

In the following Section 3.4, the three selected scenarios are analyzed and compared with regard to their main assumptions and results. The various mitigation strategies differentiated in Table 4 will then be discussed in more detail (and in slightly divergent separation) in Chapters 4 and 5.

Chapter 4 will discuss the following three strategies that significantly contribute to GHG emission reductions and which are used to a significant extent in all three analyzed scenarios:

- Energy efficiency improvements
- Increased use of domestic renewables (with a focus on renewables in electricity generation)
- Electrification and use of renewables-based synthetic fuels (“power-to-x”)

These strategies are also used extensively in other energy scenarios for Germany, and it can be argued that they need to be implemented successfully for Germany to be able to reach substantial GHG emission reductions by 2050. Chapter 5 will briefly discuss the other strategies

that are used only in one or two of the three scenarios respectively and can be regarded as more controversial:

- Final energy demand reductions through behavioral changes
- Net imports of electricity or bioenergy
- Use of CCS technology to reduce industry sector GHG emissions

In addition, Chapter 5 will also discuss non-energy related (often non-CO<sub>2</sub>) emission reductions in the agricultural sector as an important non-energy system strategy to cut GHG emissions.

### 3.4 Analysis and comparison of the three illustrative scenarios

This section analyzes and compares the three illustrative scenarios, focusing first on the key assumptions driving energy demand (Section 3.4.1). The energy system developments described by the respective scenarios are discussed with regard to final energy demand (Section 3.4.2), electric-

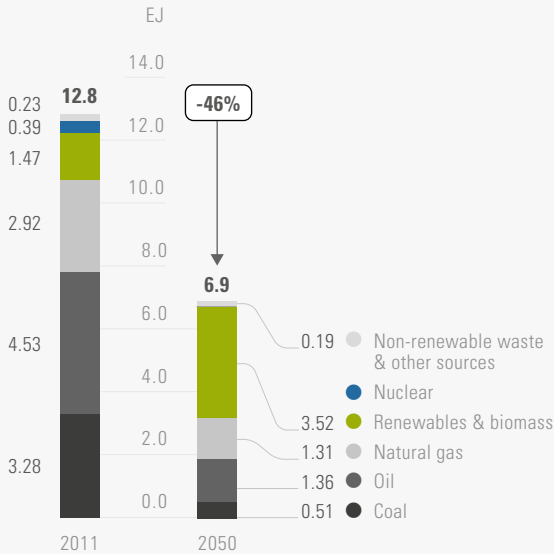
Table 4: Overview of the extent to which key decarbonization strategies are used in the illustrative scenarios \*

	Government Target Scenario	Renewable Electrification Scenario	90% GHG Reduction Scenario
<b>Energy demand reductions</b>			
Final energy demand reductions through energy efficiency	Very strong efficiency improvements	Strong efficiency improvements	Very strong efficiency improvements
Final energy demand reductions through behavioral changes	Not considered	Not considered	Considered to a moderate extent
<b>Using less CO<sub>2</sub>-intensive energy sources/carriers</b>			
Increased use of domestic renewable energy sources	Strong increase	Very strong increase	Strong increase
Substitution of fossil fuels through electricity	Moderate substitution	Strong substitution	Strong substitution
Use of renewable energy based synthetic fuels (e.g. H <sub>2</sub> ) as a final energy carrier	Not used to a relevant extent	Strongly used	Moderately used
<b>Importing carbon-free energy</b>			
Net imports of electricity	Low net imports	Considerable net imports	Moderate net imports
Net imports of bioenergy	Moderate net imports	No net imports	Considerable net imports
<b>Using CCS</b>			
Use of CCS technology to reduce industrial GHG emissions	Not considered	Not considered	Considered

\* Section 3.4 as well as Chapters 4 and 5 will provide more detailed information about the differences between the scenarios that have led to the assessment provided by this table.

