Ministry of Economic Affairs

Energy Agenda

Towards a low-carbon energy supply

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Summary

1. The transition to a low-carbon energy supply in 2050

Our energy supply is going to change fundamentally over the coming decades. The Paris Agreement on climate change has set a target of limiting global warming to well below two degrees Celsius, with a view to achieving a maximum temperature increase of one-and-a-half degrees Celsius. This requires a drastic reduction in the use of fossil fuels, to close to zero by the year 2050. By then electricity will be generated sustainably, buildings will mainly be heated by geothermal energy and electricity, businesses will have adapted their production processes, natural gas will no longer be used for cooking and the cars on the road will be almost exclusively electric.

The transition to a low-carbon energy supply requires a huge effort from the general public, businesses and public authorities. The task is a complex one: timely development and wide availability of sustainable alternatives, major investment in areas such as insulation, installations and production installations, and infrastructure and – in this densely populated country of ours – continuous assessment of the spatial effects. First and foremost the energy transition is a major social challenge: it encroaches directly onto people's daily lives and living environment. A transition of this scope can only happen if the energy supply remains affordable, reliable and safe.

The energy transition has been set in motion globally and this process will continue, irrespective of geopolitical uncertainties. The Dutch government has no wish to adopt a wait-and-see attitude, but has chosen to respond proactively. This is because the energy transition offers many great opportunities, if we can pool and increase the available knowledge and skill, capabilities and arrangements. This requires new and fruitful partnerships between businesses, knowledge institutes, civil society organisations and public authorities. In this way the transition becomes more than just a change of energy sources, it becomes an (innovative) process that increases the power of the Dutch economy and society.

This requires a clear, long-term perspective offering certainty to businesses having to invest, directors having to make decisions and the general public facing important choices. The successful Energy Agreement for Sustainable Growth provides this certainty up to the year 2023, so the first important steps in the transition have been taken, but the major challenges still lie ahead of us.

The main features of future energy policy for the period to 2050 were outlined in the Energy Report. These features were discussed in detail in the Energy Dialogue, the outcomes of which have been building blocks for the Energy Agenda. The Dutch government intends using this agenda to outline a clear, ambitious perspective towards 2030 and 2050.

2. Targeting CO_2 reduction

During the energy transition in the years up to 2030 and 2050, the government will be targeting a single goal: reducing emissions of greenhouse gases (targeting CO_2 reduction). This is because it is the most cost-effective way of achieving the aim of the Paris Agreement on climate change.

It is clear that a serious commitment must be made to energy conservation and also that major investment is needed to increase the share of renewable energy in the energy mix. The great social, economic and technological uncertainties mean it is impossible to determine the optimum ratio of energy conservation to renewable energy in advance. The best possible and most cost-effective mix of energy conservation, renewable energy and other low-carbon options will arise in the market by targeting CO_2 reduction. Targeting CO_2 reduction must be a key part of European energy and climate policy and this is what the Netherlands' efforts in Europe focus on.

In theory the European emissions trading system (ETS) is a good tool for effective CO_2 reduction. Currently, the CO_2 price in the ETS is low because of the great supply of emission allowances relative to demand. This is expected to remain the case in the coming years. Even in the long term therefore the ETS does not provide sufficient incentive to achieve significant CO_2 reduction in the European Union (EU). The Dutch government is aiming for an ambitious strengthening of the ETS by tightening the annual reduction percentage and cutting the surplus of allowances.

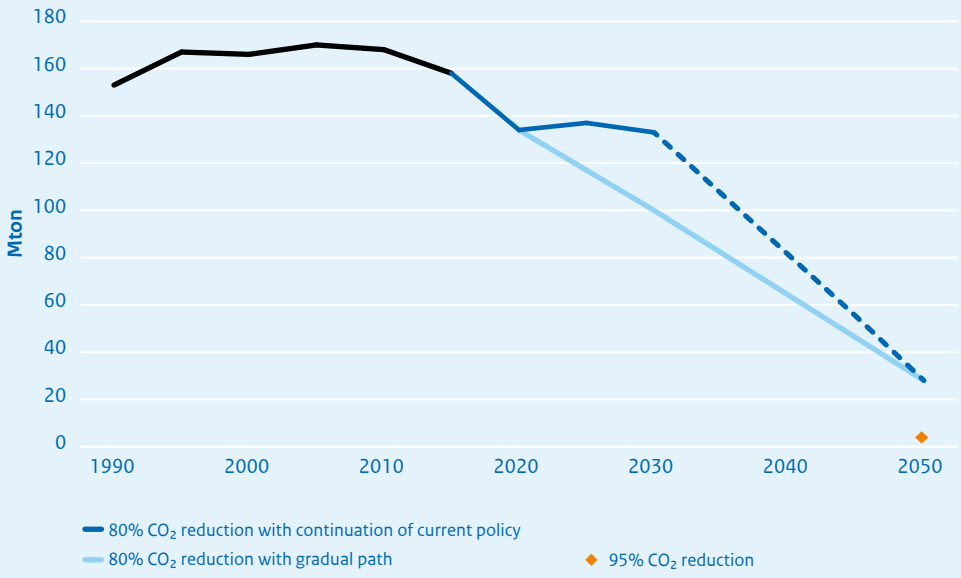
3. Need for a gradual and therefore timely transition in the Netherlands

Even if the CO_2 price rises by tightening the ETS, the incentives for contributing to CO_2 reduction for Dutch energy producers and the energy-intensive industrial sector will be limited for the time being. This is because power stations and businesses in the Netherlands are very efficient in European terms. The ETS gives all the Member States the same target, whatever the starting position. Dutch businesses are therefore among the last in the EU to have any incentive to reduce their CO_2 emissions. Without additional policy CO_2 emissions in the Netherlands – especially in these sectors – are not therefore expected to fall towards 2030. Expectations are that these emissions may even rise further in line with economic growth. The 2050 task consequently becomes greater, while the time remaining to make the transition is actually decreasing. An energy transition started in good time, which would therefore be more gradual, on the other hand, could be advantageous in terms of controlling costs and also provide a chance to exploit the economic opportunities.

The Netherlands therefore has an economic interest in an energy transition started in good time which is more gradual. This challenge is most patent in the ETS functionalities (power and light and high-temperature heat). The transition path towards 2050 in the non-ETS sectors of low-temperature heating and transport also requires close examination. Additional CO_2 reduction will be achieved in these sectors if current policy is continued, even though additional efforts are needed to achieve the national target for

2030 that Europe has proposed. The question though is whether meeting this target is sufficient to start the transition towards 2050 in an economically sensible way. These sectors are facing a major task and a long investment depreciation period. It is therefore advisable to lay down additional policy for these sectors too, and in its implementation to make choices aimed at a cost-effective implementation of the transition towards 2050. In this way a contribution can also be made towards strengthening social awareness of the energy transition and developing a good perspective for action for the general public and businesses.

Figure 1 *Development of energy emissions in the Netherlands*



Source: For the period 1990-2030 ECN (2016). An estimate has been made for 2050 on the basis of RLI (2015) and CPB/PBL (2015). The intervening years are based on a linear path.

Shifting the perspective from hitting targets in the relatively short term (the targets in the Energy Agreement for 2020 and 2023) to the desirable required transition in 2050 shows that the Netherlands has an economic interest in speeding up the transition. It is important that the investments made in the coming years are appropriate to a low-carbon economy in 2050, also with an eye to preventing disinvestments in the future. The additional policy considered necessary is therefore not prompted primarily by the global climate perspective – the contribution the Netherlands can make is limited – but by the wish to exploit economic opportunities and to prevent shock effects in the Dutch economy.

Given this long-term perspective, the obvious choice in the long term is to develop instruments aimed at the transition to a low-carbon energy supply in 2050. A greater emphasis on the policy aiming at the development and further development of new technologies and the exploitation of economic opportunities is clearly called for. To effectively harness innovation a number of long-term, mission-driven innovation programmes must be initiated. The development of radical innovations takes a long time, which is why it is important to provide better incentives for the development of relatively unknown, but potentially highly promising technologies in the framework of CO_2 reduction. As a result the transition to a low-carbon energy supply will be realistic, affordable and potentially profitable as well. The efforts in research and innovation (such as the top sector policy) will therefore be directed more towards CO_2 reduction and the long term (2050). The Dutch government is aiming for strategic international cooperation to bring promising international projects and research funds to the Netherlands.

The choice for all sectors, for now, is additional policy consisting of a mix of carrots (incentive measures) and sticks (regulation and obligations) that is in keeping with a gradual transition towards 80% to 95% CO_2 reduction in 2050. This policy is laid down in so-called transition paths. In the Energy Agenda these transition paths have been set out in broad terms for the four functionalities. The Dutch government will analyse the costs of the transition to a low-carbon society in 2050 in more detail in the first half of 2017. Based on these broad terms and assessment of the costs, we will consult the general public, businesses, knowledge institutes, civil society organisations and local and regional authorities. This should ultimately allow us to mutually determine for each functionality the ambitions and transition paths worked out in greater detail, leading up to 2030 and 2050. The innovation tasks will form an integral part of these transition paths.

4. The tasks towards 2050 for each functionality

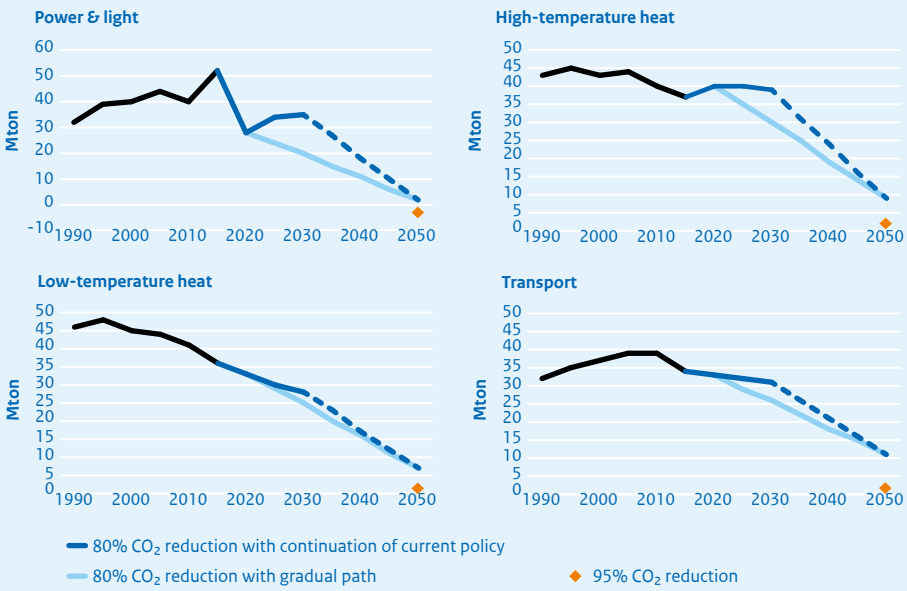
A. Power and light

For the "power and light" functionality (the electricity sector) there are three key elements in the transition:

- making the production of electricity low-carbon;
- improving the functioning of the (Northwest) European electricity market;
- adapting the electricity system to the increasingly decentralised supply and the need for the system to become more flexible.

The Energy Agreement will produce a significant reduction in CO_2 in this functionality in the coming years. However, the ETS is not expected to provide sufficient incentive to make sufficient progress towards the energy transition in this functionality leading up to 2030 as well.

Figure 2 *Development of the CO_2 reduction in the four functionalities*



Therefore policy supplementary to the ETS is and will continue to be necessary. The Dutch government is opting for the following measures:

- Continuing to promote renewable energy by extending the successful renewable energy production incentive scheme (SDE+), even after the Energy Agreement has expired. We will be examining whether it is possible, while retaining the SDE+ methodology, to extend the scheme to other technologies that also contribute to CO_2 reduction towards 2050.
- Continuing to seek collaboration with our Northwestern European neighbours to prevent competition for subsidy tools between countries.
- Continuing the large-scale rollout of offshore wind energy according to the current approach after 2023.
- Exploring how the successful offshore wind approach can also be deployed in the rollout of other forms of offshore and onshore renewable energy generation.
- Finally, continuing to encourage local renewable energy production. A decision on the design of the incentive policy for local energy will be taken in 2017 based on the evaluation of the netting scheme.

B. High-temperature heat

The Netherlands has a large, export-oriented, internationally competitive energy-intensive industrial sector. The Dutch government sees potential for retaining this industrial sector in the Netherlands, provided that production is on a low-carbon basis. The energy-intensive industrial sector is facing a major, complex transition task that requires breaking with past practice. This is because, in spite of a slight fall in CO_2 emissions in recent years, the CO_2 emissions of the industrial sector are expected to rise rather than fall in the coming years. The ETS does not provide enough of an incentive to drastically reduce CO_2 emissions.

To prevent rising costs of an abruptly necessary transition after 2030 and to benefit from the economic opportunities that the energy transition provides, more is needed than simply strengthening the ETS. The industrial sector must invest in CO_2 reduction, but also retain its earning potential and competitive position. Consequently, the approach to the industrial sector transition will be one consisting of a mix of incentive measures and regulation and obligations.

The main measures are:

- The prevention of CO_2 emissions through:
  - an ambitious commitment to energy conservation, for example by continuing the obligation or performance agreement for energy conservation (Energy Agreement) and possibly a less degressive energy tax rate (with a view to a level playing field in relation to other Member States);
  - developing and rolling out alternative heating options, such as the application of ultra-deep geothermal heating and the better use of residue streams.

- Capturing and storing CO_2 (CCS: carbon capture and storage) in cases where there are no low-carbon alternatives available. The Dutch government is aiming for the implementation of an offshore carbon capture and storage demonstration project near Rotterdam (ROAD) as a first step towards a wider and more large-scale CCS network.

C. Low-temperature heat

In the built environment the aim is for a drastic reduction in heating demand through energy conservation and a sharp reduction in natural gas use by boosting and incorporating low-carbon generation of electricity and heating.

The first pillar for CO_2 reduction in the built environment is energy conservation, which can be promoted in three ways:

- imposing a minimum;
- encouraging exceeding that minimum;
- removing bottlenecks in the rollout of specific technologies.

The Dutch government is preparing legally binding measures, such as a minimum energy label for housing organisation dwellings and for office buildings. The suitability of this for other property sectors is also being explored. The Dutch government is also continuing and expanding conservation incentives through information, grants (such as the Owner-Occupied House Energy Conservation Incentive Scheme), low-interest-bearing loans (such as the National Energy Conservation Fund) and support of innovative approaches.

The second pillar for CO_2 reduction in this functionality is a sharp reduction in the use of natural gas. To achieve this the government is opting for the following measures:

- In principle new gas infrastructure will no longer be created in newly built residential districts. The Gas Act will be adapted accordingly, preventing the task from becoming even greater.
- The requirement in the Gas Act to provide a gas connection will be replaced by a broader right to a heating energy infrastructure connection.
- Municipalities will be given the responsibility and the necessary powers to decide on the local energy supply at local level, in cooperation with the network operator.
- Preparations are being made for regulating large-scale heat networks in due course in similar fashion to electricity and gas networks, allowing a more comprehensive comparison between these energy infrastructures.

The transition of the low-temperature heat supply will largely take place at local level. A significant role has been set aside for municipalities and network operators. An optimum division of tasks and responsibilities will be considered in conjunction with these parties when working out the details of the transition path.

