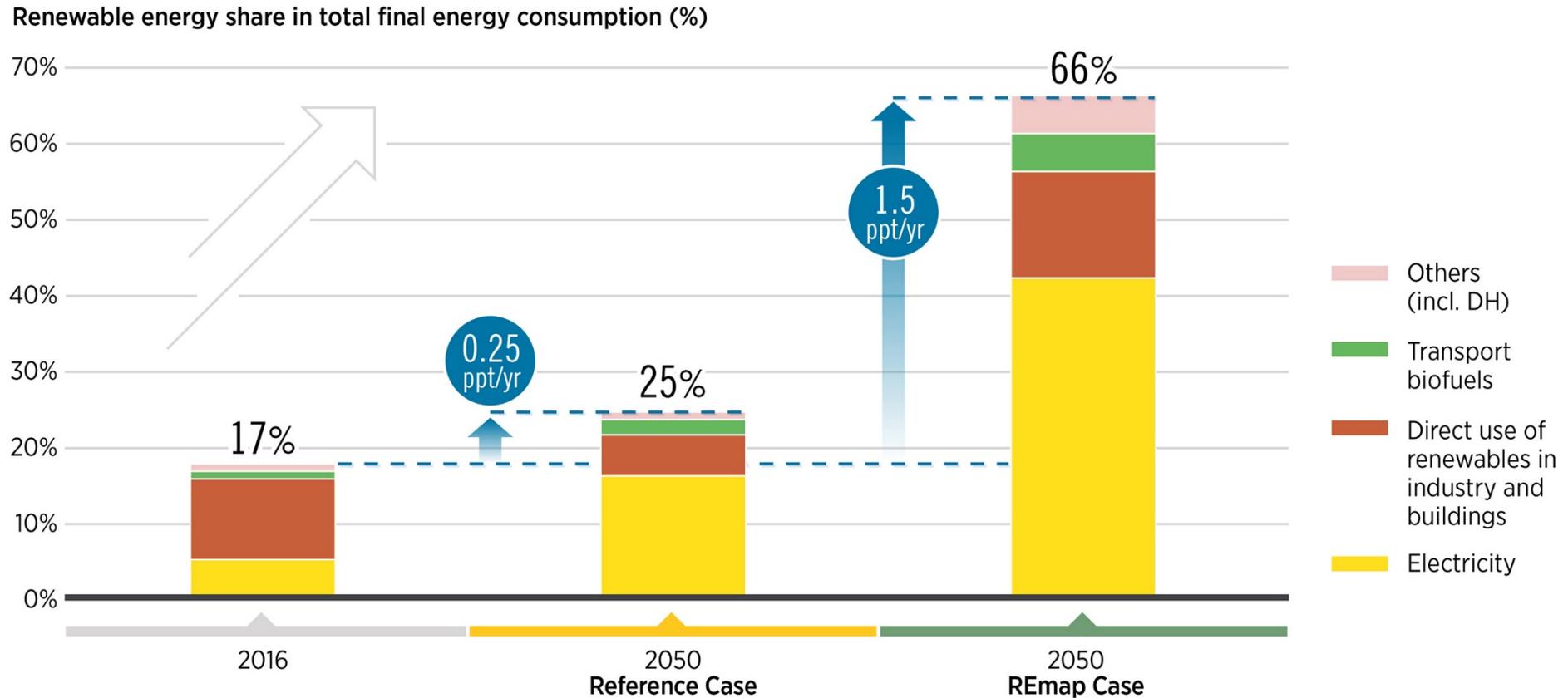
For every dollar invested in transforming the global energy system, there is a payoff of at least USD 3 and potentially more than USD 7, depending on how externalities are valued.

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 as in the REmap Case.
- 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%**.

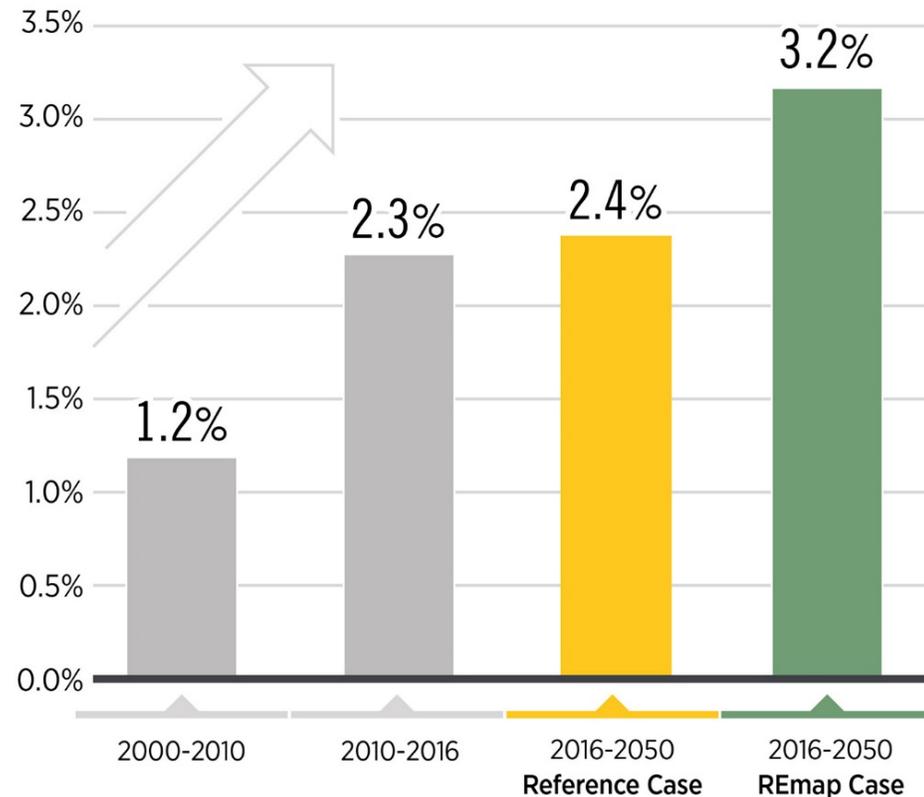
a transformed energy system: renewables growth must increase six-fold



