Climate and Energy Outlook 2019

Summary

PBL Netherlands Environmental Assessment Agency

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Netherlands Enterprise Agency

ECN | TNO innovation for life

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The study was conducted in a collaboration between PBL, ECN part of TNO, CBS, RVO.nl and RIVM. Together, this consortium has access to data and expertise to study the trends in the realisation and exploration of the Netherlands' greenhouse gas emissions and energy systems, provide independent explanations, and consider them in the proper context.

The Climate and Energy Outlook 2019 (KEV) is a joint project by PBL, CBS, ECN part of TNO, RIVM en RVO.nl. Each of these institutes carries the responsibility for its own contributions. However, this publication contains the integrated results, which is why contributions from the individual institutes can not be identified.

Summary

The Climate and Energy Outlook study is stipulated in the Climate Act
This is the first Climate and Energy Outlook (*Klimaat- en Energieverkenning* (KEV)), which, as stipulated in the Dutch Climate Act, provides insight into the development of Dutch greenhouse gas emissions, both in the past and up to 2030. The KEV provides an integrated view of developments in energy supply and energy consumption, as well as of other activities that lead to greenhouse gas emissions. The KEV builds on previous National Energy Outlooks (NEVs) and will be developed further, in the coming years. The KEV is not a policy evaluation and does not address the question of whether certain policy is efficient or cost-effective.

Dutch National climate and energy policy is dynamic
Shortly after the publication of the National Energy Outlook (NEV) 2017, the Dutch Government presented its Coalition Agreement, which included the objective of significantly reducing greenhouse gas emissions in the Netherlands. The national target, which has since been included in the Dutch Climate Act, is to reduce greenhouse gas emissions by 49% by 2030, compared to 1990 levels. The Dutch Cabinet wants to increase the current EU greenhouse gas reduction target of at least 40% to 55%, thereby taking the lead among EU Member States. This would bring greenhouse gas emission levels in line with those in the Paris Agreement. This objective represents a major challenge, both in relation to current emission levels and to the projections for 2030, under implementation of the policy adopted and proposed in 2017.

Since taking office, the current Dutch Cabinet has announced a number of substantial changes in climate and energy policy. In addition, on 28 June of this year, the Dutch Climate Agreement was published, following a negotiation process with a large number of parties. This agreement announces a large number of further policy changes. Many measures will have to be worked out in more detail, in the coming period. As a result of this process, energy and climate policy recently has been high on the political agenda. The necessary further elaboration implies that, for now, the subject will remain a priority and the process will continue to have a dynamic character.

The KEV looks at policies and policy proposals up to 1 May 2019
Similar to the previous NEVs, the KEV 2019 uses the standard reference date of 1 May. Policy that is proposed after this date cannot be included in the KEV of that year. A number of other criteria also apply to the inclusion of policy proposals. For example, the policy information must be in public records and be elaborated in sufficient detail.

The new measures announced in the Climate Agreement of 28 June 2019 were therefore too late to be included in the KEV 2019. Moreover, not all of the measures announced meet the criteria for inclusion in this year's KEV. For these reasons, the measures published on 28 June 2019 that relate to the ruling in the Urgenda Climate Case against the Dutch Government could not be included in this year's KEV, either. Furthermore, the reduction in natural gas extraction from the Groningen gas field, announced in September, also was not included. This KEV, therefore, not yet includes the entire package of policy measures intended to achieve the 49% reduction target by 2030. It does, however, provide an update of the other developments with regard to energy and climate and describes their implications on a national level and details on a sectoral level, as well as relevant international developments. As intended in the Climate Act, this year's KEV thus fulfils the function of an annually updated reference.

Effect of the National Climate Agreement 28 June 2019 in a supplementary publication
The Climate Agreement measures that could not yet be included in this year's KEV were analysed and results published in a supplementary report (PBL, 2019). This report, together with the results of this year's KEV, describes the possible contribution towards achieving the policy target of a 49% emission reduction by 2030. If new measures are worked out in sufficient detail in accordance with the KEV criteria before the reference date of 1 May 2020, they will be included in the KEV 2020.