D. Transport

The mobility and transport sector still mainly runs on fossil fuels. Additional policy is needed to implement the transition to a sustainable sector by 2050: for more fuel saving, sustainable biofuels and the use of zero emission vehicles. Implementation of the Sustainable Fuel Mix report is the starting point.

Intensification of the transition will take place through the use of new techniques, efficiency measures and behavioural interventions, so that fewer movements take place and fewer (fossil) fuels are consumed. Aiming for timely innovation within the different modes of transport is necessary if the targets for 2030 and 2050 are to be achieved cost-effectively. European and international agreements are an important basis for further reductions in the mobility sector. The Dutch government is therefore advocating stricter European standards and effective global mechanisms. It is aiming to roll out a national network of alternative fuelling and charging infrastructure.

5. The responsibilities in the energy transition

The Netherlands will only achieve the transition if all parties – the general public, businesses, knowledge institutes, civil society organisations, municipal and provincial authorities and central government – are willing and able, based on their own responsibility and competence, to contribute to it. This requires good organisation of the energy transition at European, national and regional level. A truly effective climate policy – and therefore an affordable low-carbon energy supply – can only be achieved at an international level. Agreements must be made at European level about the implications of the Paris Agreement and in addition to this close cooperation is required at a Northwestern European level. This is necessary to prevent leakage effects, to guarantee a level playing field and to make the most efficient choices. In this way we can ensure an affordable energy supply and a sustainable, competitive Europe.

At national level the energy transition requires a clear vision and consistent policy. The Energy Agenda provides this vision, which will be developed in further detail together with civil society organisations. There must be a guarantee that the energy transition, as a development that cannot be stopped, continues even when the Dutch government changes political colour. The general public, businesses and local government must sense the urgency and see the opportunities to take further steps in the transition to a low-carbon energy supply.

Statutory assurance of targets, institutions or policy may contribute to this, as it gives a sign of political commitment and stresses the need for and the urgency of the transition. The long-term climate targets of the energy policy are however already embedded in law through ratification of the Paris Climate Agreement. The EU is converting them into specific targets for 2030 and 2050 and as a result they are already legally binding for the Netherlands.

Following on from the Energy Agreement it would seem logical to implement the energy transition in cooperation with municipal and provincial authorities, civil society organisations and businesses through broad social agreement. Implementation in subagreements or regional agreements with customisation for each functionality towards 2030 and 2050 is an obvious strategy.

Realisation of the energy transition will largely take place at regional and local level. The task is to provide scope to municipal and provincial authorities and regional and local civil society organisations, and simultaneously at central government level – through financial, substantive and spatial framework creation – to aim for solutions that are better or more efficient on a supraregional or national scale.

In the coming months the Dutch government will continue to consult parties, with reference to the Energy Agenda, about the further details regarding institutions and transition paths, also considering the method of assurance.

1

Introduction

Substantial investments and major opportunities

Climate change is having a substantial impact on man and nature: sea levels are rising, the weather is becoming more extreme and biodiversity is in decline. The Netherlands has therefore committed itself, through the Paris Agreement on climate change, to limiting global warming to well below two degrees Celsius, with the aim of limiting this temperature increase to one-and-a-half degrees Celsius.

The emission of greenhouse gases must be cut drastically. The energy transition needed for this requires huge efforts from businesses, public authorities and the general public and substantial investments as well. They will only happen if sufficient certainty is provided by a clear vision and a long-term perspective, supported by the general public and businesses.

The energy transition may require investments, but also presents opportunities for Dutch society and the economy. The Energy Agenda analyses these opportunities and considers the conditions for exploiting them.

The climate targets for CO_2 reduction will stimulate the energy transition. The climate task of course goes beyond the energy-related activities. It includes issues such as the reduction of non-energy-related emissions of greenhouse gases in the agricultural sector, making materials more sustainable and climate adaptation. Conversely, the scope of the energy issue is also more than climate alone. The energy supply for instance must first and foremost be affordable, reliable and safe. Only then can we fulfil the intended CO_2 ambitions for 2050.

Global impact

The energy transition is pre-eminently a global process with many uncertainties and major implications. For the first time the United Nations adopted a global target in 2015 for increasing the sustainability of the energy sector, as part of the universal sustainable development agenda until 2030. The global energy transition will continue, despite the geopolitical uncertainties. The Netherlands has no wish to adopt a wait-and-see attitude and has chosen to respond proactively.

In the next 15 years more than 23 trillion euros will have to be invested globally in energy infrastructure. This entails a quadrupling of current investments per year. The choices that different countries, and in particular emerging economies, are going to make in this regard will help determine the growth of global energy consumption and greenhouse gas emissions in the coming decades. Note that globally the use of energy continues to be extremely varied: around 1.1 billion people have no access at all to electricity and 3.4 billion are still using highly polluting firewood and charcoal as cooking fuel.

Mutual dependence

Technological breakthroughs, market conditions and geopolitical developments have an impact on the global energy market. Conversely, changes in the energy market, such as substitution of fossil fuels, in turn have an impact on the stability of producing regions. The Dutch energy position in the world will also change as a result. The Netherlands will have to decide how to deal with the opportunities and threats associated with the global energy transition.

1.1 National energy policy

National policy within European and global frameworks

The basic conditions for energy policy in this country are largely determined by European frameworks. These in turn come about in a global context. There is scope for national policy development within these international frameworks. The Netherlands must especially seek collaboration at European level in this regard, in particular in Northwestern Europe. This will continue to be necessary in the coming years.

Energy Agreement

With the implementation of the Energy Agreement, with targets aiming at 2020 and 2023, important steps have been taken in the field of renewable energy production, energy conservation and innovation. The process to date shows that although the transition is causing friction in some respects, for example in the debates about onshore wind, this is also accompanied by new opportunities, such as the scaling up of offshore wind. The agreements and implementation of the Energy Agreement remain in full force.

As a result of implementing the Energy Agreement the share of renewable energy will rise sharply: from 4.5% in 2013 to 15.9% in 2023. Thanks to the new tender system the successful offshore wind approach has already led to the desired cost reduction of 40%. This was only anticipated for a period of ten years. Annual energy conservation of 1.5% is being achieved and the target of 100 PJ additional energy conservation by 2020 is within reach. The energy transition has major positive economic effects. Under the influence of the policy up until 2023 the added value of renewable energy is growing by 10% to 20% annually. The target laid down in the Energy Agreement of 90,000 additional years of employment up until 2020 will be achieved.

Energy Report

The Energy Report lays down the Dutch government's vision for the period after the Energy Agreement up until 2050. The future will be low-carbon. The question is how we make a concerted effort to implement it and how the Dutch economy can best benefit from this.

Energy Dialogue

Through the Energy Dialogue this has been discussed with businesses, organisations and the general public, and work has been done on increasing the "ownership" of the energy transition. Apart from the parties to the Energy Agreement, new groups (local initiatives, involved economic operators, the general public, students and youth) have also been reached. The public perspective of the transition has added a new dimension to the transition task. The Energy Dialogue is an important building block for this Energy Agenda and provides a basis for further broad social commitment of public authorities, the business community, organisations and the general public in the next steps in the energy transition.

1.2 The Energy Agenda

The long-term objectives must now be implemented, as detailed in this Energy Agenda. It directs future policy on important topics and for each functionality: low-temperature heat, high-temperature heat, power and light and transport. A clear course is crucial to provide perspective and long-term certainty to businesses and the general public, who are investing in such things as low-carbon production processes, wind turbines, solar panels and electric cars.

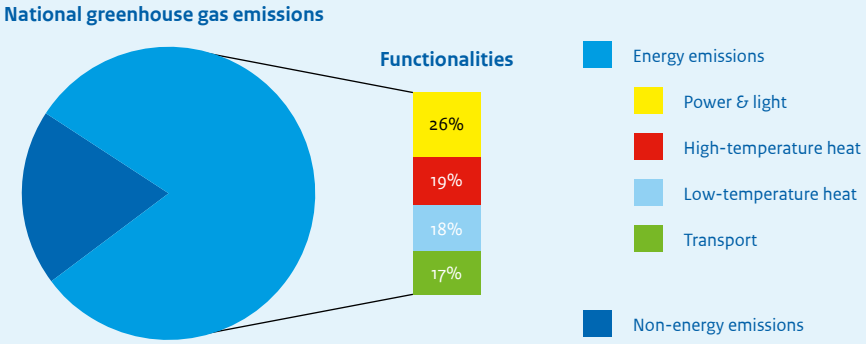
The Energy Agenda describes the choices to be made and the steps that must in any event be taken. The transition path towards 2050 and the associated policy efforts and other efforts are outlined for each functionality. The coming years will be used to implement them further in dialogue with local government, the general public, businesses and institutions and knowledge institutes.

The Energy Agenda is based on overarching themes for the entire energy transition, considering the following questions:

- What does targeting CO_2 reduction entail and what does it mean in practice for the four functionalities?
- In what way can the energy transition be organised? *(governance)*
- How can the energy transition be incorporated spatially? *(regionally, space)*
- How can the technological breakthroughs be achieved? *(innovation)*
- How can the investments be realised? *(financing)*

Box 1. Greenhouse gas emissions and the four functionalities

In 2015, greenhouse gas emissions in the Netherlands amounted to 196 megatonne CO_2 equivalents. The major part of this is associated with the use of energy and can roughly be attributed to four functionalities: power and light (electricity), high-temperature heat (process heat), low-temperature heat (space heating and tap water) and transport and mobility (transport).



This subdivision into energy functions makes our energy demand transparent and helps us decide in what area action is needed to effect the transition to a low-carbon energy supply.

The National Energy Outlook 2016 (NEV) outlines current expectations with regard to CO_2 emissions. For this Energy Agenda the Netherlands Energy Research Centre (ECN) has made an indicative breakdown of the results from the NEV for the different functionalities.

Finally, where this Energy Agenda refers to reducing CO_2, this also means greenhouse gases or CO_2 equivalents. Where reference is made to limiting emissions, it can mean both preventing greenhouse gases from being created and their storage. The Energy Agenda does confine itself to the energy-related emissions and absorption of greenhouse gases and does not consider such matters as the consequences of changes in land use.

2

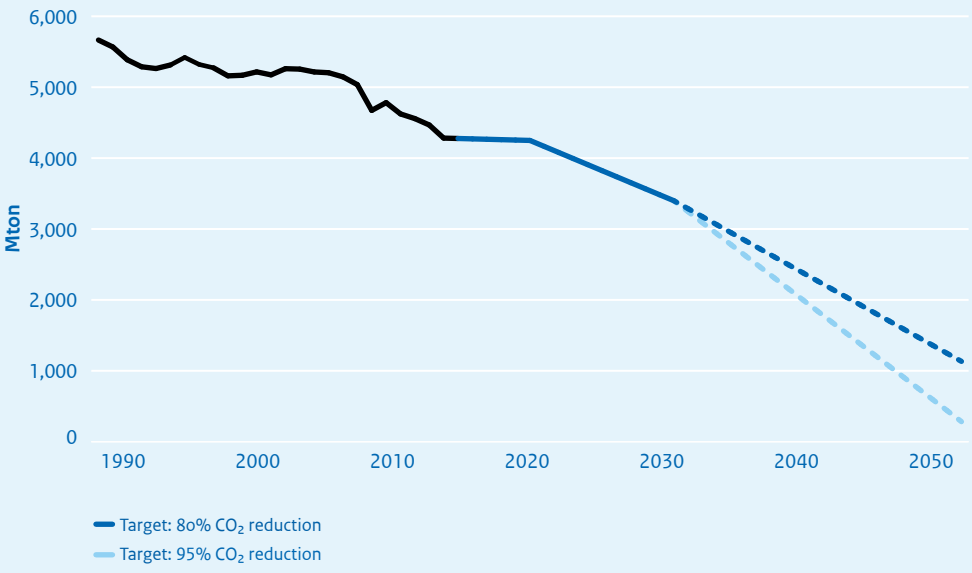
What are we aiming for?

2.1 The task leading up to 2050

In the 2015 Paris Agreement on climate change it was agreed to limit the rise in average global temperatures to well below two degrees Celsius, with the aim of limiting it to one-and-a-half degrees Celsius. This aim probably means that the corresponding ambition for CO_2 reduction for the European Union will be at the top end of the current European ambition of 80–95% CO_2 reduction by 2050.

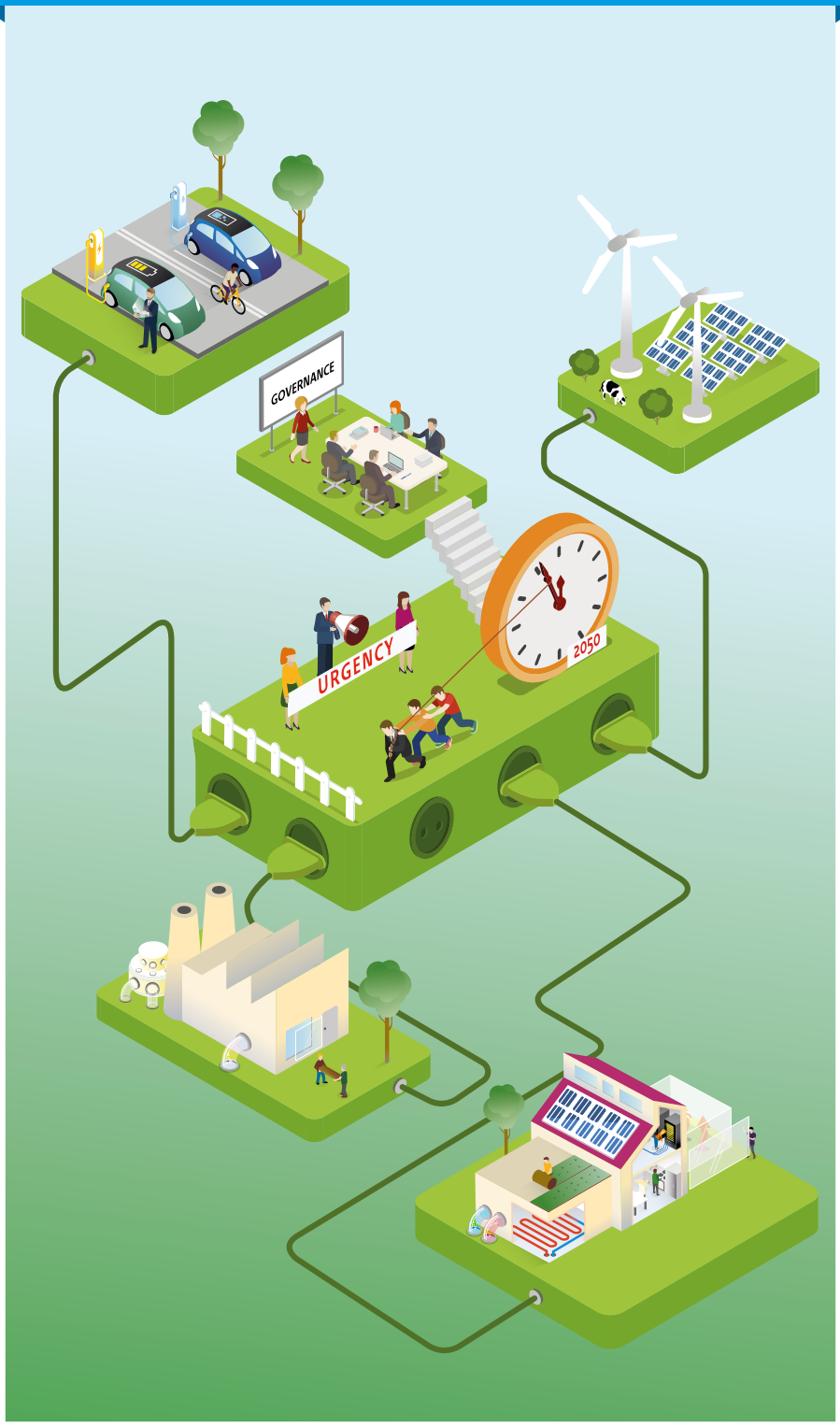
The task facing Europe in the next 34 years is substantial. The European economy must become low-carbon in a short time. Figure 3 emphasises this. It shows the development of European CO_2 emissions up until 2013 (actual) and 2020 (expected). And it also – dotted line – shows how these emissions will develop to 2030 and 2050 with current European ambitions: 40% and 80% or 95% reduction of greenhouse gases compared with 1990 respectively. The current ambition of at least 40% reduction of greenhouse gases in the EU by 2030 (compared with 1990) lies on the gradual transition path to a reduction of 80% by 2050.