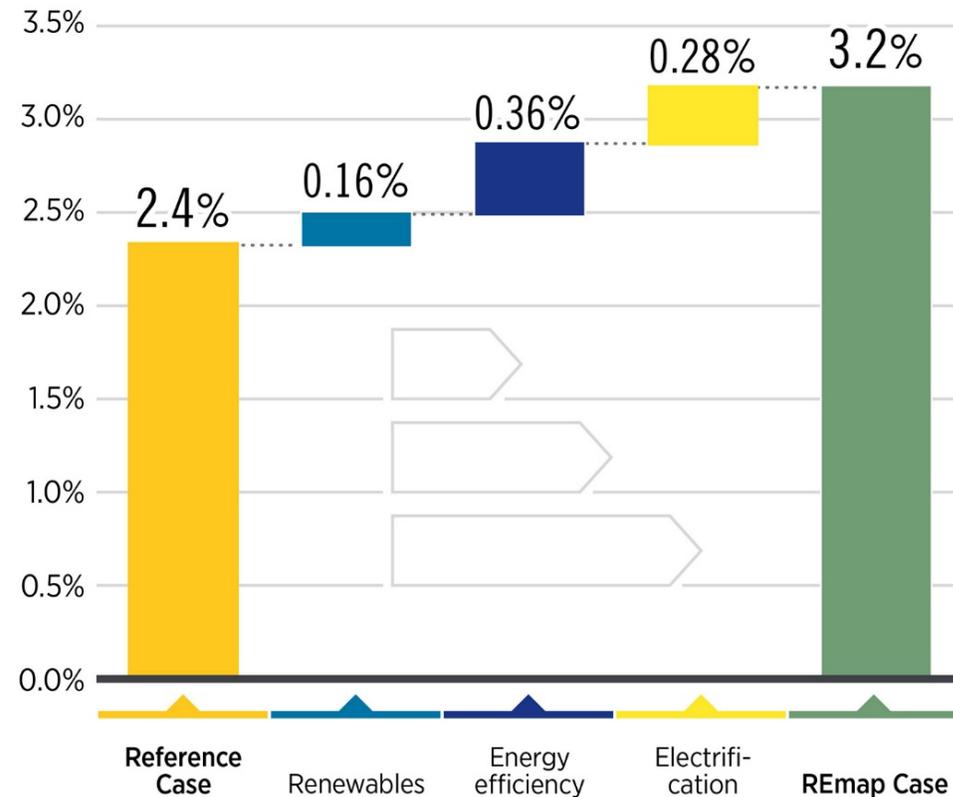
The share of renewables in the world's total final energy consumption has to increase six times faster to meet agreed climate goals.

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

Energy intensity improvement (%/yr)

