

Political action towards
100% renewable energy and climate protection

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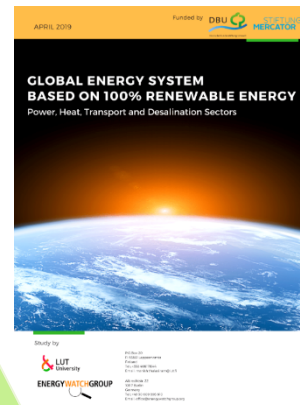


Our Study by EWG & LUT Shows:

The energy transition is not a question of technical feasibility or economic viability, but one of political will.

100% renewable energy worldwide is more cost effective than the current energy system and leads to zero emissions before 2050.

Largely domestic energy systems based on 100% renewables will create energy independence and support millions of local jobs in the energy sector.

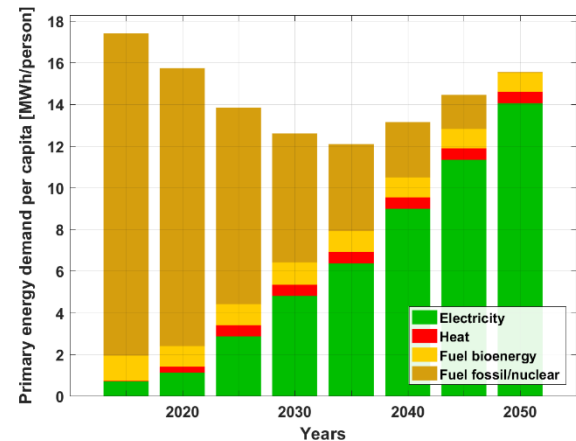
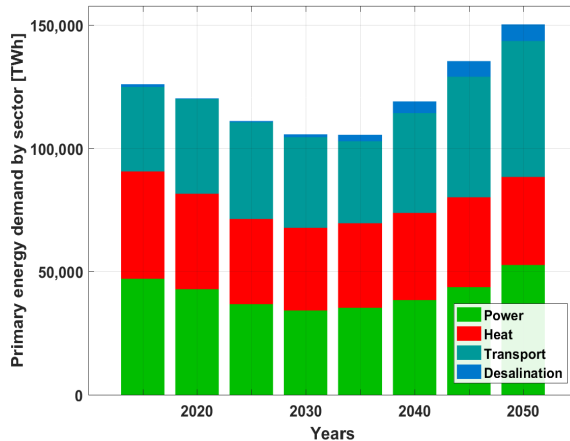


Global Overview



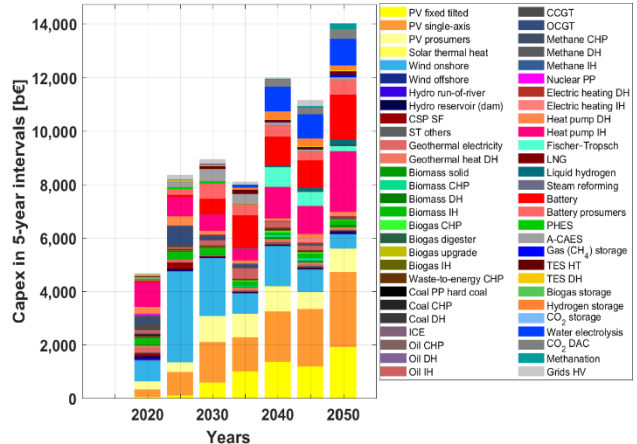
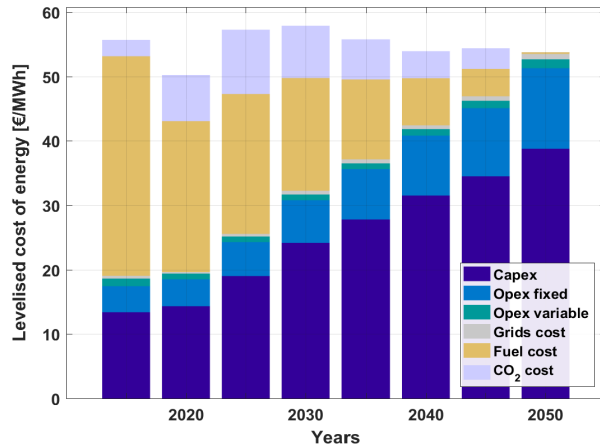
- The world is structured into 9 major regions, which are further divided to 145 sub-regions
- Some sub-regions represent more than one country, others parts of a larger country
- The sub-regions are interconnected by power lines within the same country
- The results shown are for the Power, Heat, Transport, Desalination sectors
- The energy transition scenario is carried out in full hourly resolution for all energy sectors
- In total 106 different technologies are applied