Figure 3 *Development of European greenhouse gas emissions*



Source: Compendium for the living environment (1990-2014), European Commission (2015-2030).
The period between 2030 and 2050 is based on European ambitions for 2050.

Aiming for CO_2 reduction



The possibility of raising the European climate targets for 2050 and 2030, as a result of the Paris Agreement, will take place in the framework of the facilitating dialogue on this in 2018 and the first five-year revision of the national contributions in 2020. If this discussion results in an ambition towards 95% reduction of greenhouse gases by 2050, the effort will be even greater. In that case the CO_2 emissions related to the energy supply are expected to have to fall to zero by 2050 because the scope for reducing greenhouse gases not related to the energy supply (such as agriculture) is more limited.

2.2 Underlying principles

The global target for 2050 has been set in the Paris Agreement and the Netherlands must contribute to it too. The following underlying principles are guiding in this regard:

- energy and climate policy is international policy;
- CO_2 reduction is key;
- a long-term vision is essential.

2.2.1 Energy and climate policy is international policy

Climate change is an international challenge since greenhouse gas emissions pay no heed to national borders and energy markets are very interconnected. In addition, greenhouse gas emissions in the Netherlands are just 0.5% of global emissions and those of the European Union 10.5%. An effective approach can therefore only take place at an international level.

The Dutch energy system is closely interconnected with the European energy market, in particular with the Northwestern European market. National measures consequently have little effect. A major part of the national electricity demand may, for example, be generated in surrounding countries. If we close coal and gas-fired power stations for instance, the electricity required may be imported and may then originate from less efficient conventional power stations. In that case there is certainly CO_2 reduction in the Netherlands, but none or very little at European and global level.

This does not discharge the Netherlands from its responsibility to contribute to the social challenge of climate change, but it does mean that a low-carbon energy supply can only be achieved at international level. By making agreements at European level the scope for achieving CO_2 reduction in different Member States can be weighed against each other, international leakage effects can be addressed and a level playing field can be ensured. This is important for an affordable energy supply and a sustainable, competitive Europe. The details of Dutch energy and climate policy therefore largely follow from agreements in the European Union.

2.2.2 CO_2 reduction is key

The Dutch government wants to focus its policy exclusively on CO_2 reduction and does not want any more national targets, binding or otherwise, for renewable energy and energy conservation for the period after the Energy Agreement. This focus will prevent unnecessarily high costs (see Box 2). This is essential because the energy transition already requires very significant investments from businesses, the general public and public authorities. A cost-effective policy will then ensure an affordable energy supply.

The Energy Dialogue showed that the general public, businesses and civil society organisations usually endorse the arguments for the focus on CO_2 reduction. They do desire details of what the CO_2 target means in concrete terms for different sectors and measures. First and foremost this requires careful monitoring of what happens with the CO_2 emissions in the energy functionalities. There must also be a view of which cost-effective measures are appropriate in the transition in the short and long term, allowing the CO_2 reduction target to be translated into different policy instruments. In this way the general public, businesses and civil society organisations must be offered a clear perspective for action and investment certainty.

2.2.3 A long-term vision

Towards 2050 there will be many investments in capital goods with a long life, such as dwellings, electricity production and energy infrastructure. Certainty about the ultimate goal is needed to prevent premature depreciation of these capital goods. A clear course in this regard will lead to greater investment certainty and consequently a lower financing burden.

Box 2. The goals of energy policy

European targets for 2030

For 2030 the European Council has adopted the position of setting European targets for renewable energy and indicatively for energy conservation in addition to a target for greenhouse gas reduction. Unlike the situation applying to the 2020 goals, the European Council's idea is that the energy conservation and renewable energy targets will not be converted into nationally binding targets. The 2030 goals will definitely be set in the forthcoming European legislative proposals on energy efficiency and renewable energy.

Energy Dialogue outcomes

During the Energy Dialogue there was much discussion of the goals and ambitions in the area of greenhouse gas reduction in the Netherlands. The agreements about this at a European level (ETS – the European emissions trading system for greenhouse gas reduction that applies to electricity producers and the energy-intensive industrial sector) were also frequently discussed. The option to aim for CO_2 reduction targets was broadly endorsed during the dialogue, as was the fact that ideally this should happen in a European context. The differences of opinion lay mainly in how high to set the ambition level and the question of whether the ETS system will provide the right incentives in good time.

Arguments for using several targets

Arguments for using several targets – alongside a CO_2 reduction target – often reflect doubts whether a single target will actually lead to an optimum policy mix. Such arguments include the following:

- The energy transition would not have had any impetus in recent years without the current renewable energy and energy conservation targets.
- Renewable energy and energy conservation appeal more to the imagination and are therefore more closely aligned with social drivers.
- Renewable energy and energy conservation targets may serve other public interests, such as certainty of supply, affordability of energy, improvement of air quality and economic growth.
- Additional operational targets provide greater investment certainty.

Arguments for using a single target

In European and Dutch energy policy leading up to 2020 and 2023, renewable energy and energy conservation are both a means of achieving CO_2 reduction and an end in themselves. Aiming at more than one target may, however, lead to inefficient outcomes. In the case of a specific CO_2 reduction target, a certain ratio of renewable energy to energy conservation will be cost-effective. However, this optimum ratio can only be determined in retrospect, because of the great social, economic and technological uncertainties. This makes targeting CO_2 reduction alone the most cost-effective method, using measures leading to more renewable energy and energy conservation. It prevents means from being elevated to target.

2.3 A robust European climate policy

The underlying principles outlined above first of all require an ambitious and strategic Dutch commitment to European climate policy.

2.3.1 Energy and climate framework for 2030

At the European Council of October 2014 the EU Member States agreed to adopt a new climate and energy framework for 2030, including EU-wide targets of at least:

- 40% greenhouse gas emission reduction compared with 1990;
- 27% renewable energy;
- 27% energy efficiency (indicative), including an evaluation of whether this should rise to 30%.

The European Commission will shortly be bringing forward legislative proposals which will include these targets and which must be converted into national policy.

ETS and non-ETS sectors

For the 40% CO_2 reduction the EU draws a distinction between ETS (emissions trading system) and non-ETS sectors. The functionalities of power and light and high-temperature heat fall under the ETS and low-temperature heating and mobility under the non-ETS sectors. For the ETS sectors the lower European emissions ceiling means a target of 43% CO_2 reduction compared with 2005. The remainder will be accounted for by the non-emissions trading sectors: 30% compared with 2005. For the non-emissions trading sectors the European Commission will set a binding national reduction target that differs from one Member State to another. For the Netherlands the Commission proposes a reduction target of 36% compared with 2005. Amendment of the legislation for the ETS and the non-ETS targets by which the greenhouse gas reduction target of at least 40% will be implemented is currently under consideration.

Additional legislative proposals by the European Commission

In addition to this the Commission will bring forward a legislative proposal for the governance of the Energy Union. As part of this Member States must draw up energy and climate plans in which they set out how they are contributing to the achievement of the Energy Union goals. The Netherlands sees this as a good way of meeting the European targets both nationally and with neighbouring countries. At the end of this year the European Commission is also expected to make proposals for the guidelines that monitor energy efficiency, the energy performance of buildings and renewable energy. Here too hitting the European targets is key.

The Netherlands must determine its standpoint with regard to the Commission's legislative proposals in early 2017. The Commission's proposals will be assessed on the basis of the conclusions of the European Council of October 2014, the wish of the Dutch government to focus on CO_2 reduction being guiding. It is not desirable to convert the European energy conservation and renewable energy targets for 2030 from the council conclusions into (binding) national targets.

2.3.2 Ambitious commitment to strengthening the ETS

Strong ETS is crucial

An ETS that works well is crucial for an efficient and cost-effective approach to the energy transition. The ETS currently works well for the cost-effective realisation of the desired CO_2 reduction at European level. The absolute ceiling for the emissions – within which ETS businesses may trade emission allowances – allows the ETS to guarantee that the desired CO_2 reduction is achieved at European level. The CO_2 price is a result of supply and demand, allowing ETS businesses to reduce emissions in the most cost-effective way.

Strengthening needed

Targeting CO_2 reduction does however require further strengthening of the ETS. Recent years saw a growing surplus of emission allowances due to lower demand and greater supply. The CO_2 price is therefore low. As a result the current CO_2 price in the ETS only contributes to a limited degree to the use of CO_2-saving measures that are in keeping with the EU's long-term reduction target.

Preventing an abrupt transition

The low price provides businesses in Europe with insufficient incentive to make the necessary long-term investments. There is also a risk that the low price will have a negative impact on long-term confidence in the ETS. Strengthening the ETS may prevent ETS sectors having to make an abrupt transition in the future, when the current surplus of emission allowances on the market has disappeared and the CO_2 price is substantially higher. Not only must the ETS ceiling therefore be in line with the climate ambitions, the ETS must also be strengthened. In this way the ETS can give market participants a sufficiently stable basis for making investments in CO_2-reduction measures.

Current proposals for the ETS

In the summer of 2015 the European Commission put forward a proposal for revision of the ETS Directive for the period from 2021 to 2030. The negotiations relating to this are expected to conclude in the summer of 2017.

Important elements of the revision include:

- Tightening the reduction factor from the current rate of 1.74% per year to 2.2% per year. In this way the reduction target of 43% compared with 2005 for ETS sectors adopted at European level can be achieved in 2030.
- Abolishing the option for businesses to continue using international allowances after 2020 (allowances from outside the EU) to offset their emissions.
- Limiting the list of sectors that are compensated for carbon leakage.

The Netherlands supports these proposals, but also thinks that more is needed due to the importance of targeting CO_2 reduction and pursuing a gradual transition.

Commitment of the Netherlands to further strengthening of the ETS

For the further strengthening of the ETS the preference is for measures aimed at cutting the quantity of emission allowances over measures aimed directly at the price so as not to undermine the cap-and-trade principle of the ETS. The market stability reserve will also act as a tool for increasing price stability in the ETS from as early as 2019.

There are different options for further strengthening the ETS, for example, by tightening the reduction of the ETS ceiling by more than 2.2% per year or by making agreements at European level about removing some of the surplus allowances from the market. Another option is an "automatic" correction of the number of emission allowances in the ETS in proportion to the amount of improvement of the sustainability of the energy supply and the degree of energy conservation. This corrects the price-reducing effect that additional policy has on the CO_2 price within the ETS in these areas. Implementing this option may, however, be complex.

The adjustments referred to above are very ambitious given the forces at play in the EU. Also due to the fact Member States would prefer to await the outcome of the facilitating dialogue in 2018 about the Paris Agreement for the tightening of the linear reduction factor. The Netherlands can, however, seek like-minded countries to implement these adjustments in the current revision of the ETS Directive.

In addition to the above, the Netherlands will aim to prevent proposals in the revision of the ETS Directive that contribute to increasing the surplus of emission allowances in the ETS, such as the European Commission proposal to put allowances that had originally been placed in the market stability reserve back on the market in the period 2021-2030 to finance the innovation fund (NER400) and the newcomers' reserve. The Netherlands also sees the use of ETS allowances to meet the non-ETS task – as proposed by the European Commission in the Effort Sharing Regulation proposal – as an option that may make a modest contribution to cutting the surplus of ETS allowances.

Should the above options for strengthening the ETS prove to lack sufficient support in the EU, the Netherlands is open to other proposals for strengthening the ETS, such as introducing a minimum price in the ETS at EU level, given the importance of reaching a European solution.

Finally, it is important to promote connecting the European ETS to pricing systems in other major economies, in order to work towards effective global pricing of CO_2 and a globally level playing field.

2.3.3 Implications of the Paris Agreement

Under the Paris Agreement on climate change, countries have to say whether they will be raising the national climate contribution (Nationally Determined Contribution/NDC) every five years. The first time this happens will be in 2020. The Intergovernmental Panel on Climate Change (IPCC) has also been asked to report in 2018 on the effects of one-and-a-half degrees Celsius of warming and the related global emission paths. The outcome of the IPCC analysis will be input for the facilitating dialogue in 2018 about the national climate contributions.

The facilitating dialogue is also the time to consider the commitment of the EU in relation to the contribution of other major countries. A timely decision on the implications of the Paris Agreement for the European ambition level is important to prevent uncertainty developing about the ultimate goal. If the EU decides to increase its ambitions, the Dutch government feels that the non-ETS and ETS goals must be adjusted to reflect these.

2.4 Importance of a gradual, and therefore timely, transition in the Netherlands

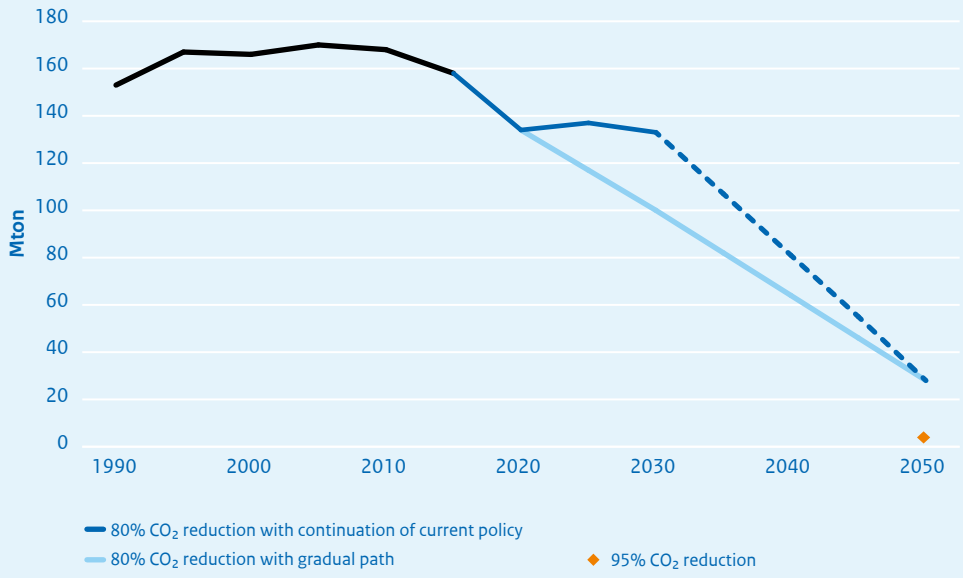
Accelerating after 2030

European policy will set the basic conditions that the national ambitions at least must meet, aiming for a linear transition path leading up to 2050 for the EU as a whole, in pursuit of a gradual transition. Figure 2 shows that current European and national policy in the Netherlands will not lead to a gradual transition, but will actually require sharp acceleration after 2030. This will be the case even with a reduction of 80% in 2050 and applies even more if the ambition is raised towards 95%. If we continue current policy, the reduction in the Netherlands in 2030 will amount to 24% (NEV 2016). This is because the Dutch economy uses fossil fuels relatively efficiently, so Dutch businesses, for example, only experience incentives to cut emissions in the ETS at a late juncture. In principle, this is fine, given the cost limitation of CO_2 reduction in the short term.