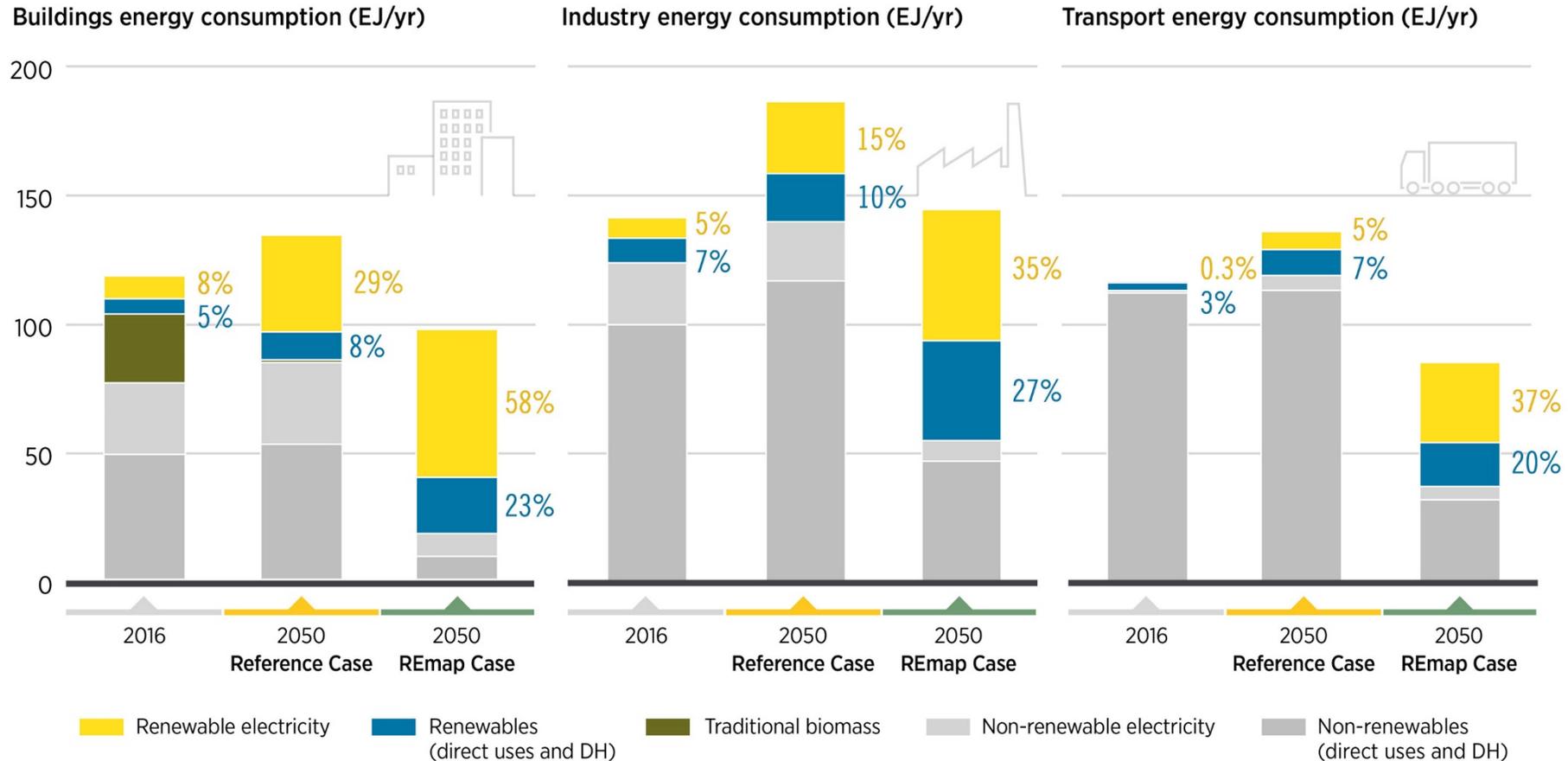


Contributions to energy intensity improvement 2016-2050 (%/yr)



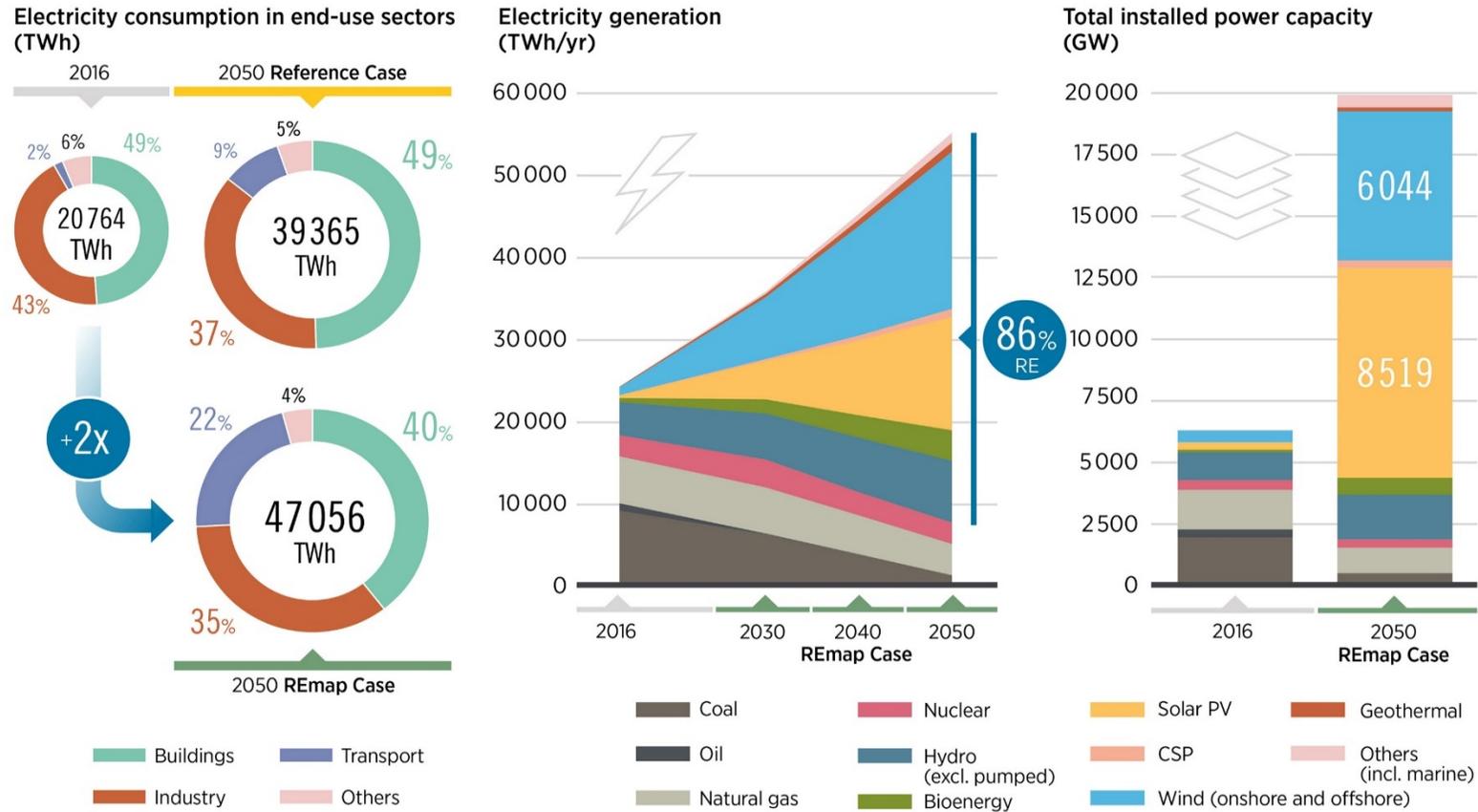
Energy intensity can be improved by: - Scaling up solar, wind and other renewables, - improving energy efficiency, - electrifying transport and heat, - structural change in transport and industry.

