Million tonnes of CO$_2$e

1990:
- All non-CO$_2$ and agriculture and waste management: 16
- Buildings CO$_2$: 21
- Transport CO$_2$: 12
- Industry CO$_2$: 5
- Power and heat CO$_2$: 16

2015:
- All non-CO$_2$ and agriculture and waste management: 14
- Buildings CO$_2$: 15
- Transport CO$_2$: 11
- Industry CO$_2$: 2
- Power and heat CO$_2$: 13

2030:
- All non-CO$_2$ and agriculture and waste management: 13
- Buildings CO$_2$: 16
- Transport CO$_2$: 9
- Industry CO$_2$: 11
- Power and heat CO$_2$: 2

2030 EU compliant target: 40% decrease vs 1990
2030 target in line with Paris Agreement: 60% decrease vs 1990
**TCO:**
Total cost of a vehicle over its lifetime

**3 YEAR TCO:**
Typical perceived cost of a consumer

**UP-FRONT COST:**
Purchase price + for EV a home charger and 2 battery replacements

---

Cost projections, 1,000 EUR/vehicle

- Gasoline vehicle
- Diesel vehicle
- Battery electric vehicle
- Electric vehicle becomes the cheapest option

Graph showing cost projections for gasoline, diesel, and battery electric vehicles from 2015 to 2030. The cost for battery electric vehicles becomes cheaper than gasoline and diesel vehicles around 2025.
Average cost per tonne: 40 EUR/tCO₂

Sector CO₂ emissions and pathway abatement:
- 2015: 15.1 Mt
- 2030: 7.4 Mt

Abatement: -7.7 Mt
### Resulting emissions in 2030, MtCO\textsubscript{2}e

<table>
<thead>
<tr>
<th></th>
<th>Power and heat</th>
<th>Industry</th>
<th>Transport</th>
<th>Buildings</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>60% pathway:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Industry push</td>
<td>5.7</td>
<td>7.4</td>
<td>4.7</td>
<td>0.1</td>
<td>11</td>
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<tr>
<td><strong>Industry efficiency,</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>push in transport and heat</td>
<td>3.2</td>
<td>12.8</td>
<td>1.8</td>
<td>0.1</td>
<td>11</td>
</tr>
<tr>
<td><strong>Abatement in agriculture,</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>waste and industry non-CO\textsubscript{2}, push in heat</td>
<td>3.7</td>
<td>14.9</td>
<td>4.7</td>
<td>0.1</td>
<td>5.5</td>
</tr>
<tr>
<td><strong>Wide range of options</strong></td>
<td>5.7</td>
<td>9.5</td>
<td>4.1</td>
<td>0.1</td>
<td>9.5</td>
</tr>
</tbody>
</table>

- Currently in 60% pathway
- Alternative packages
<table>
<thead>
<tr>
<th>Sector</th>
<th>2015 Emissions, MtCO₂e</th>
<th>2030 Current policies – BAU, MtCO₂e</th>
<th>2030 40% pathway, MtCO₂e</th>
<th>2030 60% pathway, MtCO₂e</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industry CO₂</td>
<td>15</td>
<td>16</td>
<td>15</td>
<td>7</td>
</tr>
<tr>
<td>Power and heat CO₂</td>
<td>14</td>
<td>9</td>
<td>7</td>
<td>6</td>
</tr>
<tr>
<td>Transport CO₂</td>
<td>11</td>
<td>9</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>Buildings CO₂</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>0.1</td>
</tr>
<tr>
<td>Other: agriculture, waste management, non-CO₂</td>
<td>13</td>
<td>11</td>
<td>11</td>
<td>11</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>56</strong></td>
<td><strong>47</strong></td>
<td><strong>40</strong></td>
<td><strong>29</strong></td>
</tr>
</tbody>
</table>

- Modelled on technology level and as BAU
- Projected according to WEM
Annual power demand, TWh

- Move to more efficient appliances and lighting
- Start EV uptake
- Start electric heating uptake
- Start electrification of industry

2015 2020 2025 2030

- BAU
- 60% pathway
- +5%
- +23%

2015

80 82 84 86 88 90 92 94 96 98 100 102

2020

2025

2030
<table>
<thead>
<tr>
<th>Sector</th>
<th>Emissions 2015, MtCO$_2$e</th>
<th>Modelled at technology level</th>
<th>Modelled to follow BAU</th>
<th>Projected according to WEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power and heat CO$_2$</td>
<td>14.3</td>
<td>2</td>
<td>12.2</td>
<td>Heat only plants</td>
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<tr>
<td>Industry CO$_2$</td>
<td>15.1</td>
<td>3.6</td>
<td>11.5</td>
<td>Other industry (incl. agriculture and forestry working machines)</td>
</tr>
<tr>
<td>Transport CO$_2$</td>
<td>11.0</td>
<td>0.7</td>
<td>10.3</td>
<td>Rail and marine transport and aviation</td>
</tr>
<tr>
<td>Buildings CO$_2$</td>
<td>2.2</td>
<td>2.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>12.9</td>
<td></td>
<td></td>
<td>Non-CO$_2$ GHG, Waste management, Agriculture</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>55.5</strong></td>
<td><strong>6.3</strong></td>
<td><strong>36.2</strong></td>
<td></td>
</tr>
</tbody>
</table>
EU ETS CO$_2$ price, EUR/tCO$_2$