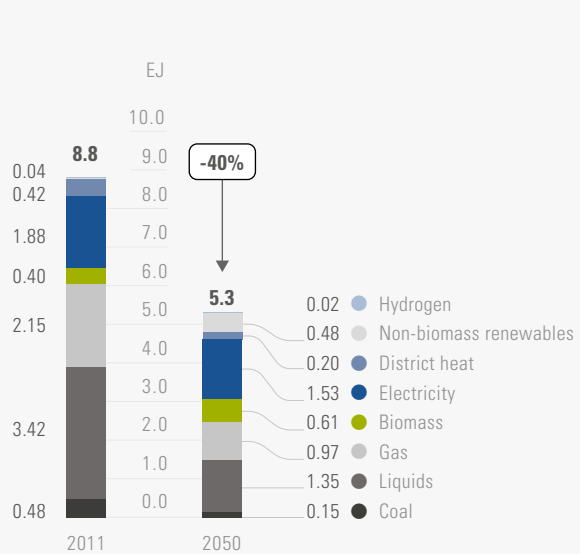
# DE - Government Target

Energy Pathways, Primary Energy by Source



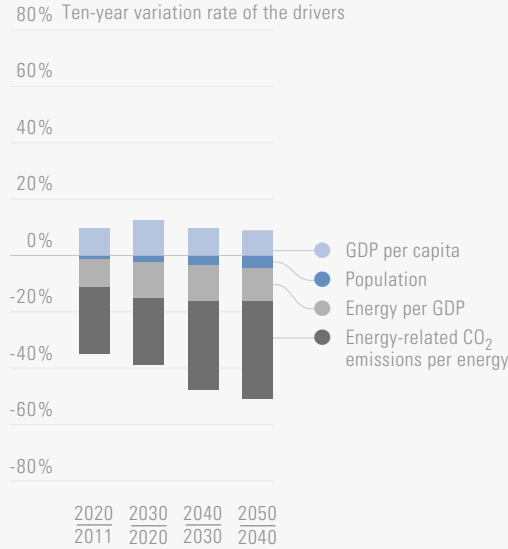
This figure relates to electrical energy output that is generated in the nuclear power plant, and does not include heat energy/steam generated.

Energy Pathways, Final Energy by Source

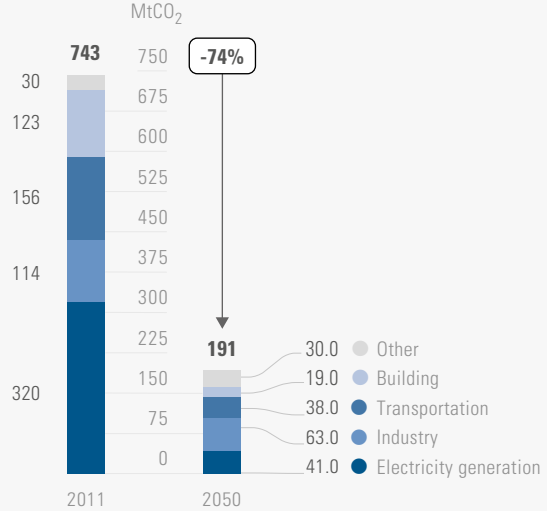


Biofuels are included among "liquids".

Energy-related CO<sub>2</sub> Emissions Drivers, 2010 to 2050



Energy-related CO<sub>2</sub> Emissions Pathway, by Sector



Some of the data used for this figure was kindly provided by the authors of the original scenario study.

## The Pillars of Decarbonization

Final energy efficiency



Energy intensity of GDP, MJ/\$2010

Decarbonization of electricity (approximate values)\*



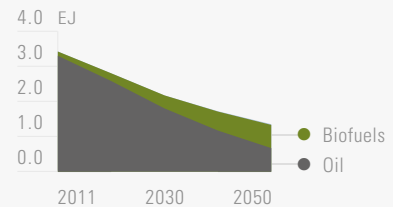
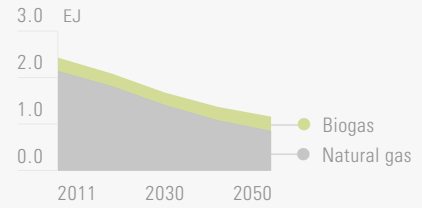
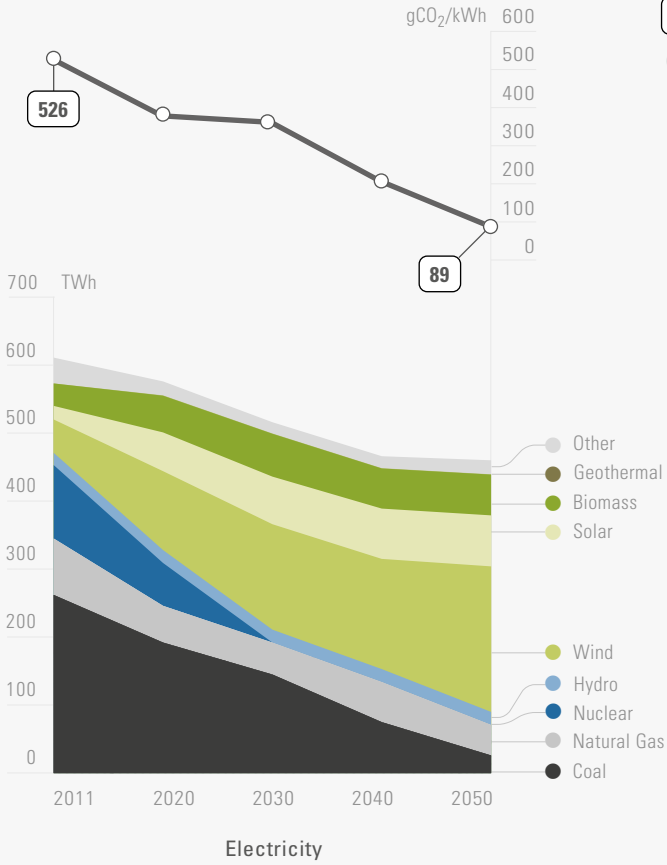
Electricity emissions intensity, gCO<sub>2</sub>/kWh