Shorter adjustment period

The acceleration however also implies a shorter period for the Dutch energy supply to adjust. Natural replacement points may go unused, resulting in disinvestments or new investments in fossil capacity. As a result the costs may ultimately turn out higher or the task may not be able to be completed in time. Shock effects may also occur if the CO_2-reducing measures can no longer be implemented immediately because of lead times or if the required adjustments have been insufficiently anticipated. In its report "Time for transition" the Dutch central bank (DNB) notes that this may also affect financial institutions through their assets and outstanding loans. As a result an abrupt transition may also have an impact on the economy.

Figure 4 *Development of energy emissions in the Netherlands*

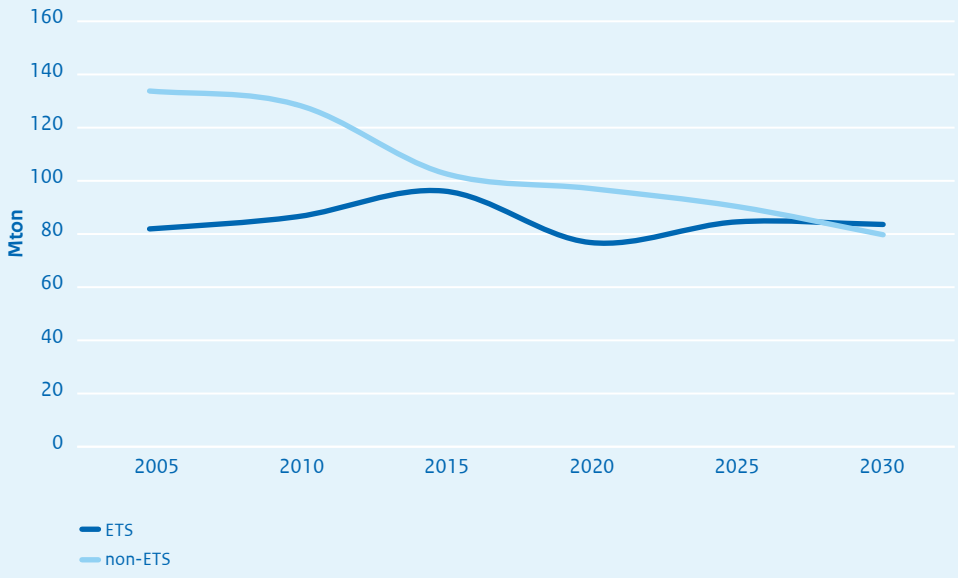


Source: For the period 1990-2030 ECN (2016). An estimate has been made for 2050 on the basis of RLI (2015) and CPB/PBL (2015). The intervening years are based on a linear path.

European frameworks will not ensure a gradual transition in the Netherlands

In the Netherlands the European frameworks will probably not lead to a significant CO_2 reduction, in any event not by 2030, see Figure 2. This is especially true of the ETS sectors. The ETS price is expected to remain relatively low until 2030 and because businesses in the Netherlands will only be among the last to feel incentives from the CO_2 price, CO_2 emissions in the Dutch ETS sectors will rise between 2020 and 2030, despite the achievement (by definition) of the CO_2 ambitions at European level. The national non-ETS target requires an additional effort of, as currently understood, 20 megatonnes (Mt) in the period 2021-2030. The exact effort depends on the outcome of the European negotiations in 2017 and may vary from 0–40 Mt. Without additional policy the CO_2 emissions will remain roughly the same on balance and consequently the pathway of the Energy Agreement will no longer be followed.

Figure 5 *Development of total greenhouse gas emissions in the Netherlands for ETS and non-ETS if current policy is continued and non-ETS target is implemented*



Source: National Energy Outlook 2016 and non-ETS study 2016

Additional policy advisable

The Netherlands has an interest in a transition that is gradual, which requires an early start.. Additional policy is consequently advisable (temporarily) to prevent negative shock effects for the economy and also to exploit the economic opportunities that the energy transition provides. This policy must be in line with the European ambition of 80–95% CO_2 reduction by 2050. The need for additional policy is prompted in particular by economic and technological considerations and less by the climate perspective; given that national policy aiming at CO_2 reduction has a minor impact on the climate. The additional policy must contribute to the prevention of an abrupt transition after 2030 and to ensuring that Dutch businesses remain among the leaders in a low-carbon economy. We have a strong knowledge base and are therefore well positioned for this challenge.

Anticipating new investments

We must ensure that new investments in the coming years are in keeping with a low-carbon economy. In this way we can prevent disinvestments in the future. This is only possible if the Dutch government gives credible direction to its ambitions. At the same time this also means that we must be careful about enforcing disinvestments in the existing infrastructure and production locations since these capital goods usually have a depreciation period in keeping with their ultimate goal. Prematurely writing off these goods is therefore not important for achieving the long-term targets, but will have a negative impact on the affordability of the energy transition.

Greater emphasis on innovation and economic opportunities

Whereas the additional policy currently aims at the renewable energy and energy conservation targets in particular, after 2023 the policy must aim at a gradual transition towards a low-carbon economy by 2050. As Figure 3 shows, this requires an acceleration. Thereby a combination of rollout, basic research, continuing development and demonstration is needed. In this case a greater emphasis on the (continuing) development of new technologies and the exploitation of economic opportunities seems obvious. We must also look at whether the current set of policy tools is future-proof and in keeping with the transition to a low-carbon economy.

Box 3. Taking steps and reducing inefficiencies faster at regional level

The European energy market is becoming increasingly integrated. EU Member States are facing similar challenges in the energy transition to a low-carbon energy supply, for example in dealing with the fluctuating supply of solar and wind capacity. These challenges increasingly require a joint European – or in any event regional – approach to make the solutions more cost-effective, also because sometimes insufficient solutions are available at national level. Where the differences at European level between western and eastern Europe, for example, are often great, regionally these differences are less so.

The Netherlands already has good experience of regional cooperation in such areas as energy market integration and the joint approach to security of supply (see the chapter on power and light). Apart from improving market integration, we must also look at whether this cooperation can be extended to improving the sustainability of the energy supply. This is possible, for example, by cooperating in the field of renewable energy (including offshore wind), energy efficiency and capture and storage of CO_2 (CCS). Greater cooperation with neighbouring countries also applies to socioeconomic aspects, such as support, spatial incorporation and opportunities for the business community. The Dutch energy supply is after all inextricably linked with the energy supply in the countries around us.

Regional cooperation, at Northwestern European level for example, is also important to reduce inefficiencies. At national level, for example, subsidies are often necessary to ensure a level playing field. Coordination of these tools can take place and possibly more stringent tools can also be used at regional level.

Using transition paths

This Energy Agenda contains a very first step to a transition path for each functionality. Transition paths can help clarify what needs to be done leading up to 2030 and ultimately 2050. However, they are not a road map to follow dogmatically towards 2050 since many developments may ensue that will change the final picture. This means that adjustments will only be made if the target for 2050 moves out of reach.

The transition paths must provide the general public, investors and local and regional authorities with greater certainty to be able to make better-informed preparations and decisions. The transition paths also form the basis for government policy regarding the innovation required and the investments in infrastructure. The transition paths require regular adjustment at predetermined intervals. Such “adaptive policy” is needed to include new developments, for example related to technology and international policymaking, in making efficient policy.

Towards detailed transition paths

Subsequent to this Energy Agenda, a rough draft will be made of the transition paths for the different functionalities. The steps to be taken in future will also be indicated for each functionality and for the innovation policy. Before further choices are made for a transition path within the functionalities based on this Energy Agenda, the general public, businesses and the public authorities must be acquainted with the costs of policy options (including the consequences for the national budget) for the entire period of the energy transition. This is important to allow the consequences and costs for the general public and businesses to impact gradually and to limit them as far as possible. The Dutch government will ensure that this insight is provided to best possible effect so that a subsequent government coalition is able to make further choices. Transition paths for each functionality can then be determined on the basis of this in conjunction with local and regional authorities, the general public, businesses, knowledge institutes and civil society organisations.

3

“Power & light” functionality

3.1 Task

The demand for energy for power and light is met almost entirely by electricity. The demand for electricity, however, is broader than just for power and light and will increase in the coming years with the electrification of other functionalities, in particular transport and low-temperature heating. At the same time the demand for electricity will fall through investments in energy conservation. In the National Energy Outlook (NEV) the net increase in the demand for electricity between 2015 and 2030 is estimated at around 3–7%.[1] This increase may turn out to be higher if the demand for energy in the form of electricity for transport and low-temperature heating grows faster or to a greater degree than is assumed in the NEV's scenarios.

Energy conservation and low-carbon electricity production

Drastic reduction of CO_2 emissions in electricity production is necessary to meet the CO_2 target in 2050. Energy conservation and all low-carbon forms of electricity are very important for this. This will involve large-scale investments and complex issues concerning the incorporation of renewable energy sources in the existing electricity system and the physical space. Negative CO_2 emissions can be achieved by using biomass in combination with CO_2 storage.

Intertwined with surrounding countries

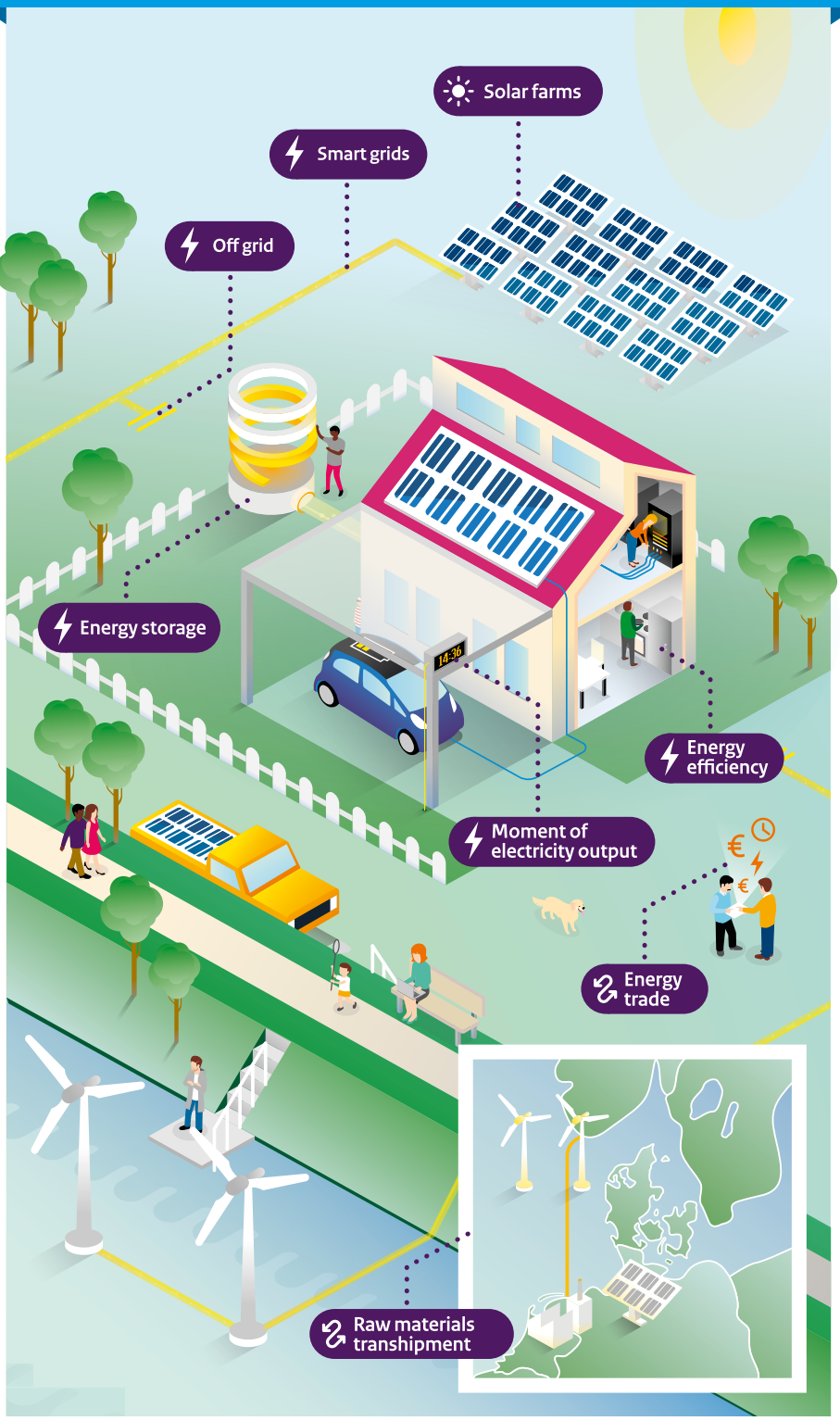
The Dutch electricity market is closely intertwined with the markets of the surrounding countries and through them with the rest of Europe. There is a complex system of producers, suppliers, infrastructure operators, service providers and large-scale and small-scale consumers. The task is to make this entire system low-carbon and at the same time to guarantee reliability and affordability. This requires a commitment along several lines:

- reducing the CO_2 emissions in electricity generation by improving its sustainability;
- strengthening the electricity markets. This means intensifying the cooperation with Member States in the Northwestern European electricity market and better exploiting the flexibility in how and when energy is consumed;
- investing in the transport infrastructure of the electricity system. Adjustments of the regulatory framework for the transport infrastructure will help prevent unnecessarily high social costs.

In addition to national policy, the first two lines, in particular, require close cooperation with surrounding countries for an effective and efficient approach, not just for the climate, but also for our competitiveness.

[1] The NEV 2016 describes a net increase in national electricity consumption between 2015 and 2030, from 115 TWh to 122.5 TWh. In its Security of Supply Monitoring Report TenneT estimates that demand will rise slightly from 113.9 TWh in 2015 to 117.6 TWh in 2030.

Power & light


Solar farms
Smart grids
Off grid
Energy storage
Energy efficiency
Moment of electricity output
Energy trade
Raw materials transhipment

3.2 Transition path: choices and directions

Five directions are outlined for the power and light functionality:

- realising a low-carbon electricity supply;
- continuing and expanding the directive role of government in renewable energy production;
- supporting local energy production;
- strengthening the electricity market system and guaranteeing the security of supply;
- making the electricity system flexible.