General observations

Four general observations can be made, before we go into a more detailed summary of this year's KEV.

Large difference between the projected reduction by 2030 and the objective
First of all, this year's KEV confirms the major difference between what was achieved over recent decades and what the government was striving for. In 2018, Dutch greenhouse gas emissions were just under 15% below those of 1990. The government's target for 2030 is that of a 49% reduction. In roughly the coming decade, emission reductions will have to be more than twice as large as they were over the past 30 years.
This KEV expects the Netherlands to achieve a reduction of 35% [28%–39%] by 2030 with its adopted and proposed policy. In order to fully achieve the 49% target, a difference of 14 [10–21] percentage points must be achieved by Climate Agreement-related measures and/or other additional policies.

To achieve the further reduction in greenhouse gases, the Netherlands relies primarily on reductions in carbon dioxide (CO_2) – the most important greenhouse gas. So far, this has not been easy; it was not until 2018 that CO_2 emission levels were slightly below those of 1990. Emissions of other greenhouse gases, such as methane and nitrous oxide, have already decreased sharply, since 1990. This year's KEV expects only a limited further reduction in those other greenhouse gases by 2030.

Agreements followed by the realisation phase
A second observation is that agreements are the first step towards policy-making, but the difficult part is that of implementing those agreements. This is no different in the countries around us. As stated, the newly announced measures in the National Climate Agreement at the end of June were not taken into account in this year's KEV. The measures in the Energy Agreement in 2013 were taken into account, including all the changes implemented up to and including 1 May 2019 in order to bring the agreed targets for 2020 within reach. These agreements have not been without consequences. The annual energy savings have increased considerably between 2013 and 2020. However, the goal of saving an additional 100 petajoules by 2020 is not expected to be achieved with 80 [48–111] petajoules. The European 14% renewable energy target for 2020 will not be achieved either, at 11.4% [10%–12%]. The Energy Agreement 16% renewable energy target for 2023 is projected to be achieved, with 16.1% [14%–17%]. The lessons for the National Climate Agreement are clear: energetic, decisive and concrete implementation is needed in order to achieve the agreed ambitions for 2030. In practice, therefore, it has proved to be difficult, which calls for policy that can be adjusted in the interim and policy that anticipates new opportunities that arise over the course of its implementation.

The Netherlands becomes a natural gas importer, will have more renewable energy and stops coal burning
The third observation is that of three substantial energy developments. The Netherlands has lost its position as an exporter of natural gas and

will be importing more of it, the share of renewable electricity will increase substantially and electricity from coal will be phased out.

The position of the Netherlands as a major exporter of natural gas is over. After more than 50 years of net exports, the Netherlands became a small net importer in 2018. After 2021, net imports will increase further. Dutch natural gas production has been declining since 2013. In 2018, it was only half of the average production over 2010–2013 and, in 2024, this amount will be halved again (not including the most recent measures to reduce production from the Groningen field even faster).

Looking at all the policies up to 1 May 2019 (including the continuation of the SDE+ scheme), this year's KEV projects a sharp increase in renewable energy, from 7.4% in 2018 to approximately 25% by 2030. Especially in the power sector, renewable energy will grow spectacularly; from 15% in 2018 to over two thirds by 2030. This increase in renewable electricity comes during the period in which the last five coal-fired power plants in the Netherlands will have to stop using coal. The result is that, by 2030, the Netherlands will have an electricity system dominated by wind and solar power, with gas-fired power stations that operate mainly when there is less wind or sunshine. Emissions from the electricity sector will decrease sharply, as a result of these developments.