Electrification of end-uses (approximate values)\*

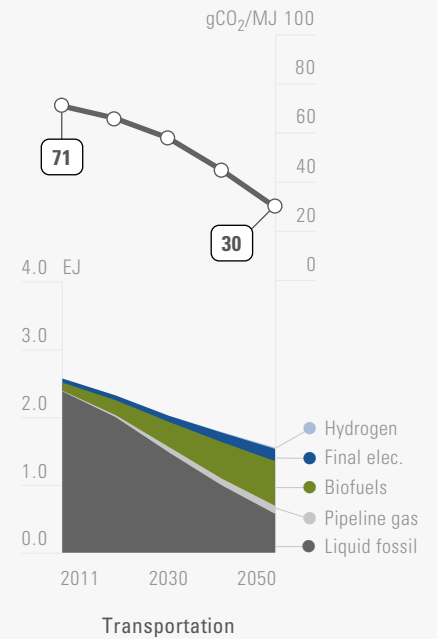
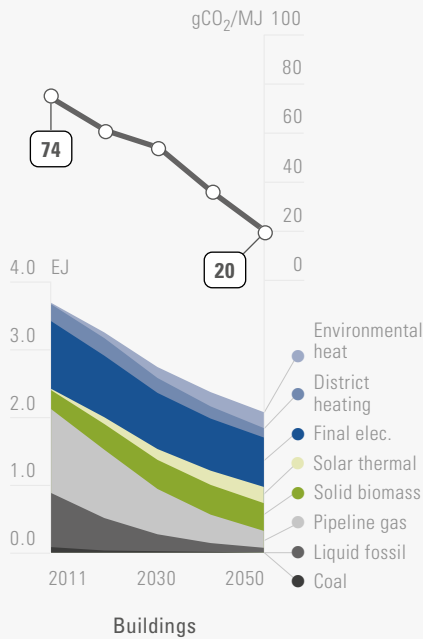
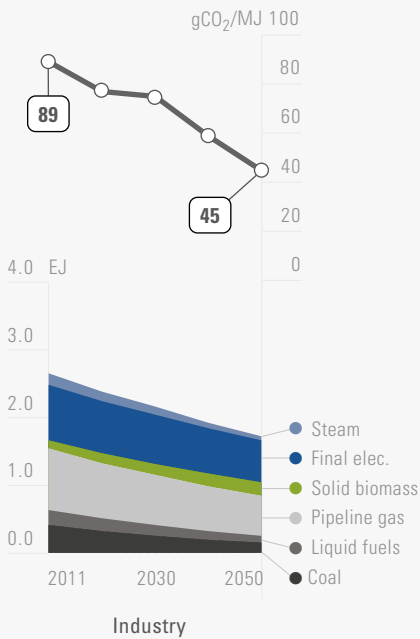


