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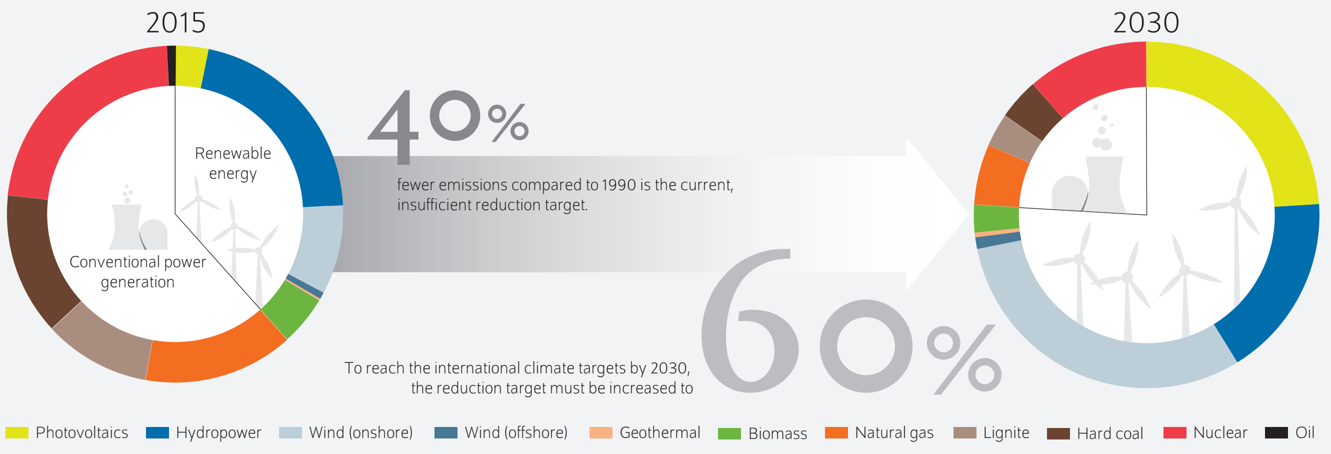
AT A GLANCE

A new climate for Europe: 2030 climate targets must be more ambitious

By Pao-Yu Oei, Karlo Hainsch, Konstantin Löffler, Christian von Hirschhausen, Franziska Holz, and Claudia Kemfert

- Compliance with the Paris Agreement targets requires a 60 percent reduction in emissions by 2030 compared to 1990
- Raising the current European emission reduction targets from 40 to 60 percent is possible and economically feasible
- Quantitative model calculations show a cost-optimal decarbonization path for the electricity, heating, and transport sectors
- The environmental costs saved exceed the additional technical system costs
- Expanding renewables makes it possible to end reliance on nuclear power and CO_2 capture technology

Change in Europe's electricity generation mix compatible with the two degree target
Share of total electricity generation



Source: Authors' own calculations using GENeSYS-MOD v2.0.

FROM THE AUTHORS

"Implementing ambitious targets to tackle climate change in Europe is possible and economically feasible, even without nuclear power and CO_2 capture. To achieve these targets, renewable energies must be significantly expanded in a timely manner."
— Claudia Kemfert —

MEDIA

Audio Interview with C. Kemfert (in German)
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A new climate for Europe: 2030 climate targets must be more ambitious

By Pao-Yu Oei, Karlo Hainsch, Konstantin Löffler, Christian von Hirschhausen, Franziska Holz, and Claudia Kemfert

ABSTRACT

Amidst other national and global climate protection initiatives, the new EU Commission under the leadership of Ursula von der Leyen is facing the challenge of concretely following through on previous announcements regarding an ambitious climate policy. Specifically, action must be taken to raise the 2030 climate targets and the 2050 long-term strategy must be revised in adherence with the Paris Agreement. Model calculations by DIW Berlin economists show that it is possible and economically feasible to increase the 2030 emission reduction target from 40 to 60 percent compared to 1990. The considerable environmental cost savings are offset by small increases in energy system costs. When implementing an aggressive climate policy, burden sharing between the member states must be considered. Furthermore, neither nuclear power nor CO_2 capture technology is needed to implement these ambitious climate targets, as the results of European model scenarios from the SET-Nav project show.