3.2.1 A low-carbon electricity supply

National policy with SDE+

Making electricity production more sustainable should primarily be incentivized by the ETS. This after all will lead to the most cost-effective method of CO_2 reduction in Europe. It will also prevent waterbed effects and impairment of Europe's competitiveness. But the CO_2 price will – in any event up to 2030 – probably remain too low to be an incentive for market participants in the electricity sector to invest in drastic CO_2-reducing measures. After all, electricity generation using low-carbon sources such as sun, wind, water, biomass and geothermal heat in most cases continues to be more expensive than electricity from fossil sources. This is why additional policy for the promotion of low-carbon electricity is temporarily required for a gradual transition leading up to 2050. The successful subsidy instrument Renewable Energy Production Incentive Scheme (SDE+) is the designated instrument for this.

In 2015 the share of renewable electricity was around 12%. As a result of the Energy Agreement this percentage will rise to around 41% in 2023.[2] The SDE+ has played an important role in this: it is a cost-effective tool for the rollout of renewable energy production and is therefore being imitated in other countries. The Dutch government wants to keep the SDE+ as its primary tool after 2023. It will accelerate the rollout of renewable electricity production as long as the ETS fails to provide sufficient incentives for this.

The focus on competition and technology neutrality will be maintained. When promoting low-carbon electricity production the Dutch government wants to cooperate with neighbouring countries so that there is no competition between countries based upon subsidy instruments. The strong international connectedness of the Dutch electricity market provides opportunities to do so.

[2] NEV 2016, table A.13, p. 170.

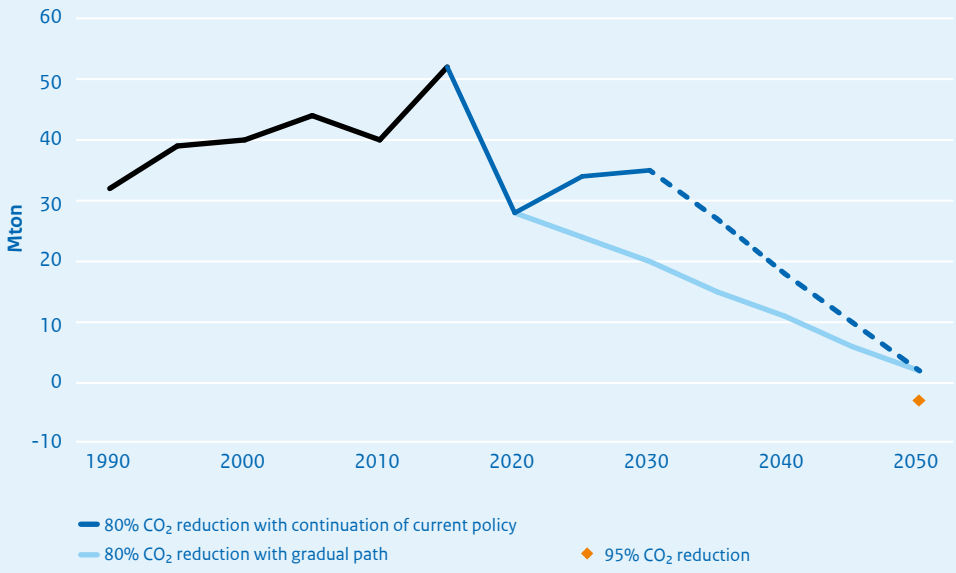
Diversified set of tools for CO_2 reduction

If CO_2 reduction becomes the main aim of energy and climate policy after 2023, the aim of the SDE+ will also shift: from focusing on renewable energy alone to focusing primarily on CO_2 reduction. With the shift other CO_2 emission-reducing measures also come into view, such as energy conservation and carbon capture and storage (CCS).

The Dutch government is considering whether and if so how it is desirable to focus the SDE+ more on CO_2 reduction. The options for CO_2 reduction can be assessed against each other within a single tool. It may, however, be more efficient to use a diversified set of tools because the SDE+ methodology is not applicable to everything. In the SDE+ for example the measured amount of electricity produced is key, while energy conservation cannot be measured in this way. It must also be seen whether an operating subsidy is the preferred instrument and how feasibility and maintainability can be assured.

Cutting back on electricity use is part of more general European and Dutch conservation policy. This includes energy audits and product standards.

Figure 6 *Development of CO_2 emissions for Power and Light*



Source: For the period 1990-2030 ECN (2016). An estimate has been made for 2050 based on the WLO. The intervening years are based on a linear path.

- Promoting renewable energy production through the SDE+ will continue after 2023 and therefore also the commitment to promoting further cost reductions for the rollout of renewable energy production through innovation.
- Consideration will be given to the way in which the current set of tools (SDE+ in particular) can focus more strongly on CO_2 reduction in the future.

3.2.2 Continuing and expanding managing role of government in offshore wind energy

Strong management successful

The government had a strong directing role in the rollout of offshore wind energy and was actively involved in the choice of location, the removal of risks and promotion of competition between developers. Strong direction ensures spatial incorporation and a substantial cost reduction. Given this success, strengthening and continuing this approach in the future is desirable. The extent to which this approach is also possible in rolling out other forms of offshore and onshore renewable energy generation, such as tidal energy, onshore wind energy, large-scale solar energy and geothermal heat, will also be explored.

Road map for 2023-2030

For the rollout of offshore wind energy work will be done on policy in the form of a road map for the period 2023-2030 and a look ahead at the period 2030-2050. Completion of this and decision-making on it in 2017 means that a first tender can take place in 2020. This will guarantee the continuity of the rollout of offshore wind energy after 2023. The main underlying principles for the road map to 2030 are to:

- Continue with the rollout into areas further out to sea in the areas previously designated, at a uniform rate of around 1 gigawatt (GW) per year. The Dutch government will manage the spatial decisions and preparatory surveys and TenneT will connect the wind farms.
- Continue with cost price reduction and promoting innovation and competition. The aim is that offshore wind farms for which a tender is issued from 2026 will no longer need to be subsidised.
- Cash in on earning opportunities and expand employment.
- Combine with other functions in the North Sea with which synergy effects can be achieved, in so far as this further reduces the costs of offshore wind energy or limits the social costs of the energy transition. This includes habitat creation, fishing, oil and gas, interconnection and energy storage.
- Prepare for large-scale multinational wind farms and for international offshore connections to connect these wind farms and possibly selection of new wind energy areas to be designated.

Cooperation with North Sea countries

Stakeholders will be closely involved in this process and regional cooperation will be sought with other countries around the North Sea. This is in line with the ambitions in the North Sea Declaration, which was signed by the most involved ministers of the North Sea countries and the European Commission on 6 June 2016. This declaration was the political starting signal for intensifying the cooperation around offshore wind energy. The Netherlands is developing a vision of how this cooperation can contribute to further efficiency, cost efficiency and spatial incorporation of offshore wind energy, and to economic growth and employment.

- The government retains its directing role in the rollout of offshore wind energy and is seeking regional cooperation with other North Sea countries.
- The government is examining the possibilities of strengthened direction of other large-scale forms of renewable energy generation.

3.2.3 Supporting local energy production

Local energy production by private individuals and local cooperatives ensures greater awareness of the energy transition and support for it. This aspect was widely stressed during the Energy Dialogue. The amount of electricity generated locally is rising, in particular through growth in solar energy. This is largely thanks to net-metering legislation and the sharp fall in the costs of solar panels. But locally produced renewable energy remains more expensive than other production techniques for renewable energy and less cost-effective than large-scale renewable energy production. This is expected to remain the case for the time being. Nonetheless the Dutch government wants to continue supporting the development of local renewable energy because of its contribution to social awareness of the energy transition and support for it.

Effects of net-metering

Net-metering allows low-volume users to offset their electricity consumption with electricity that has been fed in on the same connection. As a consequence of the netting facility they pay no energy tax, no renewable energy surcharge and no VAT on the netted electricity. The drawback of the scheme is that the attractiveness of investments in local energy production has therefore been made largely dependent on the level of taxes on electricity. The scheme also encourages consumers to use the communally funded electricity grid as a virtual storage system: electricity fed into the grid is exchanged free of charge for the use of electricity at any other time of the year.

Using evaluation for suitable incentive

To put an end to the growing investment uncertainty with regard to solar panels, the evaluation of net-metering will be used to work out a suitable incentive for local energy production. Adjustments to net-metering legislation will in any event go hand in hand with a transitional arrangement to ensure investment certainty. In conjunction with this the *reduced rate energy tax* scheme – aimed at energy cooperatives – will also be evaluated in 2017 and where necessary improved to contribute to the intended awareness and development at local level.

- Support for local renewable energy production will continue. The results of the net-metering evaluation may form the basis in 2017 for decision-making on the design policy for supporting local energy.

3.2.4 Strengthening the electricity market system and guaranteeing security of supply

Electricity market system in good order

The Dutch electricity market system is in good order. The "programme responsibility" or "balancing responsibility" system ensures that suppliers and consumers themselves keep demand and supply in the electricity market in balance because they experience an economic incentive to actually realise agreed upon production and consumption levels. The independence of grid management is legally guaranteed, which contributes to an extremely reliable grid infrastructure and competition in supply and wholesale markets. This competition contributes to the affordability of electricity.

Conserved capacity is growing

The current market system provides a good basis for a reliable electricity system, even with a far greater share of electricity production from renewable sources. Research by Frontier Economics – carried out on behalf of the Ministry of Economic Affairs – shows that security of supply is amply guaranteed up to 2035. In the latest national security of supply analysis TenneT concludes that the amount of Dutch conserved capacity – production capacity that cannot immediately be used – will grow in the coming years. TenneT will therefore be carrying out a further analysis in 2017 into the conservation or deconservation of production capacity.

High interconnection percentage

Good interconnection increases the security of supply. With an interconnection percentage of 17% the cross-border connectedness of the Dutch electricity network is in good order and much higher than the European target of 10% in 2020. An expansion of the interconnection capacity from 5,900 megawatts (MW) to 9,100 MW is also expected between now and 2021, for example by the construction of new links to Denmark (the Cobra cable) and Germany (Doetinchem-Wesel).[3] This will enable both the import and export of large quantities of electricity.

Ensuring security of supply regionally and at European level

Not only must the electricity supply be low-carbon, it must also remain affordable and reliable. It is therefore important to make the Northwestern European market even more flexible and at the same time monitor the security of supply situation in the region closely. After all, the strong connectedness of the Northwestern European electricity market means it is important to ensure that sufficient supply is available to meet the demand for this entire region at all times. The Netherlands works together with Member States on these subjects in the Pentalateral Energy Forum and the Electricity Neighbours Group, which are two Western European partnerships focusing on further market integration, developing a joint approach to security of supply and encouraging flexibility.

Sufficient production capacity available regionally

Transmission system operators of the countries of the Pentalateral Energy Forum produced a joint security of supply analysis in March 2015 showing the regional security of supply for the period 2015-2016 and 2020-2021. It indicated that there is sufficient production capacity available in the region for these periods. As regards flexibility there is still scope for improving regional cooperation in short-term markets and in doing so strengthening the business case for market participants offering flexibility. The Pentalateral Energy Forum countries are working on a road map in which barriers will be identified and where possible removed.

- At national and European level the Netherlands chooses further strengthening of the electricity market system and an international approach to security-of-supply issues.

[3] TenneT TSO B.V., Security of Supply Monitoring Report 2016 (2015-2031), October 2016, page 36 et seq.

3.2.5 Making the electricity system flexible

Weather-dependent production requires flexibility

The supply of weather-dependent electricity production – solar and wind – is growing. For this reason the electricity system has to become highly flexible: market participants must be able to respond faster to price incentives by adjusting electricity use or production. In this way they can respond to momentary electricity price differences, contribute to maintaining the balance of the electricity system and use the available transmission capacity more efficiently.

During the transition the impact of the market setup and the regulatory framework on flexibility will require constant attention. Barriers must be removed as much as possible. Below are details of the main measures for improving the flexibility of the electricity system, based on the input of Energy Dialogue participants.

Flexibility for small-scale users: opportunities for consumers

Access to the electricity market is still not complete for small-scale users. The meters and ICT systems in the energy sector are still unable to record and bill on a quarterly basis (instead of annually). The advent of smart meters will change this, while the relevant ICT systems must be modernised in 2019. Suppliers will then be able to offer their customers dynamic supply prices on a large scale and consumers will have the opportunity to participate more actively in the market.

Encouraging flexibility for low-volume users to optimum effect also requires a new kind of market role: the role of the aggregator. An aggregator is a market participant that can provide relief to consumers or producers by smart trading in their consumption, production or flexible capacity, for example by controlling their smart appliances, such as heat pumps or electric cars. An aggregator can act for both small-scale and large-scale users, but seems essential for opening up flexibility among small-scale users. The Dutch government will therefore consider whether the existing legislation and regulations provide sufficient basis for performing the aggregator role.

Flexibility for efficient grid use

The energy transition requires major investments in the electricity grids. In 2011 the joint Dutch network operators estimated the necessary investments in infrastructure required for the energy transition towards 2050 at €20–71 billion. Most of these amount concerns investments in the electricity grid.[4] Therefore, more efficient grid use instead of grid reinforcement may have major social benefits. Far-reaching energy conservation may also contribute to not reinforcing the electricity grid unnecessarily. Both these points also came up in the Energy Dialogue.

[4] "Grid for the future", Netbeheer Nederland, February 2011. The scenarios assume around €5 billion of necessary investments in the gas transmission network and for the feed-in of green gas.

A grid tariff structure that takes account of the time of grid load can promote efficient grid use. In this way consumers have an incentive to move their consumption to periods with a low grid load. Decision-making about this does, however, requires insight into the cost redistribution effects of a different tariff structure and how such a structure could be incorporated in the regulation of network operators.

Network operators should also have the ability to prevent unnecessary grid reinforcement through the use of flexibility in the market, such as demand response. At the same time consumers must remain ensured about their continued security of supply. Case-by-case analysis of each part of the grid infrastructure is needed to achieve the socially most cost-effective outcome. This requires the development of a good assessment framework that takes account of the effects of choosing to use flexibility or grid reinforcement in the broader electricity system. At least the following basic conditions should be taken into account when designing this framework:

- expected future developments are taken into account;
- flexibility offered is on a voluntary basis;
- market participants wishing to supply or consume electricity at peak times can do so;
- the use of flexibility is non-discriminatory;
- flexibility is suppled by market participants.

Electricity storage and energy tax

Electricity storage systems may become an important source of flexibility and be used in all flexibility functions: for trading and supply, for maintaining balance and for efficient grid use. During the Energy Dialogue participants referred to energy tax being levied when a party other than the generator of the electricity takes care of storage. In this situation energy tax is levied twice: once on the supply to the party storing the electricity and again on the supply to the ultimate electricity consumer. Elsewhere in the energy tax system levying energy tax twice is prevented when using natural gas for the production of electricity. In this case there is a tax exemption for natural gas (input) consumed by gas-fired power stations and installations that produce combined heat and electricity, known as combined heat and power plants (CHPs). This exemption prevents double taxation because the electricity produced (the output) is already taxed.

- The Dutch government will review levying energy tax in the case of electricity storage partly in the context of the Energy Taxation Directive. In this context attention will be paid to the current distinction between storage of electricity on the one hand and the use of energy for generating electricity on the other.

3.3 Innovation

In terms of improving the sustainability of the electricity supply the innovation tasks are mainly in the area of flexibility and the cost-price reduction of renewable electricity production. Chain partner cooperation, long-term R&D programming and public-private partnership are essential for realising the innovation task. This ties in with the Top Sector approach.