Long-term Energy Demand



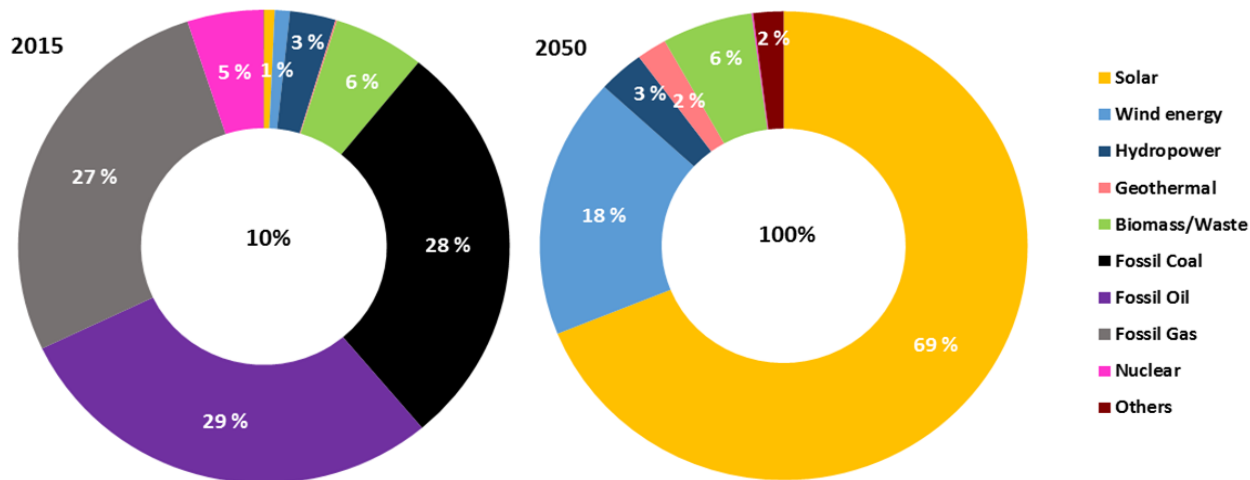
- Final energy demand grows by 1.0% per year, while energy services grow faster
- Broad electrification leads to only 0.5% per year in primary energy demand growth
- World population grows from 7.2 billion (2015) to 9.7 billion (2050)
- Substitution of inefficient combustion processes by electric solutions where possible
- Processes of 2015 for energy services in 2050 would double primary energy demand
- Fossil fuels are practically substituted by renewable electricity (mainly solar PV, wind)

Energy System Costs



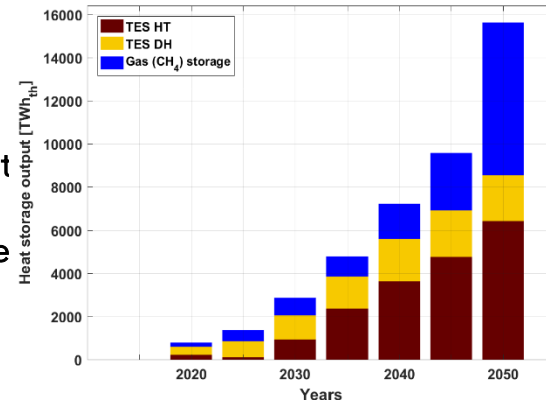
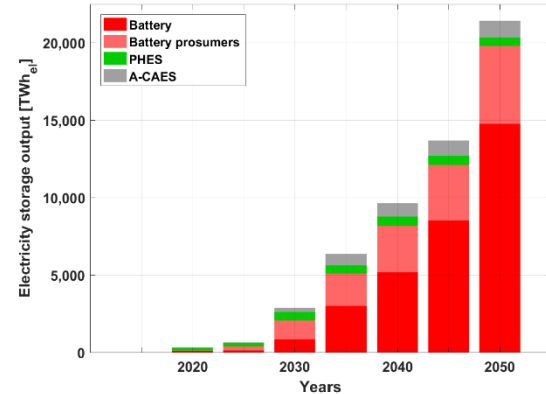
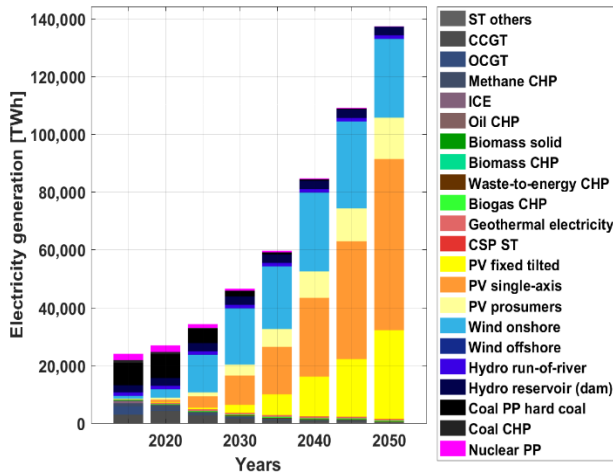
- Levelised cost of energy decline from 54 €/MWh (2015) to 53 €/MWh (2050)
- Fuel costs diminish through the transition period, while capital expenditures dominate
- Costs are well spread across a range of technologies with major investments for solar PV, wind energy, batteries, heat pumps and synthetic fuel conversion up to 2050
- The cumulative investment costs are about 67,200 b€