Following the European Parliament elections in May 2019, tackling climate change has become a high priority for both the Parliament and Ursula von der Leyen, the new Commission President.[1] This priority is reflected in the proposal to nominate Frans Timmermans, the former leading candidate of the European Social Democrats, as Executive Vice President for the "European Green Deal." Comprised of national and global efforts, European climate policy is focusing on implementing the Paris Agreement and developing a new European long-term strategy up to 2050. However, calls for raising the existing 2030 climate targets are growing, with demands that Europe increase its role as a pioneer in global climate action and its support of European industries in their efforts to develop sustainable technologies.[2] The following study analyzes the effects of raising the 2030 emission reduction targets from 40 to 60 percent compared to 1990. The model calculations show that this increase is necessary in order to comply with the Paris Agreement targets. This study is based on an analysis of the Global Energy System Model (GENeSYS-MOD), the results of which will be compared with the European energy scenario project SET-Nav. This Weekly Report is based on the results obtained by the members of the research group "CoalExit—Economics of Coal Phase-Out—Identifying Building Blocks for Future Regional Transition Frameworks" and is funded by the Federal Ministry of Education and Research.

EU to raise climate targets for 2030, develop new strategy for 2050

The current debate on climate change in Europe is being shaped by the negotiations between the European Commission and EU member states regarding national energy and climate plans (NECPs). In a new process introduced during the European Commission's most recent legislative period, member states must present their national plans for 2030, with the Commission reviewing the proposals

1 Cf. Frederic Simon and Sam Morgan, "Neue Kommission verspricht 'Green Deal,'" *Euractiv* (available online, in German; accessed on September 27, 2019. This applies to all other online sources in this report unless stated otherwise).

2 Cf. Simone Tagliapetra et al., "The European Union Energy Transition: Key priorities for the next five years," *Bruegel Policy Brief* July 2019 (1) (available online).

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Box

The Global Energy System Model (GENeSYS-MOD)

Compliance with climate targets is analyzed using the Global Energy System Model (GENeSYS-MOD). The model is based on the well-established Open Source Energy Modelling System (OSeMOSYS), an open-source software for long-term energy system analyses.[1] OSeMOSYS is continually developed by a number of researchers worldwide in a decentralized manner and is used in countless scientific and policy advisory publications. Based on this model, GENeSYS-MOD was developed for the present analysis.[2] The objective function of the model covers the total cost of providing energy for the electricity, transport, and heating sectors in Europe. The model result is a cost-minimal combination of technologies to fully meet energy demand at all times. Climate targets, such as a CO_2 emissions budget, are explicitly specified as a condition for the model calculations.[3] The CO_2 budget set for Europe is based on the remaining global budget to meet the Paris climate change targets of maximum warming of less than two degree Celsius.[4]

Since the availability of wind and solar energy fluctuates with the weather conditions, a temporal and spatial balance is necessary in order to be able to cover the energy demand at any time. For this purpose, several technologies for storage and sector coupling are implemented in the model. Above all, lithium-ion batteries serve to balance temporal fluctuations in energy supply and demand. In addition, the coupling of the electricity sector with the heating and transportation sectors enables their decarbonization by using electricity from renewable sources. Spatially, the model depicts Europe in 17 nodes, grouping together a number of smaller countries. It is possible to exchange fuels and electricity between the regions, but not heat. In order to keep the complexity of the model calculable, aggregation is also carried out on a temporal level. In the course of the analysis, all hours of a year are summarized into 16 time slices, which represent seasonal and daily fluctuations of demand and the availability of renewable energies. The years 2020 to 2050 are considered in integrated five-year steps, assuming full knowledge of future developments in demand, costs, and availability of renewable energies. The calculations are mainly based on cost estimates from 2018; however, the results could underestimate the potential of renewables due to unexpected, rapid cost decreases in solar energy.[5] On the other hand, the calculations do not sufficiently consider a part of the integration costs of renewables due to the lower regional and temporal resolution, which leads to an overestimation of the potentials of fluctuating renewables.[6]

1 Cf. Claudia Kemfert et al., "Atomkraft für Klimaschutz unnötig – Kostengünstigere Alternativen sind verfügbar," *DIW Wochenbericht*, no. 48 (2017): 1049–1058 (in German; available online).

2 Further applications of the model examine scenarios for the world and individual countries, such as India, Mexico, China, and Germany.