Price in 10/2018: 19
Historical and projected scenario emissions, MtCO$_2$e

<table>
<thead>
<tr>
<th>Year</th>
<th>BAU</th>
<th>40% target</th>
<th>60% target</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td>71</td>
<td>-34%</td>
<td>-60%</td>
</tr>
<tr>
<td>2015</td>
<td>56</td>
<td>47</td>
<td>29</td>
</tr>
<tr>
<td>2030 BAU</td>
<td>36</td>
<td>13</td>
<td>6</td>
</tr>
<tr>
<td>2030 40% target</td>
<td>29</td>
<td>11</td>
<td>7</td>
</tr>
<tr>
<td>2030 60% target</td>
<td>25</td>
<td>11</td>
<td>7</td>
</tr>
</tbody>
</table>

- Modelled at technology level
- Modelled to follow BAU
- WEM projection
Sector CO₂ emissions and pathway abatement

- 2015: 2.2 Mt
- 2030: 0.1 Mt

Average cost per tonne

-27 EUR/tCO₂
Sector CO₂ emissions and pathway abatement

2015: 11.0 Mt
2030: 4.7 Mt

Average cost per tonne

-83 EUR/tCO₂
Sector CO₂ emissions and pathway abatement

2015: 14.3 Mt
2030: 5.7 Mt

Average cost per tonne
-32 EUR/tCO₂
Residential oil boilers to electric heating and heat pumps

Commercial oil boilers to electric heating and heat pumps

Battery electric passenger vehicles

Battery electric trucks and vans

Battery electric buses

Enablers: Expand transport gas infrastructure

Gas trucks

Battery electric passenger vehicles: A/B, C/D, E/F, J

Battery electric trucks and vans: LDT, MDT, HDT

Battery electric buses: City buses, Coaches

Buildings

Residential oil boilers to electric heating and heat pumps

Commercial oil boilers to electric heating and heat pumps

Enablers: Start reinforcing grid connections to industrial sites

Gas trucks

Battery electric passenger vehicles: A/B, C/D, E/F, J

Battery electric trucks and vans: LDT, MDT, HDT

Battery electric buses: City buses, Coaches

Transport

Enablers: Move to more efficient appliances and lighting to lower power demand

Pulp and paper electrification

Steel plant conversion to electric arc furnaces leveraging hydrogen technology

Cement making with biomass and CCS

Power and heat

Onshore wind

Offshore wind

Switch to biomass CHP

Coal CHP

Peat CHP

Enablers: Start of large-scale roll-out / cost parity

2015 2018 2020 2025 2030
Average abatement potential in 2030 MtCO₂/year

- Residential oil boilers to direct electric heating + air-to-air heat pumps
- Commercial oil boilers to direct electric heating
- Commercial oil boilers to commercial micro-CHP
- Commercial oil boilers to commercial biomass boilers
- Commercial oil boilers to ground-to-water heat pumps

Average abatement cost to 2030 EUR/tCO₂

- Residential: -50 to 1 EUR/tCO₂
- Commercial: -100 to 2 EUR/tCO₂
Refurbishments in mechanical pulping to best-in-class, electrifying processes
Refurbishments in newsprint to best-in-class, electrifying processes
Refurbishments in printing and writing paper to best-in-class, electrifying processes
Refurbishments in tissue and towel to best-in-class, electrifying processes
Ethylene production feedstock conversion from naphtha to hydrogen
Convert steel plant with conventional blast furnaces to hydrogen based electric arc furnace
Coal to biomass as fuel + CCS in cement production
Natural gas to biogas in refining

Energy efficiency measures across all industries

Average abatement cost to 2030
EUR/tCO$_2$

Average abatement potential in 2030
MtCO$_2$/year

Pulp and paper
Refining and chemicals
Steel
Cement
All
Average abatement cost to 2030 EUR/tCO₂

Average abatement potential in 2030 MtCO₂/year

LNG trucks
Onshore wind replacing fossil fuels
Offshore wind replacing fossil fuels
CHP coal to biomass
ICE efficiency (no cost assigned)

Electric passenger cars
Commercial oil boilers to heat pumps
Residential oil boilers to heat pumps and electric heating

Trucks
Passenger cars
Buses/coaches
All vehicles

Power and heat
Buildings
Industry
Onshore wind
Offshore wind
Biomass CHP

Switch coal to offshore wind
Switch coal to biomass in CHP
Switch gas to biomass in CHP
Switch peat to biomass in CHP
Switch peat to onshore wind
Switch oil to onshore wind
Switch gas to onshore wind

Average abatement cost to 2030 EUR/tCO₂

Average abatement potential in 2030 MtCO₂/year