a transformed energy system: scaling up renewables not just for power, but also for heat and transport



- **Electricity consumption in transport would rise to 43% and in buildings 68% of sector energy by 2050.**
 - **Of that electricity, 86% of would come from renewable sources.**

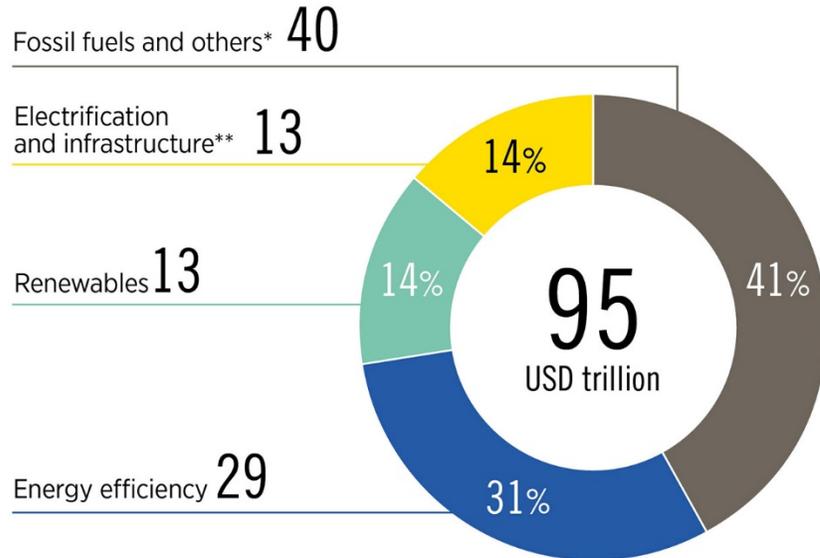
a transformed energy system: wind and solar power dominate growth in renewable-based generation



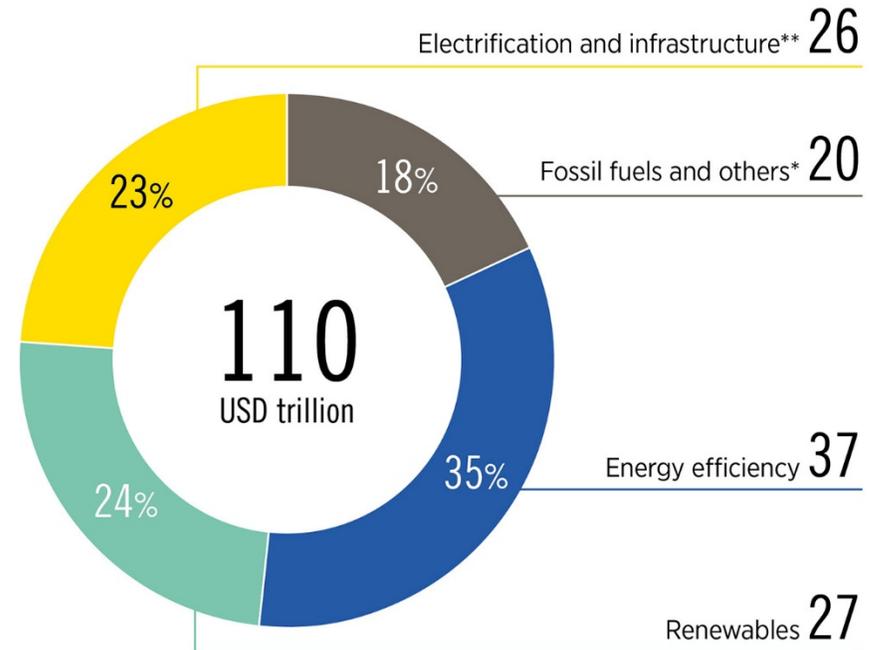
- By 2050, solar power, with 8 500 GW installed capacity, and wind, with 6 000 GW, would account for three-fifths of global electricity generation.
- Electricity consumption in end-use sectors will more than double from today's level.