3 For a more detailed insight into the model formulation and the input data used, cf. Thomas Burandt, Konstantin Löffler, and Karlo Hainsch, "GENeSYS-MOD v2.0 – Enhancing the Global Energy System Model: Model Improvements, Framework Changes, and European Data Set," *DIW Data Documentation*, no. 94 (2018) (available online).

4 Based on a global residual budget of 890 Gt CO_2 in 2015, a remaining carbon budget of 51.60 Gt CO_2 for Europe is calculated based on the population figure. Based on Joeri Rogelj et al., "Mitigation Pathways Compatible with 1.5 °C in the Context of Sustainable Development," *In Global Warming of 1.5 °C. An IPCC Special Report on the impacts of global warming of 1.5 °C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty* by Masson-Delmotte et al. (eds.) (Geneva: 2018): 93–174 (available online).

5 Cf. Eero Vartiainen et al., "Impact of weighted average cost of capital, capital expenditure, and other parameters on future ultilty-scale PV levelised cost of electricity," EU *PVSEC Paper* (2019) (available online).

6 Cf. on integration costs of renewable energies Lion Hirth, Falko Ueckerdt, and Ottmar Edenhofer, "Integration costs revisted – An economic framework for wind and solar variability," *Renewable Energy* 2015, no. 74 (2015): 925–939 as well as Wolf-Peter Schill, "Systemintegration erneuerbarer Energien: die Rolle von Speichern für die Energiewende," *Vierteljahrshefte zur Wirtschaftsforschung* 82, no. 3 (2013): 61–88 (in German).

and making suggestions for improvement if necessary. The focus is on greenhouse gas emission targets outside the EU emissions trading system, share of renewable energy consumption, and energy efficiency.[3] However, it is becoming apparent that the national plans are insufficient and will not achieve a significant increase in the 2030 European emission reduction targets. Thus, the ongoing revisions are focusing on improving and clarifying the national plans.[4] For its part, Germany has been slow in implementing the report by the Commission on Growth, Structural Change, and Employment, which has been available since the end of January 2019. Even the legislative decisions of the recently formed Climate Cabinet[5] do not ensure whether nor how Germany will achieve its 2030 climate targets.[6]

As laid out in the Paris Agreement, the EU must present its 2050 long-term strategy for climate and energy policy to the United Nations Framework Convention on Climate Change (UNFCCC). This strategy is part of the long-term goal of keeping the increase in global average temperature to well below two degrees Celsius above pre-industrial levels and of pursuing efforts to limit the increase to 1.5 degrees Celsius in order to prevent more serious climate damage. To achieve this goal, the EU must revise their long-term strategy from 2011[7] and

3 See the website of the European Commission for the complete assessments of the preliminary NECPs.

4 Cf. Ecologic Institute, *Planning for Net Zero – Assessing the Energy and Climate Plans* (Berlin: 2019) (available online) as well as Tagliapetra et al., "The European Union Energy Transition."

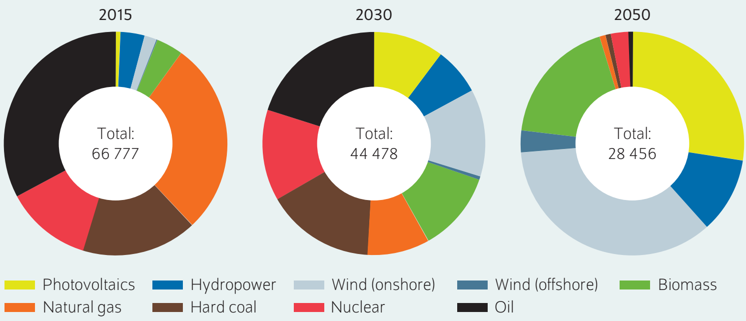
5 Cf. Bundesregierung, *Eckpunkte für das Klimaschutzprogramm 2030. Fassung nach Klimakabinett*, September 20, 2019 (in German; available online).

6 Cf. Claudia Kemfert, "Klimapaket: Der homöopathische CO_2-Preis ist ein Witz," *DIW Wochenbericht*, no. 39 (2019): 732 (in German; available online).

7 Cf. European Commission, *A roadmap for moving to a competitive low carbon economy in 2050* (Brussels: 2011) (available online).