Worldwide efforts insufficient to achieve Paris Agreement ambitions

The fourth observation concerns the inadequacy of the combined national efforts worldwide to achieve the climate commitments made in Paris in 2015. If all countries were to achieve their own targets (the Nationally Determined Contributions (NDCs)), a rise in temperature of 3.2 °C is expected, while it should be limited at 1.5 °C or a maximum of 2 °C. Estimates based on actually formulated policy are even more unfavourable.

As part of its NDC, the EU has decided to reduce its greenhouse gas emissions by at least 40% by 2030, compared to 1990. Recent projections show that the EU is unlikely to achieve this target if the policies it incorporates are implemented. In the meantime, however, new policies have been announced that may lead to adjustments to these projections. Recent projections show that the reduction target for non-ETS activities (i.e. those outside the ETS, such as transport and mobility including domestic aviation, small-scale industry, agriculture and the built environment) will still not be within reach by 2030. For the activities that do fall under the EU Emissions Trading System (power sector and large industry), the reduction target for 2030 is expected to be achieved.

National efforts are not directed at all types of emissions. In their the NDCs, countries do not have to take into account the greenhouse gas emissions from the consumption of bunker fuels by international aviation and shipping. These emissions, therefore, are not included in the national emission totals in this year's KEV. The reduction in these emissions falls under the International Civil Aviation Organization (ICAO) and the International Maritime Organization (IMO). Countries are, however, required to report the sales of international bunker fuel. This year's KEV shows that emissions related to the bunker fuel sold in the Netherlands for international aviation are expected to increase by approximately 3 Mt (25%) between 2020 and 2030. This is the same order of magnitude as the reduction in greenhouse gas emissions from the Dutch mobility and transport sector, over that period.

Main data KEV 2019:
projections under proposed policy[1]

Prices and energy	2005	2015	2018[2]	2020	2030
GDP (index 2018 = 100)[3]	83	93	100	103	120
Oil price (USD/vessel)[4]	69	56	72	63	104
Natural gas price (euro cents/m³)[4]		22	21	19	25
Coal price (EUR/t)[4]	68	62	89	66	75
CO_2 price (EUR/t)[4]		8	16	22	47
Wholesale price electricity (EUR/MWh)[4]	53	42	52	43	57
Natural gas extraction[5] (billion Nm³)	69	50	35	31	11
Natural gas demand (billion Nm³)	47	39	40	35	30
Energy investments (EUR billion, current prices)	6	13	15	16	16
Renewable energy share (%)	2.5	5.7	7.4	11.4 [10–12] (2023: 16.1 [14–17])	25.0 [21–26]
Renewable energy (petajoules)	58	119	157	239 [219–249]	502 [429–518]
Gross final energy use (petajoules)	2301	2074	2119	2090 [1886–2300]	2007 [1723–2370]
Energy saving rate (%/yr)	1.1[6]			1.5[7] [1.5–1.6]	0.9[8] [0.7–1.1]
Energy saving EU cumulative (petajoules)					556–691[9]
Energy saving Energy Agreement (petajoules)				80 [48–111]	

1 Bandwidth between square brackets. No bandwidths could be determined for land use.
2 Preliminary CBS data
3 Source: CPB, Central Economic Plan 2018, Medium-term outlook 2018–2021
4 Constant prices 2018
5 Source: Delfstoffen en aardwarmte in Nederland [Minerals and geothermal energy in the Netherlands], Annual Report 2017, nlog.nl (realisations), EZK (projections).
6 Average over 2000–2010
7 Average over 2013–2020
8 Average over 2020–2030
9 Average over 2021–2030