a transformed energy system: major investment shift from fossil to EE & RE

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

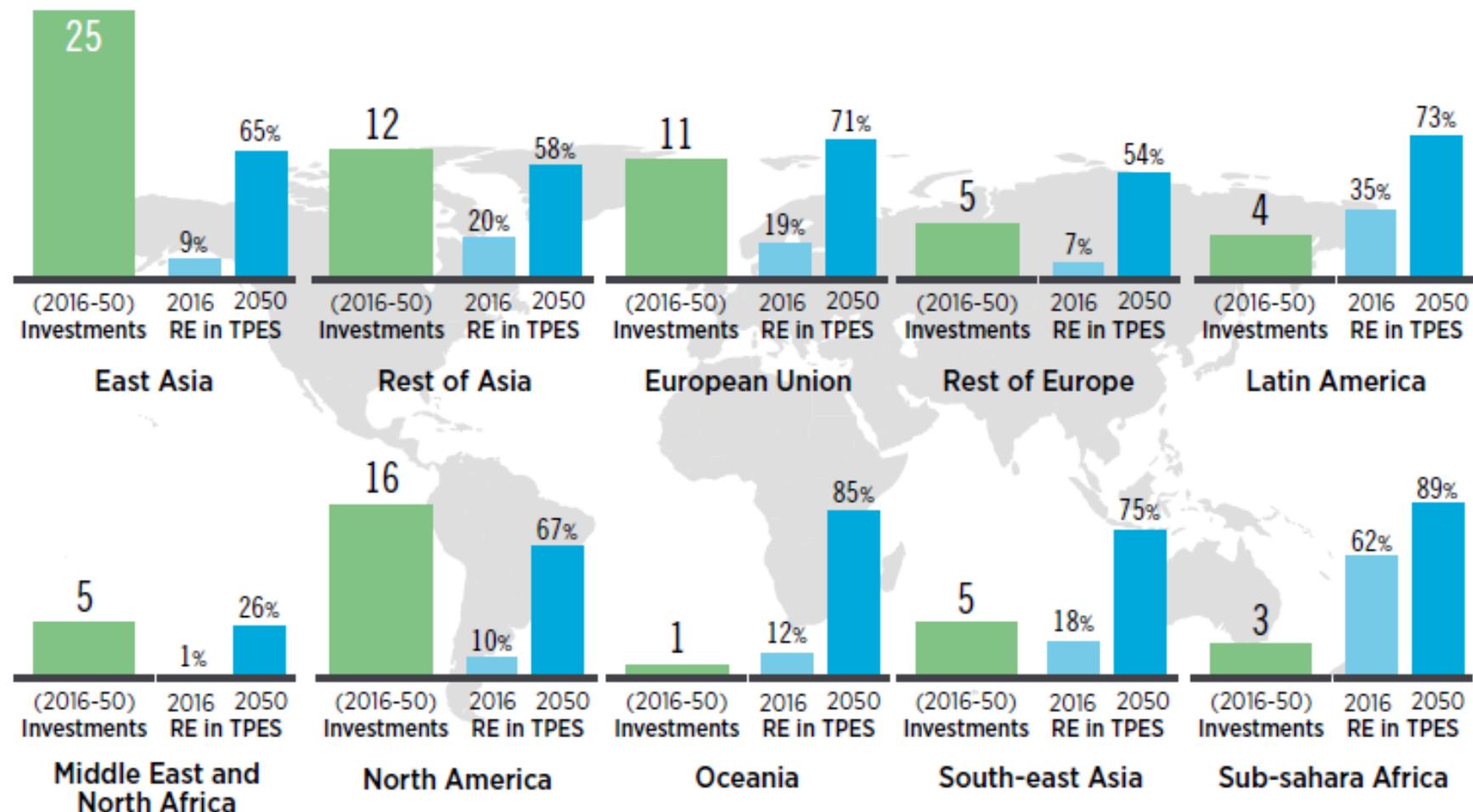


REmap Case cumulative investments, 2016-2050
(USD trillion)



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.

investments are widespread around the world but, Asia and North America lead



The renewables share in the energy mix will need to increase in all regions up to 2050. East Asia and North America will, however, require almost 50% of the total energy investment over the period in the REmap Case due to increasing energy demand.

Key actions needed now



- 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.