Share of electricity in total final energy, %

### Energy Supply Pathways, by Resource

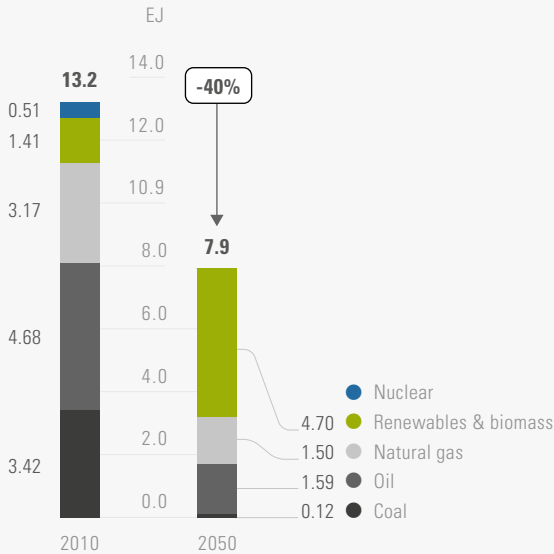


### Energy Use Pathways for Each Sector, by Fuel, 2010 – 2050



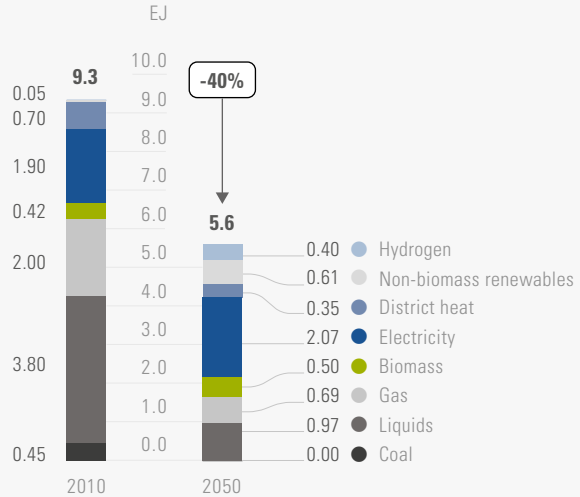
# DE - Renewable Electrification

Energy Pathways, Primary Energy by Source



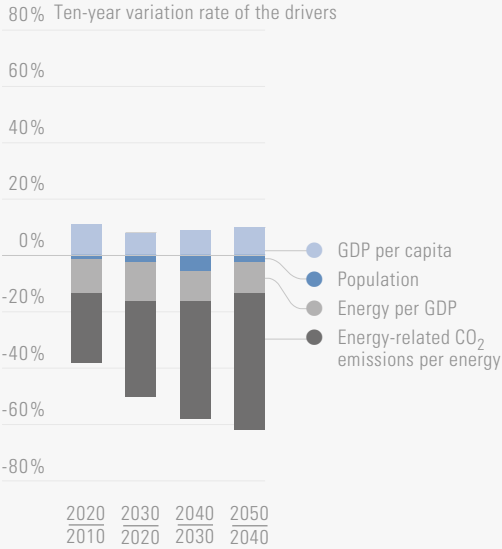
This figure relates to electrical energy output that is generated in the nuclear power plant, and does not include heat energy/steam generated.

Energy Pathways, Final Energy by Source



Biofuels are included among "liquids".

Energy-related CO<sub>2</sub> Emissions Drivers, 2010 to 2050



## The Pillars of Decarbonization

Final energy efficiency



Energy intensity of GDP, MJ/\$2010

Decarbonization of electricity



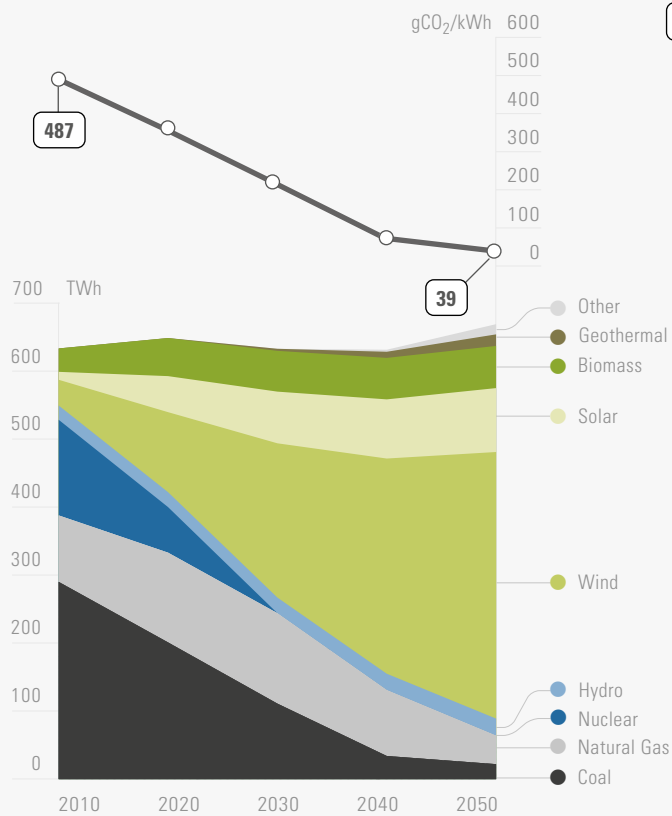
Electricity emissions intensity, gCO<sub>2</sub>/kWh