As the electricity supply becomes more weather-dependent (solar and wind), sufficient demand flexibility and storage capabilities become increasingly important. The storage of electricity is still relatively expensive and only possible for a relatively short time. Facilities for the seasonal storage of electricity are not yet commercially applicable. Within the Top Sector Energy there are several programmes that contribute to an increase in the flexibility of the electricity system: for the development of smart grids, heat/cold storage and power-to-gas.

Innovations for the cost-price reduction of renewable electricity production are an integral part of the approach for the further rollout of renewable energy production. There is work on this in several programmes in the Offshore Wind Energy TKI, while increasing the efficiency of solar PV, in particular in the built environment, is addressed in the Urban Energy TKI. Finally, local projects and innovations are linked together in the Top Sector programme for socially responsible innovation.

In due course it will be important to continue developing the capabilities for the capture and storage of CO_2 (CCS). This technique may be essential for achieving any negative target for electricity supply CO_2 emissions and is also essential for CO_2 reduction for high-temperature heat.

4 “High-temperature heat” functionality

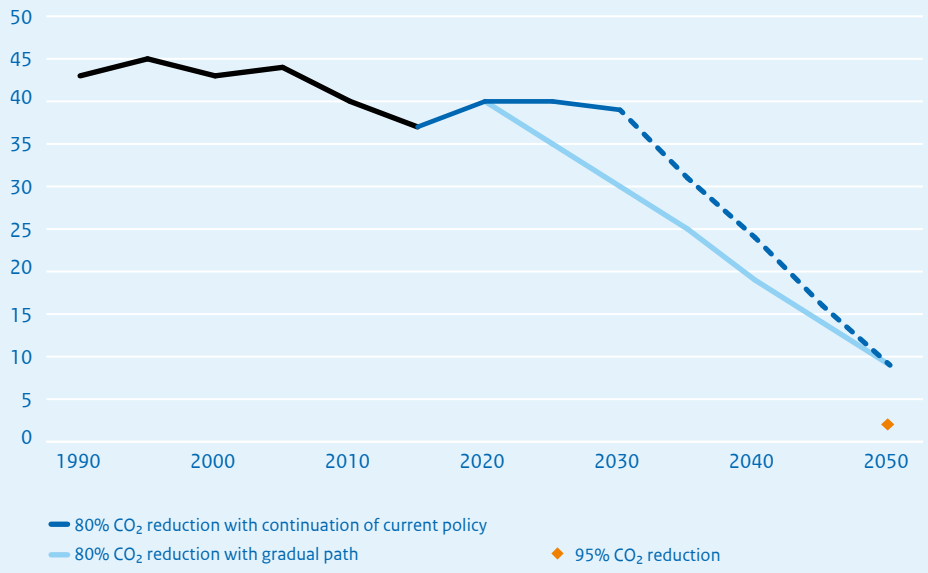
4.1 Task

The Netherlands has a strong energy-intensive industrial sector which is among the best in the world. Important activities include refining, chemicals, base metals, building materials, paper and nutrition. This industrial sector, which uses high-temperature heat, is very important to the Dutch economy. The importance of this sector was also broadly endorsed in the Energy Dialogue. At the same time this sector accounts for nearly 25% of total CO_2 emissions. The energy-intensive industrial sector will therefore play an important role in the transition to a low-carbon economy. The importance of a substantial innovation effort was emphasised in this regard during the Energy Dialogue. It must enable the industrial sector to achieve the intended CO_2 reduction.

Major complex task

The energy-intensive industrial sector is facing a major complex transition task requiring a new approach. This complexity is determined by the fact that the industrial sector operates within an international context and because many of the necessary low-carbon technologies are not yet mature. The CO_2 emissions of the industrial sector are expected

Figure 7 *Development of CO_2 emissions for high-temperature heat*



Source: For the period 1990-2030 ECN (2016). An estimate has been made for 2050 on the basis of RLI (2015) and CPB/PBL (2015). The intervening years are based on a linear path.


High-temperature heat
Using electricity
COMPANY
UNIVERSITEIT
Smart grids
Residual heat
Biogas
Carbon capture
Biobased economy
Raw materials transhipment
International interconnections
Carbon storage

to increase in the coming years and the ETS is not expected to provide enough of an incentive to reduce CO_2 emissions dramatically. Nor will continuation of current policy result in a break with past trends. Additional policy is required (temporarily) to make a gradual transition possible.

The CO_2 reduction in the industrial sector can be achieved by preventing CO_2 emissions, reusing residue streams and capturing unavoidable CO_2 emissions. Negative CO_2 emissions can be achieved by using biomass in production processes in combination with the capture of CO_2 emissions.

Individual responsibility of businesses

It is the responsibility of the businesses themselves to make the transition. The Netherlands has a strong starting position, thanks to its extensive infrastructure, highly trained staff, high-grade knowledge and great innovative strength. The business community and the government share an interest in maintaining a low-carbon industrial sector that remains among the best in the world. This future-proof industrial sector will contribute to Dutch prosperity. Ultimately there is no place in a low-carbon economy for businesses that are unable to make the transition. In the Energy Dialogue various parties put forward valuable proposals regarding how the industrial sector can contribute to the transition. The Dutch government wants to continue this dialogue as the transition paths are worked out in more detail (as outlined in the chapter “What are we aiming for?”).

4.2 Transition path: choices and directions

4.2.1 Preventing CO_2 emissions

As previously described, the incentives to reduce CO_2 emissions dramatically are currently lacking. Even a stronger ETS will probably not change this significantly by 2030. Additional policy must therefore create incentives to accelerate the transition, so that a gradual path can be followed up to 2050.

On the basis of the transition path collectively worked out in further detail the government is responsible for a policy mix of incentive and mandatory or normative measures. They must be cost-effective and efficient within the broader set of tools aiming at CO_2 reduction across all the functionalities. The impact on the competitive position of the industrial sector must also be taken into consideration. In practice this will mean an obligation or standardisation for the initial economically profitable steps, followed by incentives for further CO_2 reduction.

The following measures are appropriate in this regard:

- An ECN study from 2013 shows significant opportunities for the application of deep geothermal heating in industrial processes in the Netherlands. More than 30% of Dutch industrial demand for heat could be met by this. The possibilities will be explored in conjunction with EBN and TNO to promote the development of pilot projects.
- The Dutch government will continue promoting cooperation between businesses and sectors. A good example is the successful cluster approach adopted by port authorities. Work will for instance be done on further scaling up renewable energy, collective energy conservation measures and clustering and co-siting of businesses that contribute to emission reduction, cost reduction and the energy transition.
- It is important to actively support the creation of markets for low-carbon products, for example by promoting behavioural change, but also through mandatory requirements, such as the use of biobased plastic bags, a CO_2 label on products, certification, prohibitions of certain fossil products with good substitutes and taxing the consumption of CO_2-intensive products.

The following measures must be taken into consideration in this regard:

- Continuing the performance agreement obligation for energy conservation introduced under the Energy Agreement. This can be aimed at CO_2 reduction instead of energy conservation. It is important that this obligation gives clarity for the period to 2030 so that businesses can take advantage of natural investment moments.
- Less degressiveness in energy tax. This is also in line with the philosophy to increase the aim on CO_2 reduction more so than is currently the case. This mainly affects businesses that already fall under the ETS regime. At the same time less degressiveness fits in with the aim to have energy users pay proportionately for energy consumption, which can promote energy conservation. In this light, the level playing field relative to other Member States must be kept in mind. Any decrease in degressiveness therefore requires careful phasing and a timely announcement of the intention to this effect. Businesses can then take additional measures in good time.
- With CO_2 reduction as the underlying principle, CO_2-reducing measures other than renewable energy production come into view, such as process adjustments leading to energy conservation or capture and storage of CO_2 (CCS). This requires expansion of the range of incentive tools. The Dutch government will consider the extent to which the SDE+ can be better aimed at CO_2 reduction in a general sense instead of just at renewable energy. A more diversified range of tools will also have to be used for some CO_2 reduction options, such as a one-off investment grant.

In aiming at CO_2 reduction – instead of energy conservation – many businesses will adapt their raw material and product portfolio and incorporate the CO_2-reducing measures in the investments required for this. This will contribute to a cost-effective approach and will be in keeping with the way in which investment decisions are taken in the energy-intensive industrial sector.

- A policy mix of incentive and mandatory/normative measures will be developed on the basis of the transition path.

4.2.2 Reusing residue streams

Residual heat still only used to a limited degree

The Dutch government sees great potential in the use of residual heat in regions with a large industrial cluster. This could involve geothermal heating projects. In the Rotterdam region, for example, there is a lot of heat available because of the presence of several large energy-intensive businesses, among them the refineries. Currently, it is only being used to a limited degree. The creation of public heat grids should help to exploit this potential. An inventory must be made in conjunction with other parties as to how such projects can actually be initiated.

Clustering supply and demand

In this regard the government expects the businesses concerned to be prepared to invest in the capture of their own residual heat. By upgrading the heat stream this residual heat can be used for the business's own industrial processes or be supplied to a public heat grid. Residual heat exchange capabilities and the use of sustainable heat can be increased in time. Providers and consumers of high-temperature heat can be brought together physically for this, maybe in combination with consumers of low-temperature residual heat. Research will be conducted into how spatial policy can facilitate this.

Simplifying legislation and regulations

The Dutch government is aiming to use the Smart Regulation for the Chemical Sector programme to simplify legislation and regulations for the use of residue streams by the industrial sector. It will for example consider for which waste streams at national level "end-of-waste criteria" apply, so that intermediary links are not seen as waste plants. This may lighten the administrative burden for the industrial sector. The Dutch government wants to be a European leader in this regard.

- Reusing residue streams will be facilitated. This will show how the construction of public heat grids can actually get off the ground so that the residual heat potential can be utilised.
- Where and how the infrastructure required for the use of residue streams can be implemented and organised must be determined when working out the transition path for high-temperature heat. This includes heat grids, steam grids, electricity connections, hydrogen infrastructure, but also CO_2 grids.
- How spatial policy can increase the opportunities for the use of residual heat and sustainable heat must be determined when working out the transition path for high-temperature heat.
- Legislation and regulations that unintentionally impede the use of residue streams and carbon will be tackled (Dutch national government circular economy programme).
- Research will be conducted into the waste streams for which national 'end-of-waste criteria' apply.

4.2.3 CO_2 Capture: Carbon Capture & Storage (CCS) or Carbon Capture & Usage (CCU)

CCS indispensable for achieving climate goals

In the short term there is no ready-made solution for dramatic CO_2 reduction within the high temperature processes in the energy-intensive industrial sector. For the time being there are also – apart from the use of biomass – hardly any alternatives to fossil fuels available, either for the energy supply or as a raw material. Fossil fuels are expected to still be in use to some extent even after 2050. Carbon capture and storage (CCS) is therefore an indispensable technology for industry to achieve the climate goals. During the Energy Dialogue, the CCS option was also widely seen as a good way to achieve some of the intended CO_2 reduction. The Dutch government is committed to making widespread use of CCS in industry possible.

CCU on the rise

The reuse of CO_2 – Carbon Capture & Usage (CCU) – as a raw material is an emerging theme. Apart from expanding existing applications in glasshouse horticulture, for example, work is being done on new applications in such areas as the chemical sector, building materials and renewable fuels. The issues in the area of infrastructure and market building are similar to CCS, with CCU – thanks to the consumers involved – being able to cut the social costs of emission reduction and to accelerate the use of CCS.

Committing to more research and development

It is important for the widespread use of CCS and CCU in the future to commit to research, large-scale demonstration projects, cost reduction, fewer barriers and greater investment incentives. The market for transport, storage and reuse of CO_2 must also be built. An important first step is to test the chain of all the CCS and CCU stages – capture, transport and storage/reuse – on a large scale in practice. At international level the Netherlands is already actively working with other countries on the required research and innovation.

- Promote application of CCS and CCU throughout industry.
- Commit to implementation of the ROAD project as the first step towards a wider and more large-scale CCS network.
- Government and the business community must together draw up a CCS road map to determine what risks and barriers there are in terms of investing in CCS and what the transition path looks like.
- Collaborate and exchange knowledge with surrounding countries and set up an international infrastructure for CO_2 under which potential European Union financing sources can be used.
- Promote investments in CCS and CCU, for example through a national finance institution, so as to implement several demonstration projects, including some in industry.

4.3 The importance of an international approach and innovation

The energy transition in industry will only be possible with good positioning of Dutch businesses. The Dutch government therefore wants the Netherlands to be a distinctive front-runner in this transition. This requires an international approach and a strengthened commitment to innovation.

4.3.1 International

The industrial sector usually competes globally. The energy-intensive industrial sector in the Netherlands is largely owned by multinational companies and it cannot be taken for granted that these companies will continue to invest in the Netherlands. It is therefore important to ensure:

- an international playing field that is as level as possible;
- tools for compensating Dutch front-runners in low-carbon production for loss of competitive strength;
- innovation opportunities for climate-friendly production;
- an attractive investment and business climate.

- A commitment will be made to strengthening the already favourable Dutch business climate and promoting a level playing field. The government will also strengthen its relations with the head offices of the parent companies of the industrial concerns based in the Netherlands by investing in account management with these businesses.

4.3.2 Innovation

The development of the technologies for achieving a low-carbon industrial sector by 2050 is not yet complete. Innovations along the following lines are needed.

1. Innovations aimed at sustainable and efficient heat use: electrification of heat (using heat pumps, steam recompression, electric ovens), sharing of residual heat (steam and heat grids, including heat pumps, geothermal heat, etc.) and energy efficiency (membrane technology, centrifuges and other more low-energy separation technology).
2. Innovations aimed at new products and circularity, such as:
   - carbon capture and use (CCU), for example CO_2 upgrading as a product for the chemical sector, carbon storage (CCS) and air capture;
   - power to products (sustainably produced hydrogen as a base product);
   - biorefinery (for biofuels);
   - biobased materials;
   - capturing residues for reuse (membranes, centrifuges);
   - hydrogen (for example, in the form of ammonia for seasonal storage and as a base product for the chemical sector).

These technologies are as yet only being used on a modest scale. It is important to support research into these technologies and their development by giving them greater attention in the research programming within Top Sector policy. Unlocking and boosting knowledge requires greater use to be made of collaboration between chain partners. The circular economy – including the circular carbon chains – requires good insight into existing and potential production and reuse chains. The government will draw up a long-term R&D programme for the required technological breakthroughs with chain partners specifically for high-temperature heat. For pre-competitive research there is an opportunity to work in public-private consortia, which ties in with the Top Sector approach.

- The transition of the energy-intensive industrial sector will be given greater attention in research programming and Top Sector policy.
- There will be a commitment to a long-term innovation programme aimed at low-carbon and efficient heat use and new products and circularity.

5

“Low-temperature heat” functionality

5.1 Opgave

The energy consumption for the use of low-temperature heat accounts for more than 30% of total energy consumption in the Netherlands. This concerns heating dwellings, buildings and horticultural glasshouses, for which gas is currently largely (around 90%) used in the Netherlands. The associated CO_2 emissions must be limited as far as possible. The limited international connectedness of this functionality makes the design of additional national policy less complex, except for the internationally competing glasshouse horticulture. The main pillars of this policy are drastic reduction in the demand for heat through energy conservation and a sharp reduction in natural gas use by promoting and incorporating sustainably generated electricity and sustainable heat.