Emissions, national and sectoral level	1990	2015	2018[10]	2020	2030
Greenhouse gas reduction, total compared to 1990 (%, excl. land use)	0	12	15	23 [19–26]	35 [28–39]
Greenhouse gas emissions, total (Mt CO_2 equivalents):					
total excl. land use	222	196	189	171 [165–180]	144 [135–159]
total incl. land use	228	202	--	177	150
total CO_2 (excl. land use)	163	167	161	143 [136–152]	119 [110–133]
total OBKG[11] (excl. land use)	58	29	28	28 [28–28]	26 [25–26]
Greenhouse gas emissions per sector (Mt CO_2 equivalents):					
power	39.6	53.3	45.2	29.8 [25.8–35.8]	13.7 [10.1–20.5]
industry	87.0	56.4	57.2	56.9 [55.2–58.7]	54.2 [51.1–58.7]
built environment	29.9	24.5	24.4	22.8 [20.0–26.9]	19.0 [16.5–22.7]
mobility and transport	32.3	34.7	35.6	34.8 [32.7–35.7]	32.9 [29.5–37.5]
agriculture	32.9	27.0	26.9	26.9 [25.8–28.4]	24.5 [22.6–25.7]
land use	6.5	5.6	--	5.3	5.6
Emissions, EU ETS and non-ETS[12]	**2005**	**2015**	**2018[10]**	**2020**	**2030**
Emissions, ETS sectors (Mt CO_2 equivalents)	80.4	94.1	87.4	73.2	56.0
Emissions, non-ETS sectors (Mt CO_2 equivalents)	134.4	101.9	101.9	98.1	88.3

10 Preliminary data RIVM/Pollutant Release and Transfer Register

11 OBKG refers to the other greenhouse gases, such as methane, nitrous oxide and f-gases

12 EU ETS is the Emissions Trading System of the European Union; non-ETS represents the emissions from activities outside the EU ETS.

New developments from this Climate and Energy Outlook

Proposed European policy completed, implementation in neighbouring countries not easy

In 2019, the European Union completed the policy package that was formulated in 2016. The target to reduce greenhouse gas emissions by at least 40% by 2030 must largely be achieved through policies implemented in the EU Member States. Member States have submitted draft plans for how they propose to achieve this target, and the European Commission has responded to those plans. At the same time, there is debate about whether an EU ambition of at least 40% by 2030 would be sufficient to ensure an adequate contribution to the Paris Agreement. The new European Commission is aiming to increase this reduction target for 2030 to 55%.

EU Member States all have their own climate plans and targets, and are faced with a variety of obstacles in formulating and implementing those plans. Climate policy is more likely to succeed if the Member States harmonise their individual policies and are prepared to learn from each other. France and the United Kingdom have formulated well-founded ambitious climate targets, but are finding it difficult to translate these into concrete policy. In Germany, progress on the development of climate policy is rather difficult because the current coalition is struggling with possible increases in the financial burdens and employment effects. For example, a comprehensive recommendation has been formulated to reduce the capacity of coal- and lignite-fired power plants, but the German Government is having trouble to translate this into statutory rules and regulations. It also finds it difficult to formulate effective additional policy for achieving the national climate target for 2030.

In Belgium, the many layers of government are unable to formulate a coherent energy and climate policy. Denmark, in contrast, appears to be a successful example of a country where climate policy and economic reform can go hand in hand.

Often, the power sector is at the forefront of system renewal and innovations, while in mobility and transport and the built environment achieving zero emissions is more difficult.

Energy will see modest price increases, over time

Oil, natural gas and coal prices are expected to decrease, around the world, up to the early 2020s, after which they are projected to increase again; with a somewhat higher price increase for oil and natural gas than for coal. This year's KEV contains no in-house projections for energy prices, but uses market information for the short term and, for its projections for 2030, data from the latest World Energy Outlook by the International Energy Agency.

The CO_2 price under the EU Emissions Trading System is expected to increase to EUR 47 per tonne by 2030. This is one of PBL's own estimations. On the basis of these data, the wholesale price for electricity is estimated to also increase to an average of EUR 57 per MWh by 2030, after the initial decline up to 2020. As wind and solar energy is becoming more rampant and this is pushing down the electricity price in times of abundant amounts of wind and sunshine, the producers of wind and solar energy are increasingly receiving a lower price than the average wholesale price, with differences that will average around 13% to 16% by 2030.