Electrification of end-uses

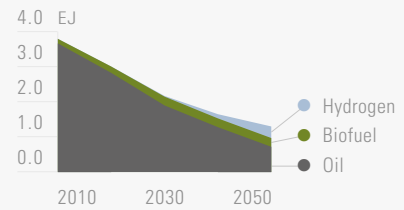


Share of electricity in total final energy, %

### Energy Supply Pathways, by Resource



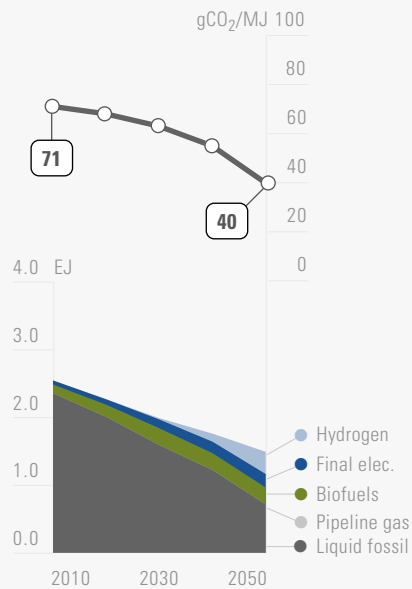
Carbon intensity



### Liquid Fuels in final energy demand

Some of the data used for this figure was kindly provided by the authors of the original scenario study.

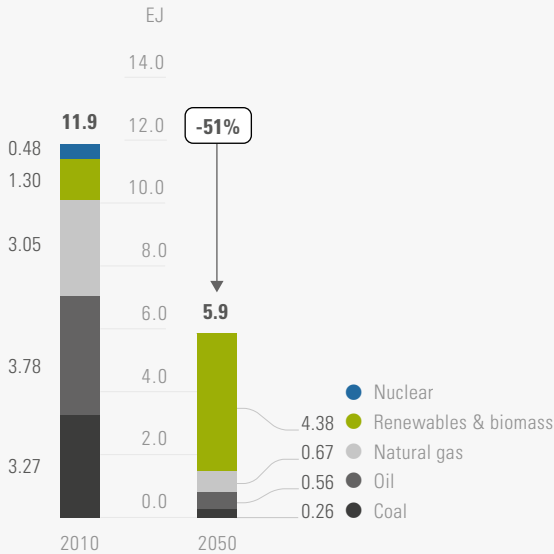
### Energy Use Pathways for Each Sector, by Fuel, 2010 – 2050



Transportation Some of the data used for this figure was kindly provided by the authors

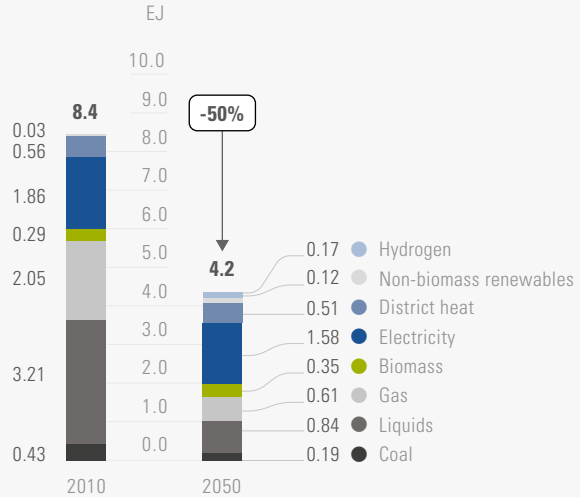
# DE - 90% GHG Reduction

Energy Pathways, Primary Energy by Source



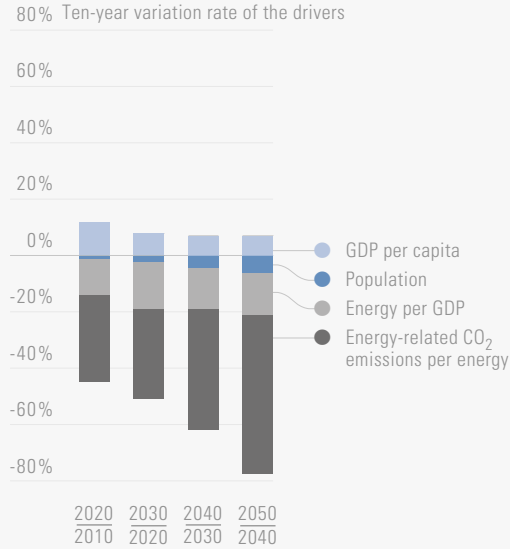
This figure relates to electrical energy output that is generated in the nuclear power plant, and does not include heat energy/steam generated.