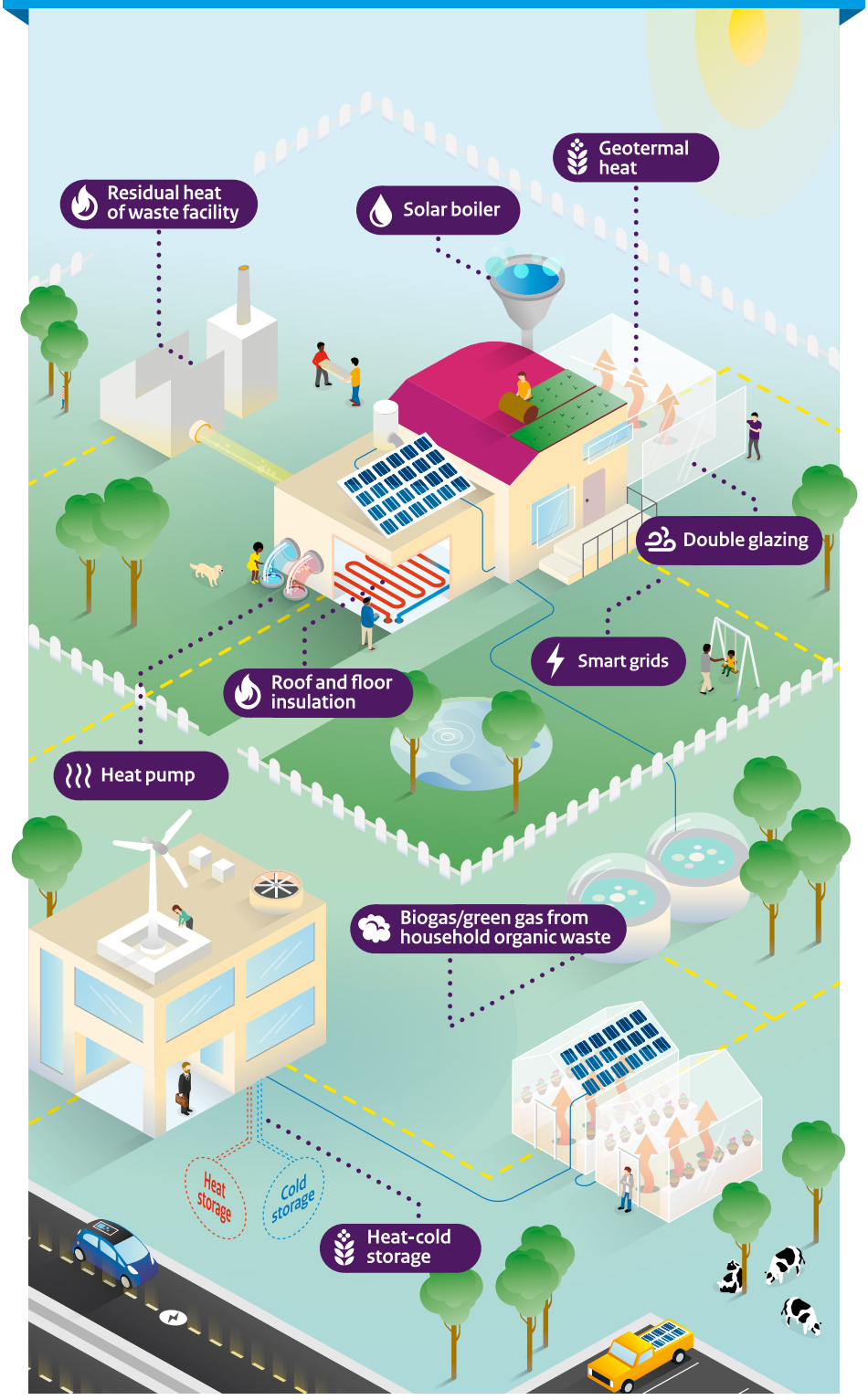
Developments with great impact

The switch from natural gas to heat requires a substantial effort from everyone: the public, businesses, public authorities and civil society organisations. Firstly, sustainable alternatives to natural gas are in short supply. Natural gas after all has a high energy value that is not easy to replace. By way of comparison: the five planned offshore wind farms will supply roughly the same amount of energy as 1.5 billion m^3 of low-calorific Groningen gas, while in the Netherlands around 30 billion m^3 of low-calorific gas is used annually. This means that other large-scale sustainable alternatives, such as geothermal heat, must be further developed.

Secondly, the transition requires substantial investments in such things as energy conservation, the replacement of (gas-fired) plants, infrastructure and the production of renewable energy. The long-term survey Energy in the Built Environment published in June 2016 confirms the complexity and scope of the task. It seems that full carbon neutrality is almost impossible to achieve with the technologies available, despite major public investments. It has also been stressed in the Energy Dialogue that the energy transition in the built environment is a major challenge, in particular in the area of financing and governance. To make the transition possible nonetheless, there must be a commitment to innovation, cost reduction and synergy with other functionalities. Proper account must be taken here of the impact on the housing market and residential housing costs.

Thirdly, the transition will have a major impact on space and people's living environment. It will involve adjustments within the home for seven million households. Increasing awareness of the need and the required change of behaviour is a major social task. A great many people will no longer be able to cook on gas or heat their home using a central heating boiler. It is an important task for the Dutch national government, municipal and provincial authorities and civil society organisations to make everyone aware of this and to support them with this transition.

Low-temperature heat

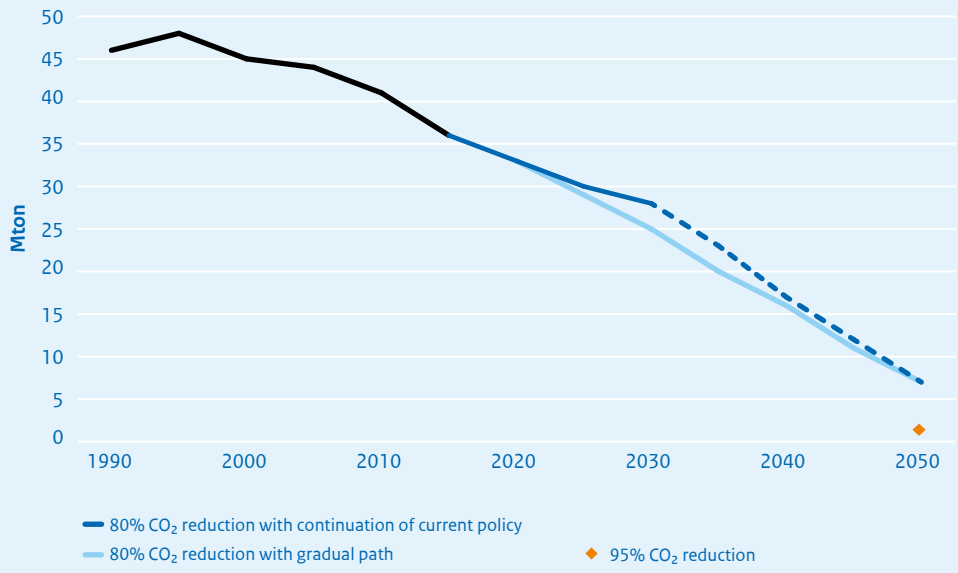


5.2 Transition path: choices and directions

The main outlines for the transition path for the low-temperature heating functionality are clear. Up to 2020 there will be a sharp decrease in CO_2 emissions. However, pursuing current policy after 2020 will not be sufficient for a gradual transition. Without additional policy CO_2 emissions may even rise again. For the existing housing stock a gradual transition means that 170,000 dwellings must be adapted annually (Ecofys, 2016).

Drastic emission reduction is technically possible, although there is still scope to improve the price of CO_2 reduction through the development of technologies. This does, however, require a permanent major commitment to energy conservation and sustainability improvement, investments in the businesses and availability of alternative CO_2 for plant growth. Maintaining sector-specific policy is important for this, as are incentives for investments. This also requires that the current and new initiatives with which CO_2 can be captured from existing and new sources is made available to horticulture and for applications of CO_2 as a raw material, using existing and new infrastructure. Substantial cuts in the emissions in the built environment are possible, but gas will still be needed for some time yet for space and tap water heating in some existing dwellings and buildings.

Figure 8 *Development of CO_2 emissions for low-temperature heating*



Source: For the period 1990-2030 ECN (2016). An estimate has been made for 2050 on the basis of RLI (2015) and CPB/PBL (2015). The intervening years are based on a linear path.

Existing buildings biggest task

For newly constructed homes, the European Energy Performance of Buildings Directive (EPBD) sets the ambition of having near energy-neutral buildings. From 2021 all new buildings must meet corresponding legal requirements. However, the construction of new dwellings will only make a limited contribution to the required improvement of the sustainability of the built environment. The biggest task is to provide low-carbon heating for existing dwellings and buildings. The Heat Strategy and the Energy Report noted that the best possible implementation of energy conservation and sustainable heat supply (heat grid, all-electric and/or renewable gas) may differ regionally or locally and requires customised solutions.

Carefully phased and cost-effective mix measures

Consequently, there is a need to opt for a programmatic approach with local and regional customisation for the most cost-effective mix of measures and a careful phasing of those measures. Buildings and the infrastructure for the energy supply have a long service life (often more than 40 years), so it is important to tie in with (large-scale) renovation and renewal of buildings and complexes, and replacement of the gas grid or other public infrastructure (sewers, roads). In the case of individual households maximum use must be made of certain investment opportunities, such as when moving house or making the dwelling suitable for all stages of life.

Seven aspects of the low-temperature heating functionality should be touched upon:

- continuing commitment to energy conservation;
- in principle no new gas grids for residential districts under construction;
- the obligation to connect to gas infrastructure will become a general right to heat;
- local decision-making and local planning;
- role of the network operator;
- allocation of the costs and price incentives;
- in principle no conversion from low to high-calorific gas.

5.2.1 Continuing commitment to energy conservation

Energy conservation is one of the pillars for CO_2 reduction in the built environment. Energy conservation can be promoted in three ways: making a minimum mandatory, encouraging exceeding that minimum and where necessary removing bottlenecks in the rollout of specific technologies. An approach has been laid down in the Energy Agreement aiming at the different sectors within the built environment, such as the owner-occupied housing sector, the rented housing sector, the commercial and social property sector, and glasshouse horticulture.

In the owner-occupied housing sector a mix of measures has been taken to encourage owner-occupiers to take energy conservation measures. For example, the Owner-Occupied House Energy Conservation Incentive Scheme came into effect in 2016 and regional innovative approaches are supported. A three-year national information campaign has also been launched. Low-interest loans can be obtained from the National Energy Conservation Fund.

The rented housing sector is working towards an average energy label B in 2020, as agreed in the rented housing sector energy conservation covenant. Since the National Energy Outlook 2016 suggests that this objective is not expected to be achieved, the Dutch government will prepare legally binding measures aimed at phasing out rented dwellings with non-green labels (worse than label C). The energy performance fee was introduced from 1 September 2016 for extremely energy-efficient renovations in the regulated sector.

For property the application has been improved of the existing obligation for businesses to take all the energy conservation measures that pay for themselves within five years (Environmental Protection Act). This has given rise to appreciable energy conservation. Where possible more binding measures will be used in addition, such as a minimum energy label C for offices that is currently in preparation and expected to take effect from 1 January 2023. The suitability of this for other property sectors will also be explored. For newly constructed national government offices a near energy-neutral requirement will apply from 2019 and energy label A is being taken as an underlying principle for renovation of central government offices.

In addition to binding measures, the Dutch government is continuing and extending the promotion of energy conservation through price incentives, grants, low-interest loans, information and support of innovative approaches. These measures will contribute to the Energy Agreement target range and are also important initial steps towards applying a sharper CO_2 reduction path for the built environment.

The measures referred to here are needed to achieve the target of 100 PJ energy conservation in accordance with the Energy Agreement and may be an important building block for CO_2 reduction after 2020. The present measures will be set up so that the most cost-effective technologies for conservation will be rolled out first. Given the major investments that the transition requires in the built environment, technology neutrality is an important underlying principle for future policy for financial promotion of conservation. Against this background the Dutch government also expects a further shift of the energy tax on electricity to gas in the future.

Where innovations for energy conservation in the built environment run up against bottlenecks during the rollout, this Dutch government will step in to rectify them. This is the case for example in the application of smart energy management systems in utilities construction. According to ECN, there is potential here to save 20-30 PJ by using Energy

Management Systems (EMS). An EMS ensures that in large office buildings, for example, systems are adjusted to each other and perform energy-efficiently. For this it brings all the energy flows into view and prevents such things as cooling and heating running at the same time. Energy Service Companies can also make an important contribution to energy management. These initiatives must be taken up further within non-residential building. The current Cabinet is looking into where government can play a supporting role.

- Continue and broaden the promotion of energy conservation through price incentives, grants, low-interest loans, information and support of innovative approaches.
- Where necessary impose energy conservation, or minimum mandatory levels, for offices and in the rented housing sector as already exists in utilities construction.
- Promote innovative technologies for further cost reduction and removing bottlenecks.

5.2.2 No new gas grids for residential districts under construction

Reducing the use of natural gas as far as possible in existing buildings is already a major challenge. To prevent this challenge becoming even greater we need to ensure that in principle no new gas infrastructure is built for residential districts under construction. New buildings must be near energy-neutral and the remaining demand for heat can in most cases also be met without natural gas. We have the technology to use different, sustainable heat sources for heating.

The obligation to connect in the Gas Act however currently provides individual initiators and builders a way to arrange for a network operator to build a new gas grid in a new build district for their own use and at the expense of all grid users. This is true even if the local parties have decided to make the district in question sustainable and low-carbon.

The Dutch government considers it necessary that in principle no new gas grids are built in residential districts under construction. The Gas Act will be amended accordingly. Exceptional situations may exist where a dispensation from this prohibition is appropriate. For instance, a distinction is possible between greenfield newbuild residential districts and “newbuild in oldbuild”. Whether it is a matter of just one dwelling or a few dwellings or an entire neighbourhood is also relevant.

In principle no new gas grids will be built in residential districts under construction.

5.2.3 The obligation to connect to gas infrastructure will become a general right to heat

The existing right of the general public and businesses to a means of heating homes, greenhouses or offices is currently interpreted as a right to a gas connection: a network operator's statutory duty to provide a gas connection. This statutory duty will be replaced by a technology-neutral right to heat. Fulfilment of this right to heat means that the government will guarantee the presence, quality and affordability of the required energy infrastructure.

Depending on the local situation, end users instead will have a right to a connection to a heat grid, a (reinforced) electricity grid or a gas grid. The Gas Act, which provides for the current right to a gas connection, will in any event be amended accordingly. This amendment is also important for in principle no longer connecting residential districts under construction to the gas grid. The intention is to lay down rules for deciding between an electricity grid, a gas grid or a heat grid, and for the conditions under which a grid can be removed. In that case the operator of the gas grid can be exempted from its obligation to connect households to the gas grid.

The obligation to connect in the Gas Act will be scrapped and a broader right to connect to energy infrastructure for heat supply will be anchored in legislation.

