Federal Ministry for Economic Affairs and Climate Action

Energiewende direkt

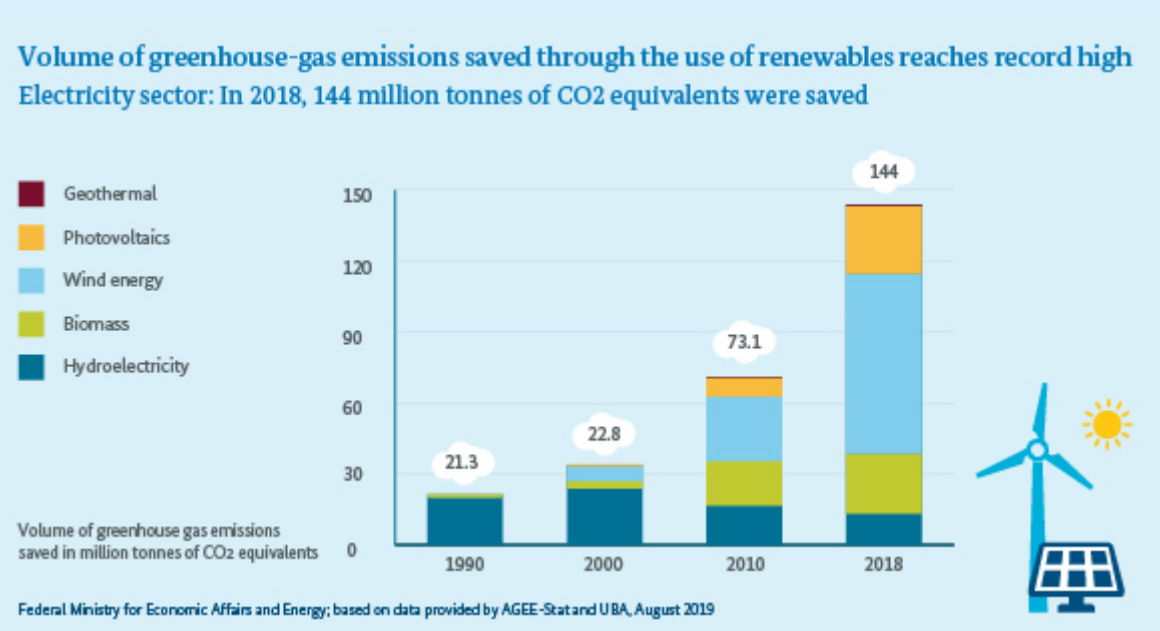
30 Oct 2019

Integration of renewable energy into the grid: a key issue around the globe

The Federal Ministry for Economic Affairs and Energy and the International Energy Agency co-hosted a Global Ministerial Conference on System Integration of Renewables

In the electricity sector: Renewables use leading to big cuts in greenhouse-gas emissions

Using renewable energy plays a key role in reducing greenhouse-gas emissions. In 2018, renewables use enabled greenhouse gas emissions to be cut by twice as much compared to 2010.



The use of fossil energy carriers is increasingly giving way to renewable energy sources. This means that the level of greenhouse gas emissions from combusting coal, gas and oil is falling. In 2018, the working group AGEE-Stat (responsible for generating statistics on the use of renewables) and the Federal Environment Agency (UBA) calculated that emissions with a total greenhouse gas potential of more than 187 million tonnes of CO_2 equivalents were saved from being released in the electricity, heating, cooling and transport sectors. CO_2 equivalents are a measure used to compare the emissions of different greenhouse gases based upon their global warming potential.

Greatest share of emissions saved in electricity sector, followed by heat and transport

The electricity sector accounted for the largest share of greenhouse gas emissions saved from release in 2018 – with a total of around 144 million tonnes of CO_2 equivalents being cut. This corresponds approximately to the CO_2 equivalents emitted by industry in 1996. (In 2018, Germany's industrial sector emitted 131.7 million tonnes). In the heating sector, around 35.5 million tonnes of CO_2 equivalents fewer were released into the atmosphere in 2018. For the transport sector, statisticians recorded a cut of around 7.7 million tonnes.