Energy Pathways, Final Energy by Source

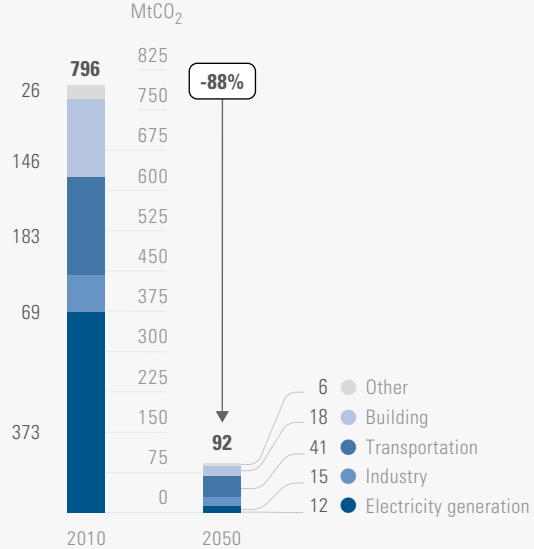


Biofuels are included among "liquids".

Energy-related CO<sub>2</sub> Emissions Drivers, 2010 to 2050



Energy-related CO<sub>2</sub> Emissions Pathway, by Sector



## The Pillars of Decarbonization

Final energy efficiency



Energy intensity of GDP, MJ/\$2010

Decarbonization of electricity



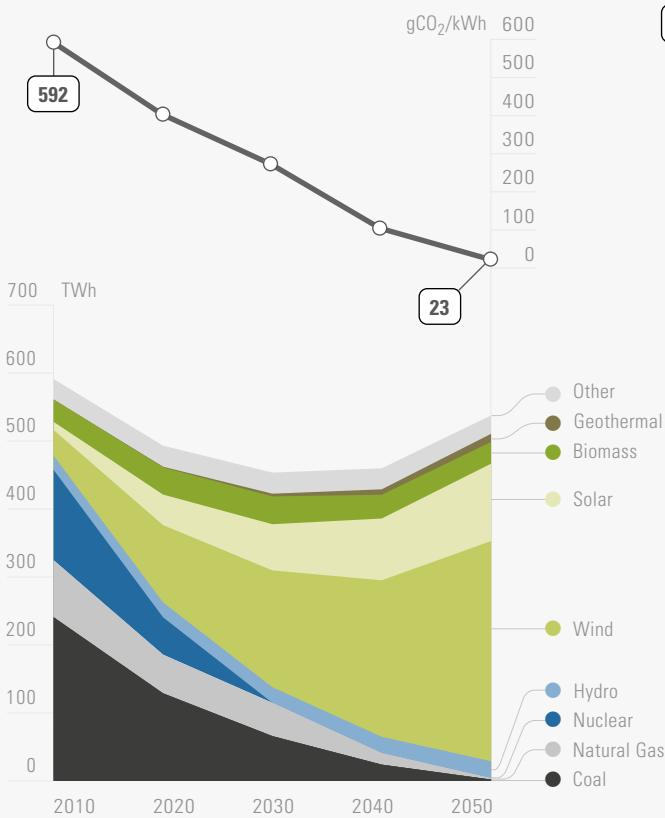
Electricity emissions intensity, gCO<sub>2</sub>/kWh

Electrification of end-uses

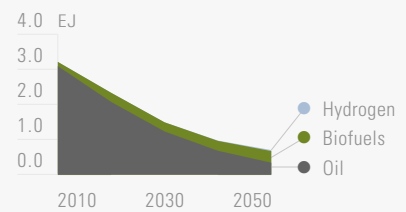


Share of electricity in total final energy, %

Energy Supply Pathways, by Resource



Electricity (Data refers to domestic electricity generation)



Liquid Fuels in final energy demand

Energy Use Pathways for Each Sector, by Fuel, 2010 – 2050