Figure 1

Primary energy demand in Europe in the climate action scenario
In exajoules

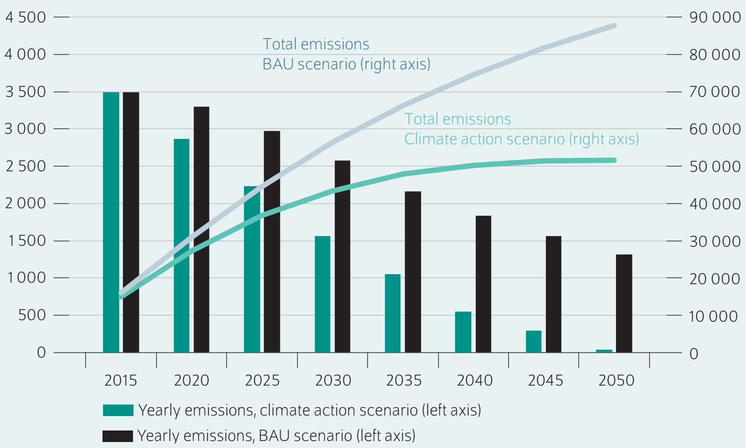


Source: Authors' own calculations using GENeSYS-MOD v2.0.

Fossil fuels and nuclear energy are gradually being replaced by renewables.

Figure 2

Annual and total CO_2 emissions in Europe
In millions of tons of CO_2



Source: Authors' own calculations using GENeSYS-MOD v2.0.

The two degree target can still be reached by reducing CO_2 emissions by 60 percent by 2030.

integrate it into the UNFCCC process by 2020. In adherence with the Paris Agreement, the first review of the long-term strategy (global stocktake) will occur in 2023. The EU member states' National Long-Term Strategies until 2050 (NLTSs), which are currently being written, will be included in the process as well. The following analysis therefore presents a quantitative scenario in which the Paris climate targets are met. This scenario requires an increase in the 2030 climate targets from 40 to 60 percent emission reduction compared to 1990. The modeling includes both the latest technology and cost developments as well as the risk of stranded assets.

Energy system modeling: reduce emissions by 60 instead of 40 percent

An energy system model, GENeSYS-MOD, is used to analyze scenarios for achieving this more ambitious climate target. The model calculates cost-minimal development paths for the electricity, transportation, and heating sectors, thus excluding parts of industry and the agricultural sector. Therefore, Europe is represented as 17 countries or country groups (Box). The respective scenario's energy and technology mix composition depends on how the parameters, in particular the size of the CO_2 emissions budget, are chosen. In the climate action scenario, a CO_2 budget that would achieve the Paris climate target of limiting global warming to below two degrees Celsius is modeled in comparison to a "business-as-usual" (BAU) scenario. Thus, the respective energy mix as well as the associated (additional) costs can be determined.

The European energy mix in the climate action scenario indicates that primary energy demand will be halved by 2050 (Figure 1). This is due to the higher energy conversion and efficiency of the largely electricity-powered technologies and the assumed behavioral changes. Fossil energy sources are slowly being replaced by renewable energies, resulting in a roughly 33 percent share of renewables of the total primary energy demand in 2030. Electric vehicles are gaining significant importance in the transport sector and will generate an additional 739 terawatt hours of electricity demand in 2050. Biomass will be used in the transport sector only initially, but will be needed in the heating sector in the long term, as some of the most energy-intensive processes are more difficult to electrify. Due to its limited sustainable potential, biomass is not used as much in the electricity sector, although its overall use is increasing slightly.

In the BAU scenario, yearly emissions will sink by only approximately 38 percent in comparison to 1990 by 2030 (Figure 2). Although this is more or less in line with the current 40 percent target, it means that the Paris climate target will not be met, as the cumulative emissions will cause far too much warming by 2050. In the climate action scenario, an emission reduction target of 60 percent by 2030 achieves the remaining CO_2 budget set for Europe to meet the two degree Celsius target.

Significant investments in renewables needed

Electricity demand will rise over the next decades as additional electricity demand outstrips the efficiency gains from sector coupling (transport and heating) (Figure 3). Coal-powered electricity in Europe is declining continuously; gas usage is also decreasing sharply. By 2040, almost all electricity will be generated by a combination of photovoltaics, onshore wind power, and hydropower. By 2030, 870 gigawatts (GW) of solar energy and 600 GW of onshore wind power must be added in Europe, a massive increase compared to the current 120 GW of solar power capacity and 190 GW of wind power capacity. In 2030, more than 230 GW of storage capacity will offset the temporal volatility resulting from renewables.