Savings in the electricity sector have doubled in eight years

Since 1990, the total volume of greenhouse gas emissions saved has also risen more or less steadily. Whereas in 1990 renewables use accounted for a cut of only 21.3 million tonnes of CO_2 equivalents, survey results for the year 2000 already showed savings of 33.8 million tonnes. In 2010, savings of CO_2 equivalents in the electricity sector amounted then to 71.1 million tonnes and, by 2018, had more than doubled.

Power generation from wind energy cuts greatest volume of greenhouse gas emissions

In 2018, the greatest share of greenhouse gas emissions was saved by electricity generation from wind turbines (76.3 million tonnes of CO_2 equivalents, of which almost 62.7 million tonnes fell to onshore and 13.6 million tonnes to offshore), followed by photovoltaics (28.7 million tonnes), biomass (25.6 million tonnes), hydropower (13.2 million tonnes) and geothermal energy (0.093 million tonnes). By comparison, in 2010, emissions savings accruing to wind turbines still sat at 27.5 million tonnes, compared with only 6.4 million tonnes in 2000 and around 3.2 million tonnes in 1999.

In the electricity sector, the result of the calculations is significantly influenced by which fossil or nuclear fuels are replaced by renewable energy. For a detailed explanation of the basic methodology used to calculate the emission balances for renewable energy sources, please see the UBA publication Emissionsbilanz erneuerbarer Energieträger (available in German only).

FURTHER INFORMATION

[→ Federal Ministry for Economic Affairs and Energy's information portal on renewable energy: Zeitreihen zur Entwicklung der erneuerbaren Energien in Deutschland (timelines showing the development of renewable energy sources in Germany, available in German only)

How does CO_2 pricing actually work?

In 2021, carbon pricing will be introduced in the transport and heat sectors. The new system is the centrepiece of the Federal Government's Climate Protection Programme. To find out the how the carbon pricing system has worked up to now, and how transport and heat are to be incorporated, please read on.

© BMWi

Widening of emissions trading: carbon emissions to be priced in the transport and heating sectors.

Under the European Emissions Trading Scheme, in place since 2005, energy and industrial companies have had to purchase allowances for the emissions they produce from energy generation, and can trade these with one another at market-based prices. Heat is the only sector in which a proportion of the allowances allocated are free.

The number of new emissions allowances made available each year is constantly declining. As the prices paid for traded allowances increase, so too does the economic pressure on carbon-intensive power plants. This makes the electricity produced by these plants more expensive than electricity from less carbon-intensive power generation (e.g. from renewable sources or combined heat and

power plants). The allowance price thus turns long-term European emission reduction targets into a price signal for companies. In this way, emissions can play a role in business decisions.

The European Emissions Trading Scheme is the European Union's key instrument for reducing harmful greenhouse gas emissions and is the most important lever for implementing the EU's climate goals. The scheme covers almost half of all greenhouse gas emissions generated by Europe. In November 2017, the European Commission, Council and Parliament agreed a reform for the fourth trading period (2021 to 2030). For more information on this reform, please click here.

Germany to introduce new national emissions trading scheme from 2021

As is already the case with the energy industry and energy-intensive industries within the scope of the European ETS, prices for carbon emissions are to be introduced for the transport and housing industries. The aim of the new scheme is to help Germany achieve its climate targets. The principle behind the national scheme is the same: the more it costs to pump carbon emissions into the atmosphere, the greater the incentive against doing so. Although the energy industry is responsible for the majority of carbon emissions in Germany, carbon emissions are also released in transport and heating.

How the fields of transport and heating are to be incorporated

The new carbon pricing system for heat and transport to be launched in 2021 is the centrepiece of the Federal Government's 2030 Climate Action Programme. The system is principally based on the emission budgets set for Germany by the EU and the carbon targets for the transport, buildings and energy sectors in the Federal Government's Climate Action Plan for 2050. It enables the upper limits of the carbon targets for the individual sectors to be controlled and reduced each year. Companies that bring heating and fuel into circulation have to buy certificates (digital papers) which serve as 'pollution rights'. For every tonne of heating oil, liquid gas, natural gas, coal, petrol or diesel, a certain number of certificates must be surrendered by the supplier. The criteria for which suppliers are obliged to acquire and surrender certificates are still to be set down in law. The exact number of certificates that must be surrendered depends on the carbon content of the fuels. Certificates are paid by the suppliers who then pass the costs on to the consumers. The fewer certificates that are issued, the higher the price and the greater the incentive to cut back carbon emissions or invest in carbon-saving technologies. This market mechanism is also designed to ensure that investments are made where they are particularly cost-effective.