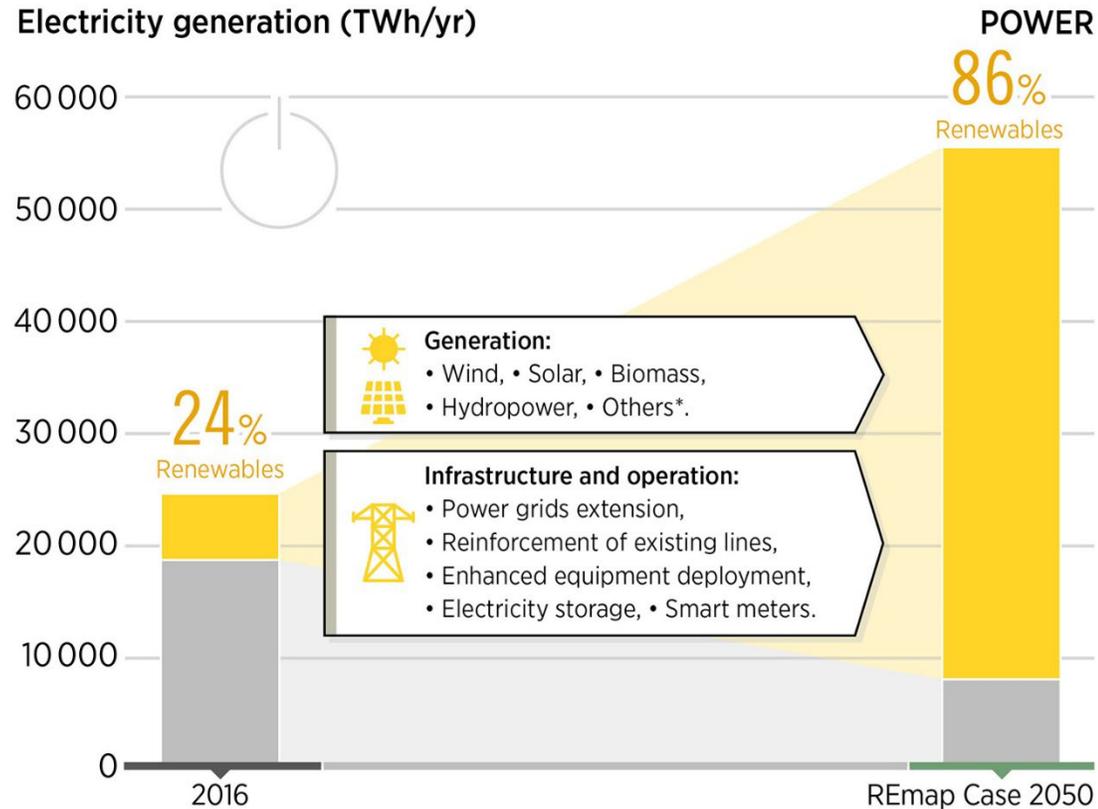


- Hydrogen produced from renewable electricity could help to reduce fossil-fuel reliance.

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



- Decarbonising the global energy system requires swift and decisive policy action.



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.

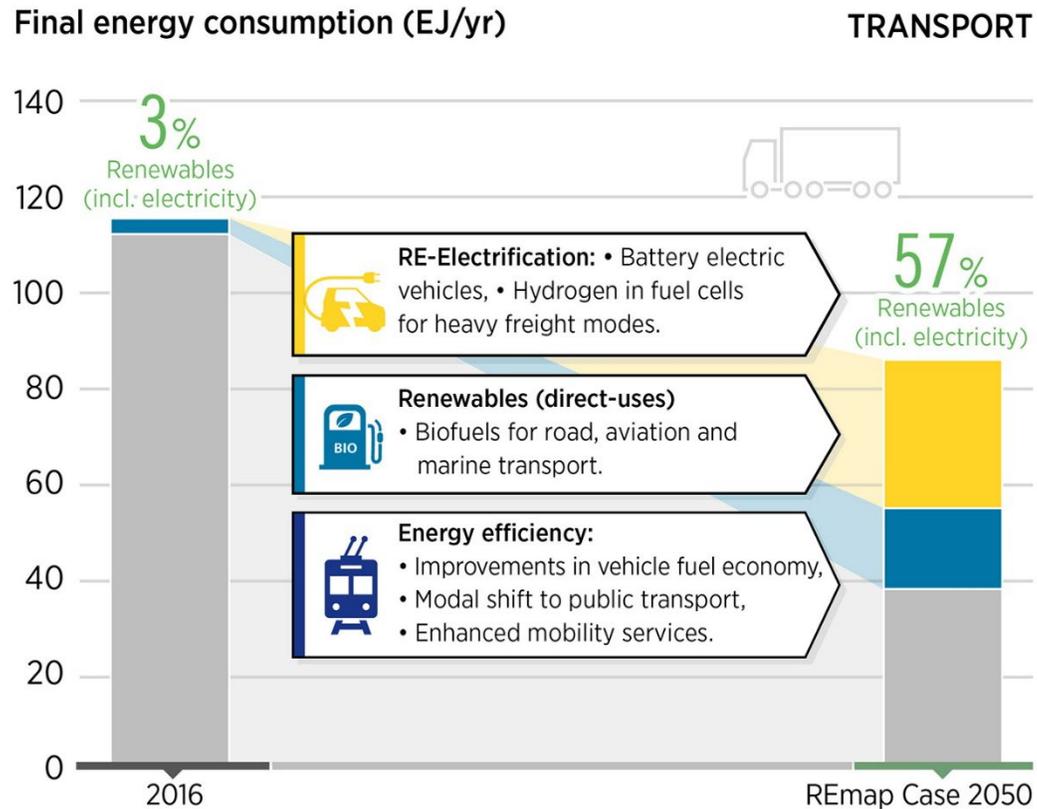
PLAN FOR THE POWER SECTOR TO ACCOMMODATE INCREASING SHARES OF VARIABLE RENEWABLE ENERGY:

- 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.

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).