Biomass does not play a central role in the electricity sector and is used primarily in the transportation and heating sectors due to its limited availability. While hydropower remains at 2019 levels, offshore wind and geothermal energy are currently playing only a minor role due to high costs.

No need for nuclear energy or CO_2 capture

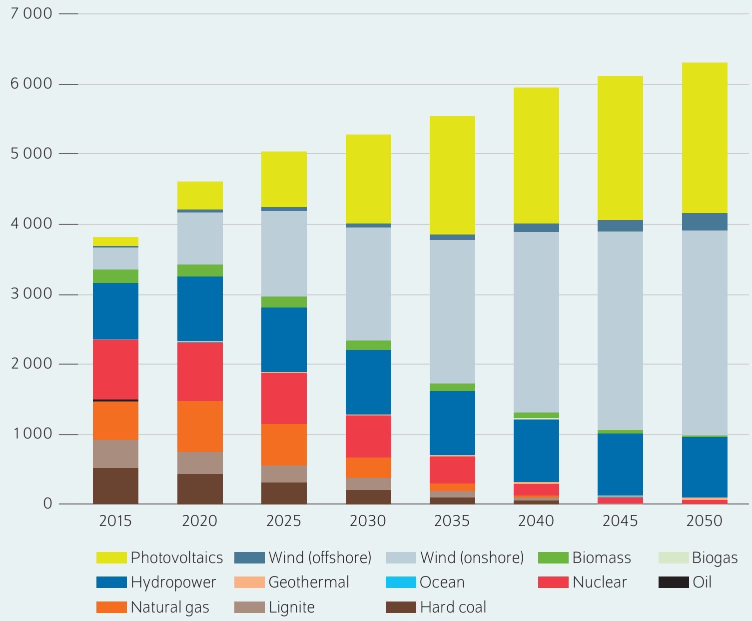
The 2030 climate targets as well as the 2050 long-term strategy must balance European goals and national sovereignty concerning energy supply. In the past, individual member states (such as France and the United Kingdom) have used large amounts of nuclear energy to reach their climate targets, although this is demonstrably expensive and dangerous for society when all environmental and health costs are included.[8] Other countries, such as the Netherlands and the United Kingdom, defend the continued use of fossil fuels by the hypothetical possibility of one day making fossil fuel combustion "low carbon" through carbon capture, transport, and storage (CCTS).[9] The majority of the model calculations cited by the Intergovernmental Panel on Climate Change (IPCC) also suggest that prolonged use of fossil fuels can be offset by later applying CO_2 capture technologies such as negative emission technologies (NET).[10] This gives rise to unjustified hopes that fossil fuel infrastructure (coal or natural gas-fired power plants) can continue as usual or even expanded (natural gas pipelines and liquefied gas terminals). However, with more ambitious climate targets, fossil fuel infrastructures are poor investments that contradict a consistent climate action strategy.[11]

Keywords such as "climate neutrality" by 2050 or "net zero emissions" in the draft of the long-term strategy assume that nuclear power and CO_2 capture technology will continue.[12] However, expanding these technologies is not economically desirable, does not make sense because of high external costs, and is not technically necessary, as renewables have such high potential. DIW Berlin researchers have been pointing out this "modeling paradox" regularly for almost a decade.[13] The model calculations show that the most affordable way to comply with the climate targets can be achieved without new nuclear power plants or CO_2 capture in the electricity sector. A sustainable European energy and climate policy should therefore aim to reduce gross emissions (not only net emissions) and ultimately eliminate them ("gross zero emissions"). Such an energy mix should avoid coal and nuclear energy entirely ("no carbon, no nuclear") instead of simply reducing the share of coal energy ("low carbon").

Figure 3

Electricity generation mix in the climate action scenario in Europe, 2015–2050

Electricity generated in terawatt hours



Source: Authors' own calculations using GENeSYS-MOD v2.0.

The decarbonization of the energy sector is based on a drastic expansion of solar energy and wind power.