National emissions trading system to start with a fixed price per tonne of carbon emissions

The trading of certificates can cause prices to fluctuate over time. In order to give consumers time to adjust to the higher fuel costs, the new national emissions trading system (nEHS) launching in 2021 will start with a fixed price for each tonne of carbon released that is set in advance. This will initially be 10 euros per tonne and will rise to 35 euros per tonne by 2025. After that, the price is to be determined by the market as far as possible. In order to ensure that it does not rise too quickly however, a minimum and a maximum price have been set for 2026. In 2025, it will be decided whether it would be useful or indeed necessary to establish a price corridor for after 2026.

Falling electricity costs, a higher rate of commuter tax allowances and cheaper train journeys

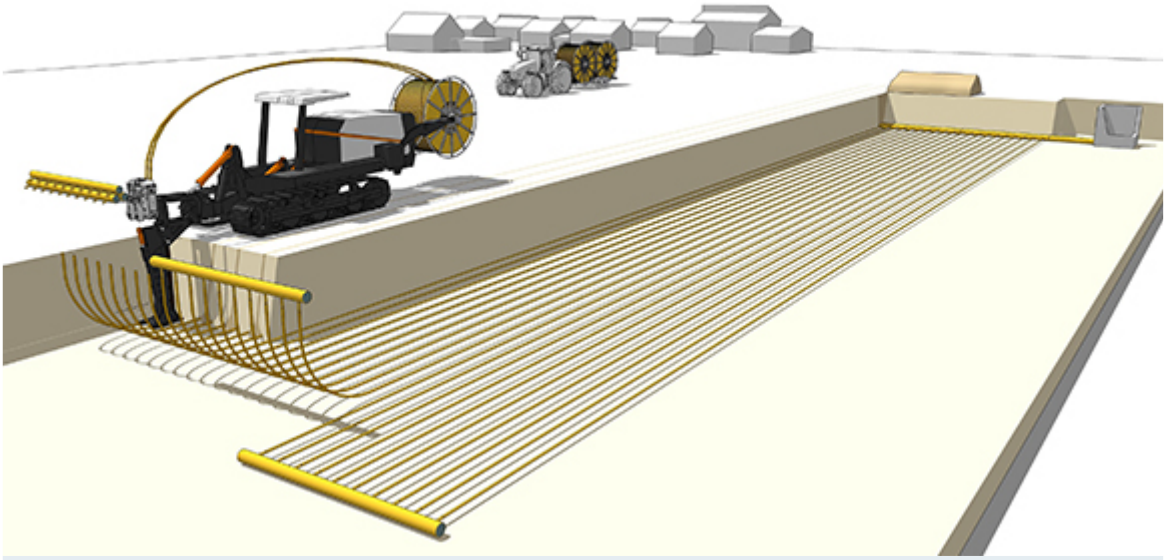
The Federal Government plans to invest the revenue from carbon pricing in climate protection measures and to pass it on to citizens by reducing costs in other areas. As of 2021, the renewable energy surcharge will be reduced (which will also reduce electricity costs), commuters will receive a higher travel allowance, and a reduced VAT rate can make longer train journeys cheaper.

FURTHER INFORMATION

- Key components of the Climate Action Programme: Carbon pricing (available in German only)
- Video blog on the Climate Package by Federal Minister for Economic Affairs and Energy, Mr Peter Altmaier (available in German only)
- Article by the Federal Ministry for Economic Affairs and Energy: The EU emissions trading system essential for the energy transition

Research on geothermal energy: using collectors under farmland

Two research projects are under way to investigate how innovative geothermal collectors can be used to harness heat from agricultural land. The scientists involved are also exploring how this heat can be used to supply the local area.