Solar and Wind Will Dominate the 100% Renewable World



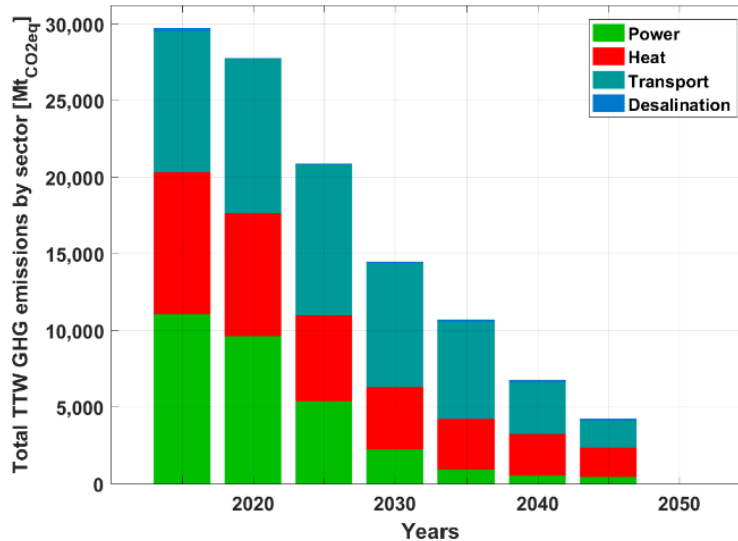
Primary energy source	Solar	Wind	Biomass/Waste	Hydro	Geo-thermal
Share in 2050	69%	18%	6%	3%	2%

Electricity Supply and Storage



- Electricity generation covers demand of all sectors
- Solar PV supply increases from 32% in 2030 to about 73% in 2050 becoming main energy source
- Wind energy very important in Northern hemisphere
- Batteries store 92% of all to be stored electricity
- Heat is mainly stored in thermal energy storage
- Gas storage contributes around 39% of the heat storage output in 2050, mainly for seasonal demand

Greenhouse Gases Emissions



- Greenhouse gases (GHG) emissions can be reduced from around 30,000 MtCO_{2eq} in 2015 to zero by 2050 across all energy sectors
- Remaining cumulative GHG emissions comprise ca. 422 GtCO_{2eq} from 2018 to 2050
- The presented 100% RE scenario is compatible with the Paris Agreement for 1.5°C

Policy Recommendations

- Feed-in-tariffs crucial until 40 MW (GET-FiT)
- Auctions for utility-scale projects
- Abolish fossil and nuclear subsidies
- Carbon, methane, radioactivity tax
- Research, education & campaigning
- Reducing licensing obstacles

Not successful:

- Certificate systems
- Emission trading

Policy Recommendations

Combined Power Plant Remuneration

The aim of the combined power plant remuneration is to strengthen the expansion and use of renewable energies, necessary for climate protection, and at the same time to promote their systemically useful grid integration.

Policy Recommendations

Feed-in Tariff for combined Renewable Power Producer

Tariff paid for per law if:

- Power generation meets demand each hour of the year
- Mix of 100% renewable power generation
- Frequency and voltage stability, reactive power is guaranteed

Effects:

- Grid stability is growing, decentralised bottom-up approach
- Integration of heating/cooling and electro-mobility
- Development of storage technology
- Emergence of smart cities

The World Trend must be clear

The share of renewable energy will grow rapidly

- Energy-consuming countries will phase out fossils due to falling renewable energy prices and climate protection.
- Countries acting too late will face enormous economic difficulties.

The share of fossil/nuclear energy will decrease

- Energy-producing countries must be aware of this trend and adapt accordingly.
- When they are too late to shift to renewables they will face a disastrous crisis in the years thereafter.