Protecting the climate is the cheapest option

By meeting the climate targets, 15.34 gigatons (Gt) of CO_2 can be reduced cumulatively by 2030. By 2050, the reduction would increase to 36.17 Gt of CO_2. Assuming the same discount rate as in the model, this corresponds to savings in environmental and climate costs of 1,381 billion euros by 2030, since every ton of CO_2 not emitted causes costs of 180 euros on a global level.[14] Achieving these climate targets would entail additional system costs of 222 billion euros; this corresponds to approximately 3.3 percent of the total energy system costs and is well below the avoided environmental and climate costs. The system costs can increase further due to the integration costs of renewables, which are not included in the model. The analysis also focuses on climate impacts from CO_2 emissions and neglects additional emissions as

8 Cf. Ben Wealer et al., "High-Priced and Dangerous: Nuclear Power Is Not an Option for the Climate-Friendly Energy Mix," *DIW Weekly Report*, no. 30 (2019): 511–520 (available online) and Mycle Schneider et al., *The World Nuclear Industry – Status Report 2019, Paris & Budapest* (2019) (available online).

9 Cf. Pao-Yu Oei and Roman Mendelevitch, "European Scenarios of CO_2 Infrastructure Investment until 2050," *The Energy Journal*, no. 31 (2016): 171–194.

10 Cf. IPCC, "Summary for Policymakers," in *Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty* by Masson-Delmotte et al. (eds.) (Geneva: 2018): 1–24 (available online).

11 Cf. Fitzgerald et al., "Destabilisation of Sustainable Energy Transformations: Analysing Natural Gas Lock-in in the case of Germany," *STEPS Working Papers* 106 (2019) (available online).

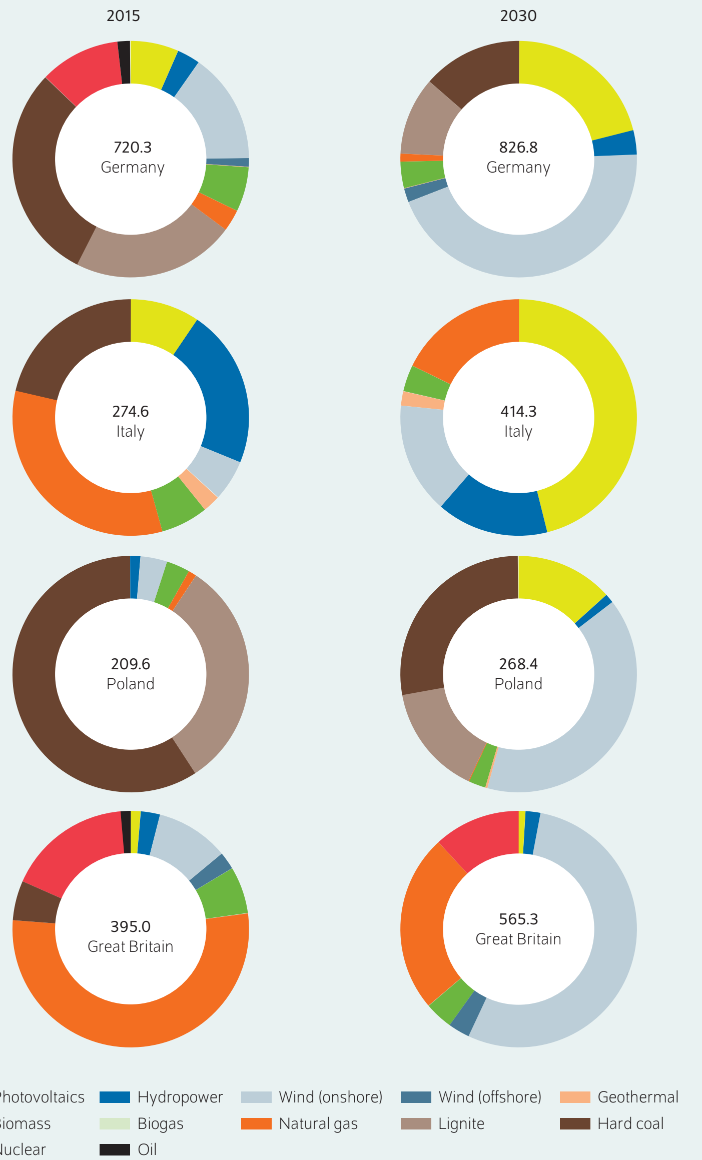
12 Cf. European Commission, "A Clean Planet for All – A European Long-Term Strategic Vision for a Prosperous, Modern, Competitive and Climate Neutral Economy," *COM* (Brussels: 2018): 773.