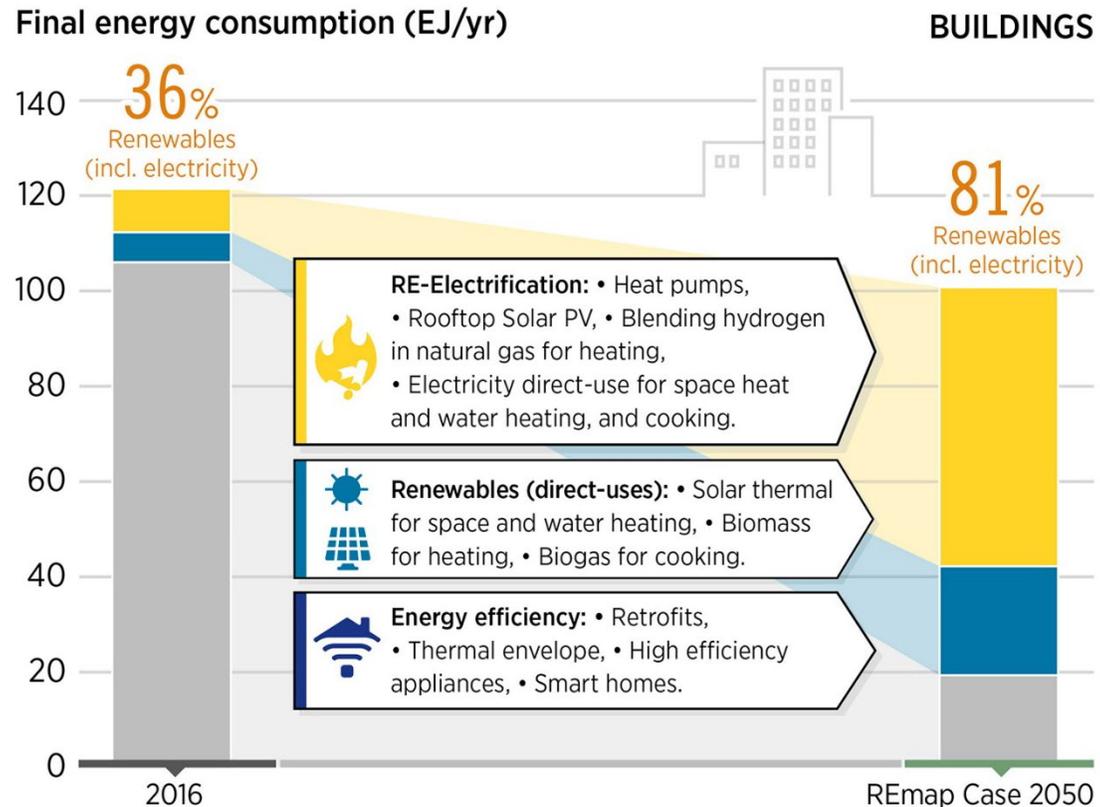
ACCELERATE THE UPTAKE OF ELECTRIC MOBILITY:

- 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.

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.

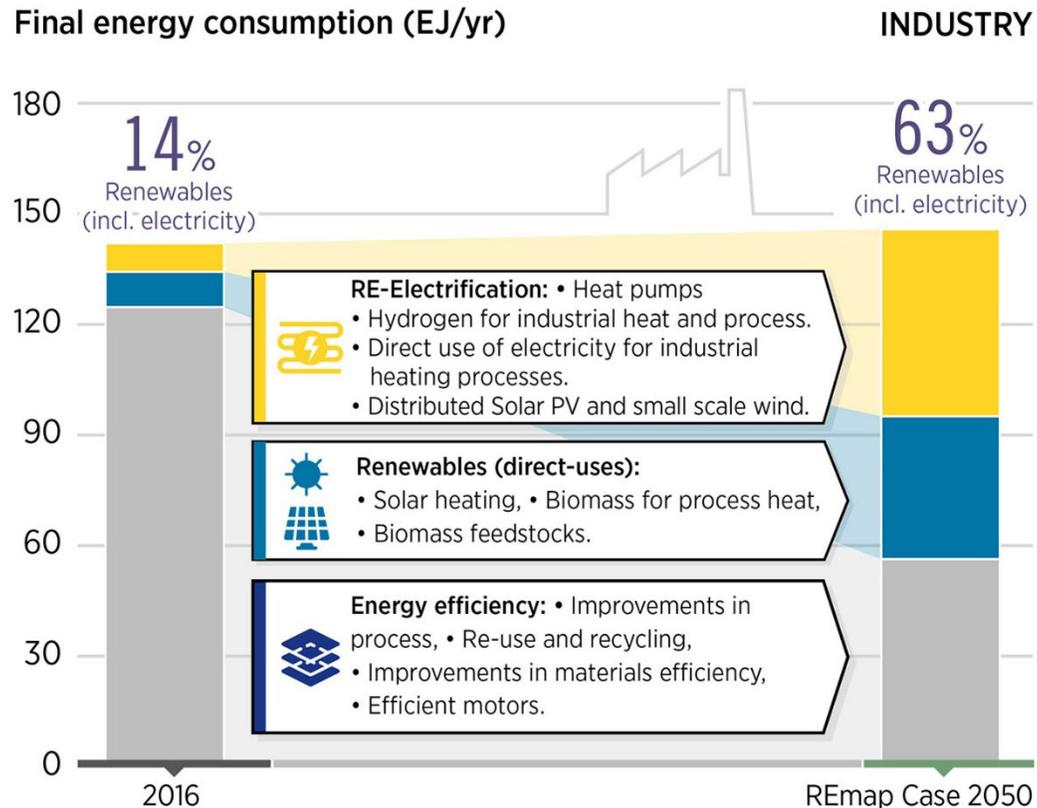
SUPPORT AND FOSTER THE DEPLOYMENT OF DISTRIBUTED ENERGY RESOURCES:

- 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).