Emissions in 2020: 23% [19–26] below 1990 levels, significant reductions in the power sector

In 2018, total greenhouse gas emissions were 15% below those of 1990. This year's KEV estimates that, by 2020, greenhouse gas emissions will be 23% below 1990 levels, with a range of 19% to 26%. This range reflects the effect of several uncertainties in the short term. For example, the amount of electricity generated in the Netherlands is extremely sensitive to changes in coal, natural gas and CO_2 prices. As a result, national production levels can easily be considerably higher or lower than one would estimate on the basis of the average assumptions used for 2020. In addition, the outside temperature in 2020 may turn out to be cooler or hotter than average. This would lead to more or fewer emissions and thus to a lower or higher emission reduction compared to that of 1990.

At 23% [19–26], projections in this year's KEV are lower than the 25% reduction target, although the reduction target does fall within the bandwidth. This target is based on a court ruling in the Urgenda Climate Case against the Dutch Government; also on appeal, the court ordered the government to reduce greenhouse gas emissions by 25%, between 1990 and 2020. After the KEV's reference date (1 May), the government presented an additional package of policy measures on 28 June, for Urgenda 2020, which was too late to be fully included in this year's KEV. The KEV does, however, include a previously published and relatively large measure from this additional Urgenda-related package of measures, namely the closure of a coal-fired power plant.

The projected decrease in national emissions between 2018 and 2020 is mainly explained by a significant decrease in the power sector. This is due to the expected strong increase in renewable electricity generation, a relatively high import level of electricity in 2020, as well as to the estimated development in the price of energy and CO_2. For the built environment, industry and transport and mobility, emission reductions are expected to be more limited between 2018 and 2020.

The projected reduction of 23% [19–26] is higher than the 21% [17–24] expected last January, in the short-term projections (*Kortetermijnraming*) for 2020 (PBL, 2019). This is mainly due to the higher fuel and CO_2 prices estimated for 2020 in this year's KEV.

Emissions in 2030: 35% [28–39] below 1990, substantial reductions in the power sector

For 2030, this year's KEV projects that, with the currently adopted and proposed policies, emissions will be reduced by 35% [28–39] compared to those of 1990. This leaves a distance of 14% [10–21] to the 49% reduction target under the Climate Act. Expressed in absolute emissions, this KEV's estimate for 2030 is 144 Mt [135–159], while the reduction target of 49% corresponds to 113 Mt. For 2030, a reduction target of 31 Mt [22–46] remains.

As stated, the Climate Agreement could not be fully analysed in this year's KEV, with the exception of certain government decisions that were announced up to 1 May, such as the ban on the use of coal in electricity generation by 2030 and a minimum CO_2 price for electricity. The KEV also takes account of the fact that renewable energy will increase as a result of the continuation of the SDE+ (but without the broadening of its scope from the Climate Agreement) and the net metering scheme for solar PV, up to and including the year 2030. The report *Het Klimaatakkoord: effecten en aandachtspunten* (in Dutch) (PBL, 2019) describes the extent to which the measures announced in

the Climate Agreement, but not yet included in this year's KEV, meet the greenhouse gas reduction targets as set out above.

Between 2018 and 2030, greenhouse gas emissions are expected to decrease by 45 Mt. Two thirds of this emission reduction will take place in the power sector (more than 31 Mt between 2018 and 2030). This significant reduction will partly be due to the ban on burning coal, the expected increase in renewable energy, expected changes in energy prices and an expected increase in CO_2 prices. The expected reductions between 2018 and 2030 are much lower for the built environment (more than 5 Mt), industry (more than 3 Mt), mobility (almost 3 Mt) and agriculture (more than 2 Mt excluding land use). The expected reductions per sector are often the sum of the underlying pros and cons.