13 Cf. Christian von Hirschhausen et al., "Europäische Stromerzeugung nach 2020: Beitrag erneuerbarer Energien nicht unterschätzen," *DIW Wochenbericht*, no. 29 (2013): 3–13 (in German; available online) as well as Claudia Kemfert et al., "European Climate Targets Achievable without Nuclear Power," *DIW Economic Bulletin*, no. 47 (2015) (available online).

14 The global environmental, climate, and health costs caused by the emission of carbon dioxide are calculated. Cf. Umweltbundesamt, *Methodenkonvention 3.0 zur Ermittlung von Umweltkosten – Kostensätze Stand 02.2019* (Dessau-Roßlau: 2019) (in German; available online).

Figure 4

Varying distribution of electricity generation within Europe in 2015 and 2030
In terawatt hours



Note: Model results, not statistical values, are shown for 2015. These deviate slightly from the actual amount of energy generated.

Source: Authors' own calculations using GENeSYS-MOD v2.0.

Depending on the region, solar and wind energy must be expanded significantly by 2030.

well as the environmental and health costs of other pollutants (including nitrogen oxides, sulphate dioxide, mercury, and particulate matter) arising from fossil fuel combustion.[15]

Distributing the emission budget amongst member states is highly political

Increasing the EU climate targets and introducing a European Green Deal raises questions regarding the distribution of emission reduction targets to individual countries. When implementing these policies, both the economic development of the individual member states as well as the regions affected by structural change in the energy sector must be taken into account.

The model enables explicit consideration of distribution effects by distributing the available CO_2 budget among the member states according to different keys. The distribution can be proportional to earlier emissions levels, the population, or the 2015 GDP. In the model, the first two options lead to roughly comparable decarbonization pathway results.

The importance of burden sharing can be illustrated using the example of system transformation in Poland. Energy from coal has played, and will play, a vital role in the Polish energy economy, both in the past in 2015 and in the future in 2030 (Figure 4). In contrast, other regions, such as the Iberian Peninsula or Scandinavia, will be able to have almost completely switched to renewable energy sources by 2030. If allocated according to GDP, Poland would still receive 1.4 billion tons of CO_2 budget by 2050; on the other hand, if it were allocated according to historical emissions, the budget would be 4.3 billion, more than three times as much. Accordingly, increasing the climate target from 40 to 60 percent would be particularly difficult for Poland and would have to be accompanied by parallel instruments for regional development and structural change.

Overall, the initial characteristics of the member states must be taken into account when setting ambitious climate targets in order to ensure equitable system transformation. Recent news—such as announcements by Greece, currently still dependent on coal, to phase it out by 2028—shows that the necessary energy transformation can be successful.[16]

Further model analyses prove feasibility of more ambitious climate targets

The feasibility of ambitious climate targets has also been demonstrated in other model-based studies. Recently, within the framework of the European research project SET-Nav, various models for different sectors (electricity, transport, industry, buildings, natural gas, renewables, overall economy) were linked together.[17] Unlike in GENeSYS-MOD as described above, each sector is modeled separately with its respective technological and economic characteristics. This way, it is

15 Further studies which calculate the pollutant costs of energy production include Sanbag et al., *Last Gasp: The coal companies making Europe sick* (2018) (available online) as well as CAN Europe et al., *Europe's Dark Cloud. How coal-burning countries are making their neighbours sick*, (Brussels: 2016) (available online).

16 Cf. Svetlana Jovanovic, "Greece seeks to phase out coal by 2028, Ptloemaida V prospects unclear," *Balkan Green Energy News* (2019) (available online).

17 In addition to DIW Berlin, many other European research institutes participated in the SET-Nav project (2016–2019), such as TU Vienna, the Fraunhofer Institute for Systems and Innovation Research, the University of East Anglia, and the NTNU. See the SET-Nav project's website.

possible to map individual sectors' contributions to emission reduction and assess their costs and other conditions.