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.

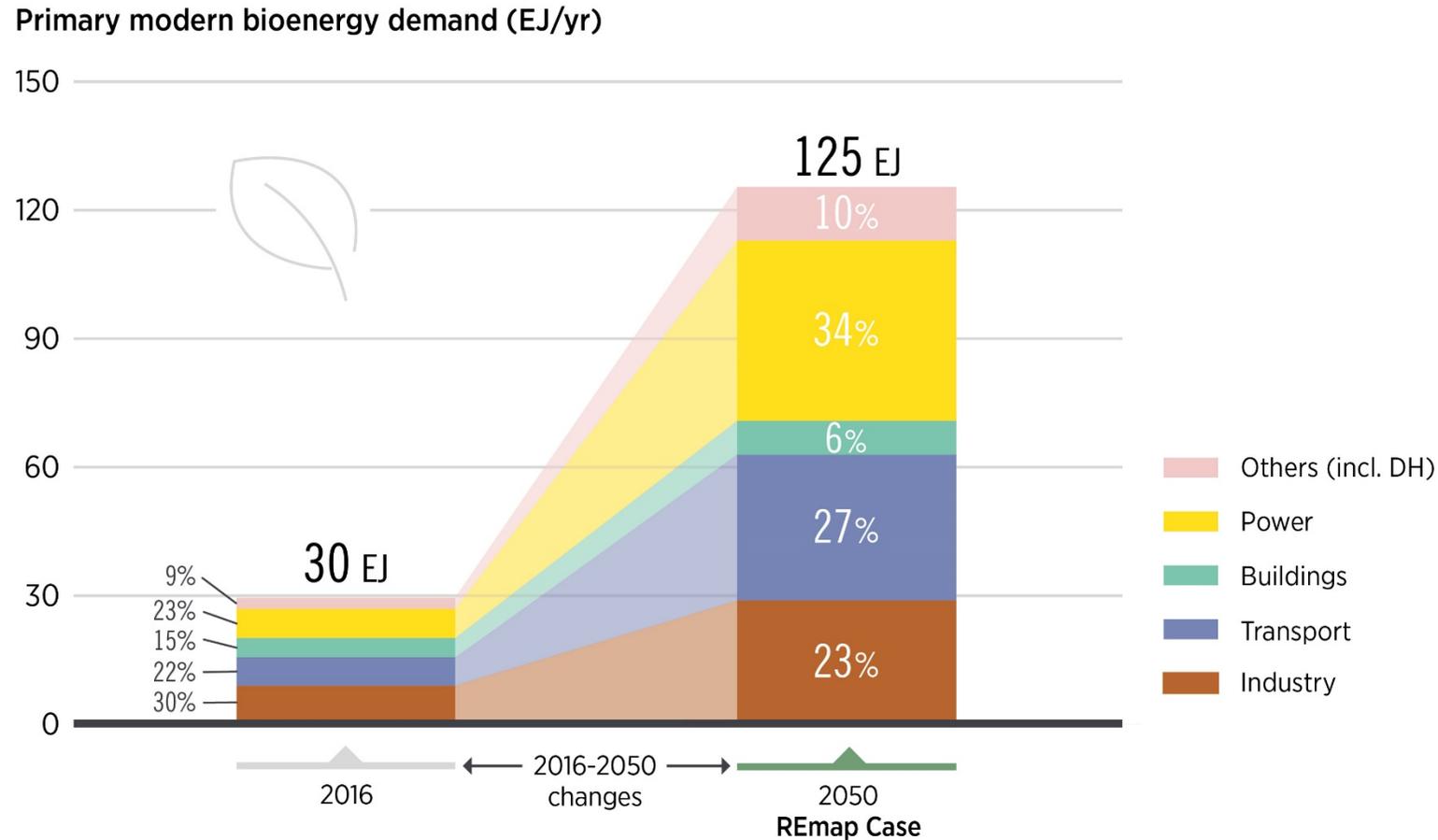
ENABLE CORPORATE SOURCING OF RENEWABLES:

- 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).

Bioenergy has a decisive role in the energy transition



Liquid biofuels consumption would reach 652 billion litres, up from 129 billion in 2016. Biofuels would have important roles in aviation and marine energy supply by 2050, as well as providing thermal energy in industry and fuel for power generation.

Summary: the 3 pillars

- **Electrification of the transport and heating sectors.**
- **Renewable energy - generation.**
- **Energy efficiency.**





International Renewable Energy Agency

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For further information or to provide feedback, please contact IRENA at info@irena.org

For further information or to provide feedback on the socio-economic analysis please contact the Policy team at policy@irena.org, on the REmap analysis please contact the REmap team at remap@irena.org.



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