KEV 2019 projects lower emission levels for 2030, compared to the NEV 2017
In this year's KEV, the emission projections for 2030, including proposed policy, will be 144 Mt CO_2 equivalents, which is approximately 10 Mt CO_2 equivalents below the NEV 2017 (154 Mt CO_2 equivalents). This has different causes per sector. For example, for 2030, this year's KEV estimates 16 Mt less in emissions for the electricity sector, compared to the NEV 2017. The ban on the burning of coal is decisive, in this respect. For industry, on the other hand, the KEV estimates an increase in emissions of nearly 5 Mt by 2030, compared to the NEV 2017. This is explained, in particular, by a number of previously identified necessary corrections in statistics and estimates, an administrative shift from a source to the industry sector, and an increased use of combined heat and power (CHP). Estimates for the sectors of the built environment, agriculture and mobility and transport are comparable, between the KEV 2019 and NEV 2017. However, there are internal differences within these sectors.

Non-ETS greenhouse gas target for 2020 is in sight, but not yet for 2030
The Netherlands also has to comply with European reduction targets. These relate to the sectors not covered by the EU Emissions Trading System (EU ETS), the so-called non-ETS sectors such as mobility and transport, the built environment, agriculture and small industrial companies. There are cumulative targets for the 2013–2020 and 2021–2030 period.

The cumulative target for 2013-2020 is 921 Mt of CO_2 equivalents. This year's KEV projects that, under adopted and proposed policies, cumulative emissions are expected to reach 813 Mt over the 2013–2020 period. The EU target for the Netherlands is thus expected to be achieved.

For the period 2021-2030, a cumulative target of 891 Mt of CO_2 equivalents can be derived on the basis of preliminary emission data. The KEV expects cumulative emissions for 2021–2030 to be 926 Mt. This leaves a policy challenge of about 34 Mt in relation to the EU target. This objective for 2030 could become even greater if the Netherlands were to decide that measures in non-ETS sectors also should contribute to achieving the objective for land use (see below).

Land-use-related emissions expected to increase, possibly additional policy objective for the Netherlands
Land Use, Land-Use Change and Forestry (LULUCF) refers to the emission and removal of greenhouse gases resulting from land use or land-use change, particularly in agriculture. These land-use emissions do not play a direct role in the national reduction targets for 2020 (Urgenda ruling) and 2030 (Climate Act). National land-use emissions do fall under international climate policy: the Kyoto Protocol and the EU LULUCF regulation.

Unlike in many other European countries, land use in the Netherlands will lead to an increase rather than a reduction in greenhouse gas emissions. This is mainly due to greenhouse gas emissions from the peat areas and a low uptake of CO_2 by forests compared to in other countries. In addition, there are land-use-related CO_2 emissions from arable farming and in built-up areas. Emissions are expected to increase slightly between 2020 and 2030. This increase is due to the fact that, in that period, forests will sequester slightly less CO_2 and more emissions are expected from built-up areas.

According to EU LULUCF regulation, the increase after 2020 may lead to a policy objective (net debits) for the Netherlands. This year's KEV estimates a cumulative objective of approximately 2.7 Mt of CO_2 equivalents, for the 2021–2030 period. The Netherlands can choose to achieve this objective in the land-use sector itself with additional measures and/or by taking additional measures in the non-ETS sectors. This may mean that the expected policy objective for the non-ETS sectors will increase for the 2021–2030 period.