© Doppelacker GmbH

As part of the research projects, collectors are being installed under farmland where they absorb temperatures of between five and 15 degrees. The heat generated can be used to provide surrounding

households and commercial areas with either heating or cooling, while the field above the collectors can be used as normal.

Instead of using conventional district heating, municipalities would also be able to utilise this technology to harness enough geothermal energy to meet their needs and could even operate their own plants. Given the fact that temperatures in soil layers close to the surface are comparatively low, the collectors can be used for either cooling or heating as required. In the future, such systems could also go be used as storage mediums and absorb energy whenever supply exceeds demand.

No interference with land use: fields can be re-used as soon as collectors installed

Due to the fact that ground collectors are installed at shallow depths, they often interfere with other types of land use. This is the reason why this type of collector has typically been installed across small and unused areas. By cooperating with one another across these projects, research and industry are now setting out to change this precedent by developing innovative new ways of using collector technology and harnessing energy.

The aim of the research is to advance and significantly simplify the installation of large-scale geothermal systems at shallow depths. As part of the model project EnVisaGe, which is being coordinated by the University of Applied Sciences in Stuttgart, the project partners have implemented the agrothermal collector technology for the very first time. In the municipality of Wüstenrot (Baden-Württemberg), collectors were installed across an area of around 5,000 square metres. The facility, which is the size of a football field, supplies the entire local area.

While the first collectors were installed using a tractor, in future a special installation machine will be used. This machine is being developed as part of the KollWeb 4.0 research project at the University of Applied Sciences in Dresden under the coordination of Doppelacker GmbH, an engineering company specialising in low-temperature supply systems. With the help of the new technology, near-surface collectors of the desired size can be 'ploughed' into the ground at a depth of two meters with minimal intervention. As the collectors are installed below the depth reached by agricultural machines, the area can be used again for farming immediately after the collectors have been laid.

Collectors offer many advantages: cold heating networks

The heat generated by the collectors is then fed into a 'cold heating network' and then distributed. 'Cold' is used to refer to the temperatures of between five and 15 degrees Celsius found all year round where the collectors are installed – compared the higher temperatures in deeper layers of the earth. Once the energy has been transported through to the consumer, the temperature is raised using heat pumps so that it can be used for heating buildings or hot water, for example. Thanks to the low temperatures, the system can also be used for cooling – either directly or by means of refrigeration machines. By using heating and cooling simultaneously, additional synergy effects are created that can increase the efficiency of heat pumps and chillers.

Another advantage is that traditional district heating networks usually supply heating on the basis of supply. In contrast, the cold heating networks are able to deliver a needs-based supply of geothermal heat for heating and cooling at any time of the day.

As the required temperatures are only generated once the energy has reached the consumer, there is hardly any heat loss during transport – especially compared to district heating networks. Traditional district heating is usually produced as a by-product of fuel-based electricity production using combustibles. Agrothermal collector systems are also able to fully regenerate themselves. This is because the geothermal energy that is extracted from close to the surface largely comes from solar radiation over the course of the year.

The Federal Ministry for Economic Affairs and Energy is initially providing €2.6 million in funding for the 'EnEff: Wärme Kollweb 4.0' project up to the end of 2019. The project 'EnEff:Stadt – EnVisaGe' (municipal network-connected energy supply – Vision 2020 based on the example of the municipality of Wüstenrot) was provided with €3.4 million in funding up to the end of 2017.

FURTHER INFORMATION

[→ Information on the EnEff:Stadt – EnVisaGe project (available in German only)
[→ Information on the EnEff: Wärme Kollweb 4.0 project (available in German only)

Quote of the week

© IRENA

'Energy efficiency and renewables are the only way to mitigate climate change. So integrating renewable energy is not a choice; it's a must.'

Director General of IRENA, Mr Francesco La Camera, speaking on the occasion of the 'Global Ministerial Conference on System Integration of Renewables', held in Berlin at the beginning of October.

You can subscribe to the Energy Transition

Order the international edition of the "Energiewende direkt" Newsletter here.