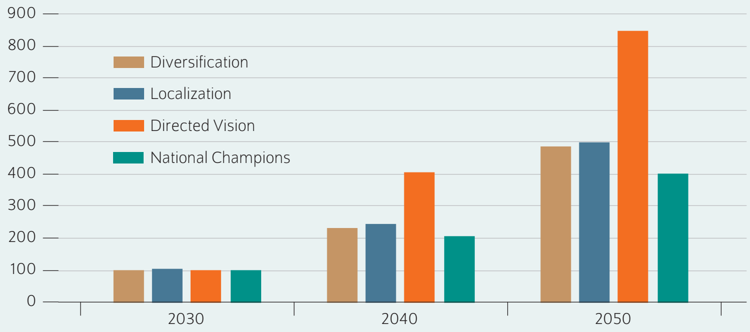
The starting point for the analyses is the Strategic Energy Technology Plan (SET Plan), which was adopted by the European Union over a decade ago.[18] The SET Plan contains measures to support the energy transformation in the EU through technological innovation, coordinating national research activities, and funding concrete projects. It considers a variety of technologies, both on the energy supply side (such as renewable power generation from wind and sun) and on the energy consumption side (such as electromobility).

The SET-Nav research consortium, which DIW Berlin was a part of, considered the feasibility and conditions for implementing ambitious climate targets in four possible hypothetical development scenarios for the European energy system up to 2050. The four scenarios were defined along the dimensions of cooperation (across countries and sectors) and path dependency (degree of innovation in technologies and business models). This resulted in four scenarios: Diversification, Directed Vision, Localization, and National Champions.[19]

Figure 5

Electricity demand of the transportation sector in the EU-28 in the four SET-Nav scenarios

In terawatt hours (electric)



Source: Set-Nav.

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In all scenarios, extensively electrifying the transportation sector proves to be a cost-effective solution for achieving the climate targets.

All four scenarios meet the EU-wide emission reduction target of 85–95 percent compared to 1990 levels by 2050. The breakdown of emission reductions by sector is not fixed in advance and can differ between the scenarios. The result is four very different paths, all of which offer the possibility to sketch the system transformation under a wide range of drivers and uncertainties. The scenarios serve two purposes: first, they can highlight the central drivers and most important uncertainties with regard to a successful transformation (model assumptions); second, the consequences of the respective decisions can be determined (model results).

Key results of the SET-Nav model scenarios include that renewables can provide between 75 and 98 percent of electricity generation by 2050. Gases are used to a small extent. Controversial technologies such as CCTS, nuclear energy, and coal-fired power generation are not required to decarbonize electricity generation in Europe in a cost-efficient and effective way. Analogous to the results of GENeSYS-MOD, it shows that a significantly higher end-use of electricity instead of fossil fuels is a cost-effective way to decarbonize Europe. Both in the transport sector (Figure 5) and in industry, the use of electricity from renewable sources offers an economically viable option for environmentally friendly energy use.[20]

Although the emission reduction targets can be achieved in all four scenarios, cooperative scenarios of cross-national and cross-sectoral cooperation generally offer more cost-effective and efficient solutions for effectively reducing greenhouse gas emissions than non-cooperative scenarios.

Conclusion: reduction of emissions by 60 percent is necessary and possible

Analyses of comparable energy and climate action scenarios by DIW Berlin and the "CoalExit" junior research group have shown that even ambitious climate targets in Europe and in Germany can be achieved through an increased use of renewables. Energy system calculations show that compliance with the Paris Agreement climate targets is both possible and economically feasible by increasing the 2030 target from a 40 to a 60 percent reduction in greenhouse gas emissions compared to 1990. The environmental costs saved exceed the additional technical system costs.

In order to achieve these ambitious climate targets, wind and solar energy infrastructure must be expanded significantly and investment in nuclear power and CO_2 capture technologies must be ended. Due to the urgency of the climate crisis and the resulting need for a system transformation, there is no time left for "bridge energy sources." Therefore, the objectives of the Paris Agreement can only be achieved in Europe by accelerating renewables expansion.

In shaping the new European climate strategy, distribution issues and local differences between member states must be sufficiently taken into account. For example, some Eastern European member states need extra support to speed up their transition to solar and wind energy. The German Federal Government should set a good example in this regard by adapting its national energy and climate plans (NECPs) and intensifying the recommendations of the Commission on Growth, Structural Change, and Employment and the Climate Cabinet.

18 See information on the European Commission's website.

19 Cf. Crespo del Granado et al., "D9.5 Summary report 'SET-Nav – Integrative policy recommendations' Decarbonising the EU's Energy System," *Deliverable D9.5* (2019) (available online).

20 Cf. Crespo del Granado et al, "Comparative Assessment and Analysis of SET-Nav Pathways," *Deliverable 9.4*, May 2019 (available online).

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