Spectacular change in electricity generation

In 2014, the 28 GW capacity of Dutch coal-fired and natural-gas-fired power plants was 40% greater than 10 years before, but this capacity was the maximum at the time. For the various coal-fired power plants, the ban on the use of coal for electricity generation will apply between 2020 and 2030 Diverse mix of information and collaboration. The 2030 projected capacity of gas-fired power plants is more than 13 GW. Although the market position of natural-gas-fired power plants will be much better around 2020 than was foreseen in NEV 2017, the role of those types of power plants will diminish after 2023. The improved market position for natural-gas-fired power plants around 2020 is partly due to the sharp rise in CO_2 prices within the EU ETS. After 2023, the share of natural gas in the electricity supply will decrease again due to, among other things, the growth in renewable electricity generation, which is cheaper once the capacity has been installed. By 2030, the Netherlands will have a wind- and solar-dominated electricity system that accounts for more than two thirds of its production, and natural-gas-fired power plants that operate mainly when there is less wind or less sunshine. In 2018, the share of renewable electricity generation was still 16%.

The Netherlands could become an ever-increasing exporter of electricity to Belgium, as hardly any new production capacity is expected to be built there, and provisions are made for closing down old nuclear power plants. This is the largest factor in the Netherlands' transition from being a net importer of electricity to becoming an exporter, from 2023 onwards. This obviously has an impact on Dutch greenhouse gas emissions, depending on how much electricity is generated from fossil energy.

The first and major step in the energy transition, thus, will be taken in the electricity sector, especially in offshore wind farms and large-scale solar collector areas, and certainly also on rooftops in the built environment and with wind turbines on land, possibly in co-ownership.

The projections for the electricity supply depend largely on the assumptions about energy prices and the developments in neighbouring countries. This is why two sensitivity analyses have been carried out, one for 2020 and one for 2030. In the analysis for 2020, different energy prices we used and we assumed there to be less wind, more sunshine and more maintenance of nuclear power plants in Europe. As a result, the Netherlands will produce more electricity from coal- and natural-

gas-fired power plants and import less electricity. This will lead to approximately 4 Mt in additional CO_2 emissions in the Netherlands, in 2020. The sensitivity analysis for 2030 assumes more renewable electricity production in Germany, France and the United Kingdom, as well as more electricity demand due to electrification. This sensitivity analysis shows only a small difference for Dutch electricity production by 2030, compared to the situation under the baseline scenario.

Energy consumption decreases

Energy is used by final consumers (industry, built environment, agriculture and transport and mobility), also known as final energy consumption, and when converting one energy source (e.g. natural gas, coal or oil) into another energy source (e.g. electricity or petrol).

End users consume energy in two ways, namely for final energetic use (e.g. for heating, cooling or mobility and transport) or as a raw material in industry for the production of certain products (e.g. fertilizers or plastics). The final consumption for energetic use in the Netherlands is projected to drop from 1871 petajoules in 2018 to 1740 petajoules by 2030. Approximately half (53%) of final energy consumption in 2018 was used for heating, about one quarter (27%) as motor fuel, and one fifth (20%) as electricity consumption. Most energy is consumed in the built environment (36%), closely followed by industry (29%) and transport and mobility (27%), and much less in agriculture (7%). The decrease in total consumption for energetic use between 2018 and 2030 will mainly be due to the decrease in the energy used for heating. The consumption of energy carriers as raw materials was approximately 530 petajoules in 2018 and is expected to increase to 584 petajoules by 2030.

Primary energy consumption includes final consumption for energetic and non-energetic use and the use of energy for conversion. Primary consumption is projected decrease from 3115 petajoules in 2018 to around 2800 petajoules by 2030. In particular, the consumption of natural gas will decrease up to 2030, while that of oil will decrease by much less. The use of coal will also be substantially reduced by the ban on its use in electricity production. The contribution of renewable energy sources will increase significantly, especially in electricity generation.

Less change in heat supply

The final energy consumption for heating is projected to decrease from 1008 petajoules in 2017 to 903 petajoules by 2030. The national heat supply will continue to be dominated by natural gas; its share will decrease slightly from 76% in 2017 to an expected 68% by 2030 (under established and proposed policy). The share of renewable energy is projected to double from just under 6% in 2017 to around 13% by 2030. Therefore, up to 2030, the growth rate of renewably generated heat will be far slower than that of renewable electricity (the latter share will be over two thirds, by 2030).

The share of renewable energy in district heating is projected to increase from 20% in 2017 to more than 50% by 2030. The scale of district heating in the Netherlands is limited and amounts to only a few per cent of the total final energy used for heating.

Energy saving shows a varying picture

Records on saving primary energy consumption have been kept for many years and are therefore a good indicator of long-term performance. The Dutch protocol for monitoring energy saving (Protocol Monitoring Energiebesparing (PME)) adds up all the energy being saved, regardless

of the reason why it is being saved. The rate of saving, according to PME, is expected to be around 1.5% over the 2013–2020 period – which is considerably higher than the 1.1% between 2000 and 2010. This difference is mainly due to the Energy Agreement. Because this 2013 agreement contains no new policies, and any possible new policy for the 2020–2030 period as yet has not been taken into account, the savings rate for the 2020–2030 period decreases to an annual average of 0.9%.

The European Union has set itself the target of saving 32.5% of its energy consumption by 2030, compared with 2007 levels, which has been recorded in the in 2018 revised Energy Efficiency Directive. According to Article 3 of this Directive, Member States must stipulate their intended level of national final and primary energy consumption for 2020 and to indicate the national level they are aiming for, for 2030. The Netherlands is expected to achieve its indicative national target for final consumption by 2020, but not for primary consumption. The policy assumed in the KEV 2019 is insufficient to achieve the indicative national final and primary levels for 2030.

Article 7 of the Directive obliges Member States to make an additional saving in final energy consumption – added together over several years for a given period. Only the effects of national policy are taken into account. The effects of European policy and autonomous saving are not taken into account. The Netherlands is projected to achieve its target for the 2014–2020 period, but the policy assumed in the KEV 2019 is projected to still be inadequate for achieving the target for the 2020–2030 period.

Finally, the Energy Agreement formulates a target to save an additional 100 petajoules by 2020. This year's KEV projects this saving to amount to 80 [48–111] petajoules. Although 2020 is in the near future, the estimated saving will still have a large bandwidth, which indicates that there is a relatively high degree of uncertainty. Four major measures – European standards for cars, a covenant for households, better enforcement of the Environmental Management Act and energy-saving agreements in large industry – together, may deliver a saving of 40 petajoules. A large number of smaller measures will result in another 40 petajoules. Given the limited progress regarding the expected saving between NEV 2017 (75 petajoules by 2020) and this KEV 2019 (80 petajoules) and the limited time up to 2020, the likelihood of achieving this goal does not seem very large.

Energy is an important sector for the Dutch economy

Trade in energy products, such as coal, oil products and natural gas, plays an important role in Dutch imports and exports. In 2018, the total value of imported energy products accounted for 11% of total Dutch imports. Some of these products are shipped directly to neighbouring countries, while others are processed from various raw products into high-quality products that are then also partially exported. The export value of the transit of energy products and the processed energy products accounts for 9% of the total value of Dutch exports. Most of this still concerns the conventional energy carriers; oil, coal and natural gas.

Energy is also capital-intensive. Over 8% of all investments in the Netherlands are energy-related. Half of this is now invested in renewable energy and energy saving, a quarter in conventional energy and a quarter in infrastructure. These investments are growing rapidly: from EUR 12 to 13 billion between 2014 and 2017 to approximately EUR 16 to 17 billion in 2020 and beyond (figures are in current prices). This increase is mainly due to an increase in investments in renewable energy and

energy efficiency in the proposed policy up to 2030. The energy sector is thus making an increasing contribution to the renewal of our economy.

The energy sector makes a total contribution of 4% to 4.5% of GDP, over the 2018–2030 period. Up to 2014, this contribution was higher due to natural gas production. The contribution of conventional energy will decrease to around 1.6% of GDP between 2020 and 2030, renewable energy will increase to 2% over this period, and energy saving and energy infrastructure will each contribute around 0.5% by 2030.

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