5.2.4 Local decision-making and local planning

The proportion of further energy conservation measures (insulation) as opposed to the use of sustainable alternatives for the remaining demand may vary locally or regionally. The type and the age of the buildings will play a part, as will the proximity of sustainable heat and residual heat options. The life cycle of the built environment and the energy grids is a long one, so it should be done in conjunction with a house move, large-scale renovation of buildings or replacement of the gas grid or other public infrastructure (sewers, roads). Smart timing of the transition to a sustainable heat supply will prevent unnecessary costs.

The importance of smart planning and clear management was also underlined in the Energy Dialogue. Municipal and provincial authorities are asking for clear national policy and the powers to enable them to put well supported local change processes into motion. The success of these developments depends on a good, locally agreed process with clear communication. The parties concerned must receive a good substantiation for the intended changes and have a suitable perspective for action.

Local assessment goes with local decision-making

The Dutch government agrees that local assessment requires local decision-making and believes that municipalities must be given the responsibility for this. Municipalities must take the lead in the local transition of the heat supply. They are in the best position to assess local conditions and effects for the timing and direction of the transition. Enterprising residents, united in energy cooperatives or otherwise, and providers of support services and products can play an important role in this regard.

At local and regional level it may be best to see which conservation options and sustainable alternatives are suitable for meeting the heat demand. The same is true of the rate at which the transition can best take shape locally. The municipality lays this down in the environment plan, which also acts as a local energy and heat plan. In this way the municipality sets out in what way, at what rate and with which tools the improvement of sustainability will take shape. The environment plan must be approved by the municipal council as this provides the required – democratic – legitimacy for the necessary interventions. Municipalities wishing to experiment will be given assistance.

Municipalities are responsible for the regional coordination of energy and heat plans. The consistency of these plans is an important condition for network operators to make sound investments. National government will ensure clear frameworks that follow from the transition path, once the latter has been worked out in detail. The coordination across municipal boundaries must be assured. The Dutch government will enter discussions with municipalities, provinces and regional network operators about role allocation, powers, information supply and cooperation.

At local and regional level it may be best to see which conservation options and sustainable alternatives are suitable for meeting the heat demand and at what rate the transition can best take shape locally. Municipalities will share responsibility for this.

5.2.5 Role of the network operator

A regulated network operator currently has specific tasks in respect of electricity and gas grids, but not regarding heat grids. This must change now that the intention is to give the general public the right to energy infrastructure for heat supply. Current regulation disadvantages heat supply and may impede (local) decision-making from resulting in the most cost-effective heat supply. Government regulation of grid management is recommended for further development of heat grids. This will prevent potential abuse of market power because – just as with the gas and electricity infrastructure – there is a natural monopoly in the case of heat grids. By putting the regulation on the same footing as for gas and electricity, a more comprehensive appraisal can be made of the various grids.

For these reasons the Dutch government wants the following roles to be subject to public rules, in any event in the case of large-scale heat grids:

- independent system management (supply and demand, balancing);
- grid management (construction, operational aspects and maintenance);
- owner/financier.

This requires amendment of legislation and regulations. The specific physical characteristics of heat grids must be taken into account in this process. There must also be a transitional regime for existing heat grids.

As operators of the different infrastructures, network operators have an important part to play in the decision-making by the municipality. Network operators will have the task of providing information about the condition of gas grids. For this they will draw up a plan including what would be a good time to take a gas grid out of operation, give its condition. Network operators will also see to adaptations to the various infrastructures that follow from the decision-making by the municipality.

- Large-scale heat grids will be regulated in a similar way to electricity and gas grids.
- Network operators will decide which infrastructure (gas, heat or electricity), given the available alternatives, can best be constructed, reinforced or removed in cooperation with local public authorities.
- It will be the network operator's task – based on the condition of the gas grid concerned – to establish what would be a good time for taking it out of operation (if applicable).

5.2.6 Allocation of the costs and price incentives

A different heat supply at local level also leads to different cost characteristics. The Dutch government is going to conduct research into an effective allocation of costs, the right financial incentives being included in the decision-making. The allocation of the costs of the infrastructures concerned would have to be adapted to this. Logical underlying principles in the division of costs are that within a specific region or municipality similar households with different heat supplies should have a similar bill and that the general public or businesses abandoning natural gas early should not experience any disadvantage from doing so compared with those who switch later. The more local implementation of the heat supply will probably mean differences in costs for heating between regions. The Dutch government will examine the allocation of costs and include the different grid-related costs, the regulation methodology, costs of energy conservation, the market prices and the relevant taxes.

A meaningful start was made in 2016 with the shift of the tax on electricity to gas. A further shift may make a limited contribution to further CO_2 reduction. Important areas of attention in this regard are the purchasing power effects and the associated increase in the tax burden for businesses. A further shift should therefore preferably be introduced in stages.

In addition, the tax treatment of the use of renewable heat in district heating projects will be addressed. Current tax legislation gives favourable treatment to district heating plants largely (more than 50%) using residual heat. This is heat released as a by-product of waste incineration, electricity generation or industrial processes that would otherwise be emitted into the open air or via cooling water into surface water. The arrangement does not as such apply to renewable heat production plants whose purpose is only to generate heat. As a result of this difference, in practice a heat grid may in some cases be worse off with a renewable heat source.

To gain a good idea of the situations that may occur in practice, the Dutch government will examine whether and in what cases district heating will face a disadvantage as a result of an increase in energy tax when switching from gas-fired boilers to the use of renewable sources. Should there be a disadvantage, it will consider how it can be overcome. Several options are conceivable, inside and outside the energy tax sphere. The budgetary consequences and the economic efficiency of the different options will be determined. The Dutch government will soon start this research with the intention of having its results ready for sending to the Dutch House of Representatives in the second quarter of 2017.

5.2.7 In principle no conversion from low to high-calorific gas

From 1 January 2017 all new gas appliances in the Netherlands must be capable of operating with both high and low-calorific gas. This no-regret measure is important – if the extraction from Groningen has to be drastically reduced for safety reasons – to make a switch to high-calorific gas possible. If this is unnecessary, a conversion from low to high-calorific does not seem logical, given the associated costs and the ambition ultimately to phase out gas in the built environment. Investments can better be made in improving sustainability rather than in a conversion of gas. The requirements of newly sold gas appliances from 1 January 2017 include the requirement for the appliances to handle more than one type of low-calorific gas, so that there is greater scope for green gas and other sustainable gases in the low-calorific gas supply during the transition.

5.3 Innovation

Innovations in support of the task are also needed for energy conservation in the built environment and to ensure the (continuing) development of new and existing techniques. In recent years new concepts have been developed for far-reaching conservation, for example. The zero-energy concepts resulting from the Dutch government's Energy Leap innovation programme are an example of this. Partly on this basis initiatives such as the Stroomversnelling have emerged in the market.

An innovation drive is also needed to make technologies more suitable for use in dwellings. Not every home has enough space for a heat pump. Simply producing these in smaller sizes could be enough make their purchase more attractive. Innovation for this functionality also relates to how to make it appealing for residents and businesses to become involved in the transition. This also requires a major shift in terms of social innovation. This is considered in more detail in chapter 9. Technologically, further development is needed regarding geothermal heat, energy storage, ventilation and feeding lower temperatures into heat grids.

Finally, there is a commitment to the use of renewable gas, in various forms, from biogas to hydrogen. Improving the sustainability of gas is useful for different energy applications and also for its role as a raw material. Renewable gas can play a part in space heating, for example in hybrid heat pumps with green gas. However, because of the limited supply this will only be possible in certain regions. The use of renewable gas in other functionalities – in particular in transport and in the industrial sector – is a more obvious choice, because here there are fewer options for improving sustainability. For renewable gas in general there must be a further commitment to the development and the application of existing technologies and in particular scaling up production.

Box 4. Gas extraction in the Netherlands

Natural gas has an essential part to play in the Dutch energy supply: it provides around 40% of our primary energy requirement. It is the lowest carbon of all the fossil energy sources and is an efficient energy carrier.

In the built environment there is a strong commitment to gradually phasing out natural gas. Natural gas, however, also plays an important part in the transition in the other functionalities (power and light, high-temperature heat and transport). As the least polluting fossil fuel, gas will also long continue to play an important role on the transition path to realise the ambitions of the Paris Agreement on climate change.

In the Netherlands natural gas is extracted from small gas fields and the Groningen gas field. A new consent decision has recently been taken for Groningen, which sets the production level at 24 billion m^3 per year, in accordance with advice from State Supervision of Mines (SodM). In the event of a colder than average winter there is scope for additional extraction. The production level was decided based on an assessment of all the interests concerned, with safety, the limitation of damage and security of supply as main guiding factors.

If it can be extracted safely, extracting natural gas from the Dutch subsurface is to be preferred. It leaves us less dependent on imports and the cleaner extraction in the Netherlands limits the carbon footprint. Underground Dutch gas also has a financial value: the employment and natural gas revenues. There is currently a legislative proposal before the Dutch Senate to amend the Mining Act to minimise the safety risks, for instance through licensing and more central government management regarding the circumstances in which mining can be permitted. The scope for public consultation and the rights to be consulted have also been extended so that the public perspective will have a prominent place in decisions on mining. If the public nevertheless suspect damage as a result of mining activities, they can report this to the Mining Damage Desk, which will support the public in submitting claims for the damage. This desk will be operational from 1 January 2017.

In part because of the persistently low oil and gas prices it is becoming less and less profitable for mining companies to extract gas. Without any action these mining companies will disappear from the Netherlands and the existing infrastructure will be dismantled. The remaining small gas fields will go unexploited because the construction of new infrastructure especially for them will no longer be profitable. Apart from employment, knowledge that is necessary for extracting (ultra-deep) geothermal energy and CCS may also disappear with the departure of the mining companies from the Netherlands. These are options that must be exploited to reach carbon neutrality by 2050.

It is crucial that the remaining, usually marginal, gas stocks on the Dutch part of the continental shelf can still be extracted in the coming years with the existing infrastructure (platforms and pipelines) in the North Sea. For this reason the incentives for the development of small fields will be continued after 2016. There will be research into the way in which this should be done. A level playing field with the United Kingdom is key to improving the mining climate.

The reduction of gas production in the North Sea has the unavoidable consequence that platforms and the associated infrastructure will have to be shut down, dismantled and removed faster. The onshore gas extraction sites will also have to be cleaned up in the future. This involves large sums, which are estimated at over €7 billion, but which may be higher. Further consideration is currently being given as to how to ensure that mining companies can fulfil their clean-up obligations.

6

“Transport” functionality

6.1 Task

The mobility and transport sector still runs mainly on fossil fuels. In the past great progress has been made in making vehicles more fuel-efficient and as a result air quality in terms of nitrogen and particulates has improved. This, however, has made hardly any contribution to the climate task because the demand for transport has grown and with it CO_2 emissions. It is therefore a positive development that the Dutch mobility sector has embraced the climate task and is prepared to join the government and NGOs in shaping the sustainable transition leading up to 2050. A decline in emissions began in 2011, mainly due to a more economical vehicle fleet and the addition of biofuels to regular fuel. The following sector goals were agreed in the SER Energy Agreement:

- a contribution to total energy conservation of 15 to 20 petajoules (PJ) in 2020;
- a reduction to 25 megatonnes (Mt) of CO_2 equivalent at most in 2030; compared with 1990 (–17%);
- all newly sold passenger cars capable of zero emissions performance from 2035;
- all passenger cars capable of zero emissions performance in 2050;
- all parties embrace the EU ambition of a reduction in CO_2 emissions in the mobility sector of 60% by 2050 compared with 1990.

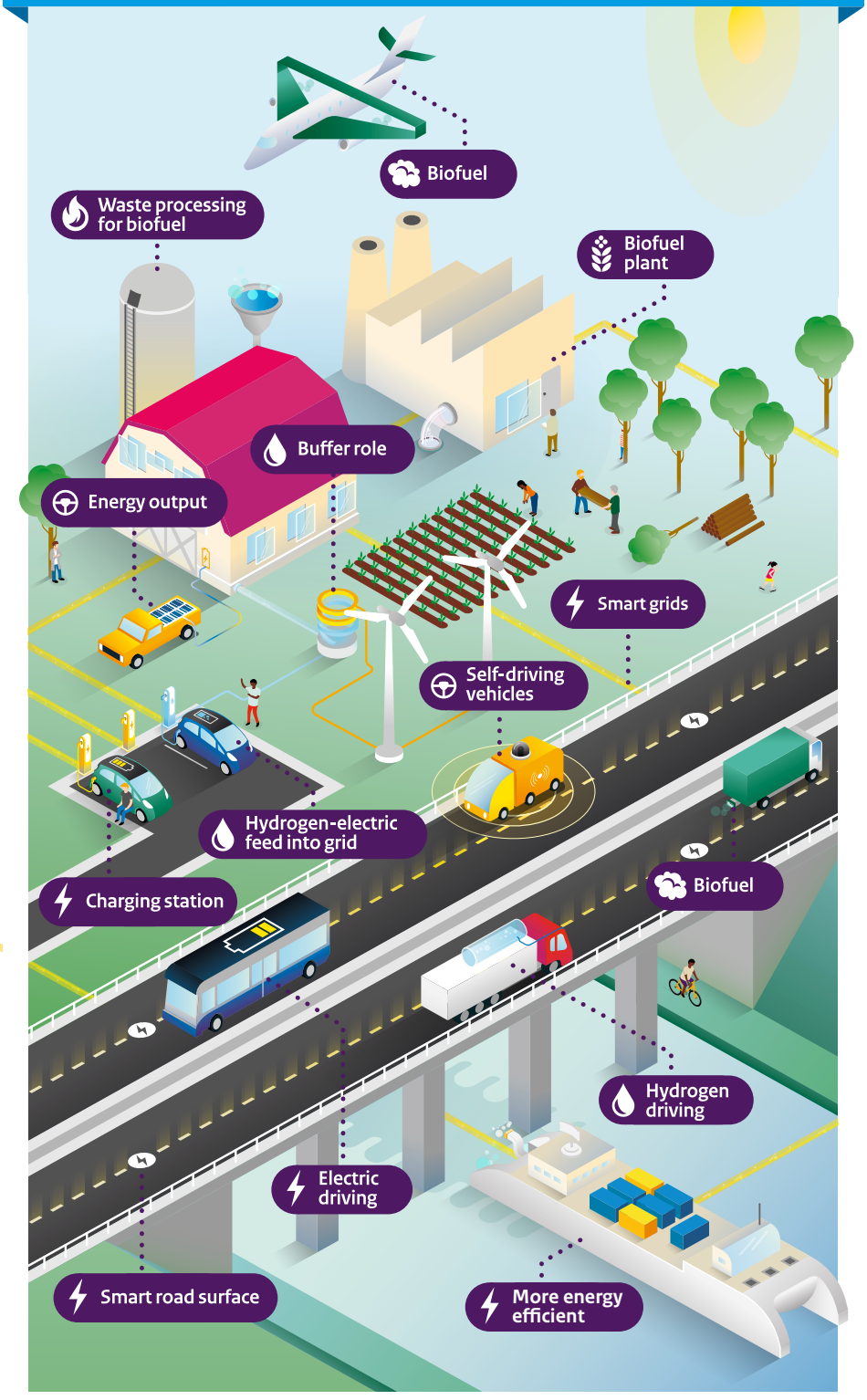
Huge task requires far-reaching measures

To make a gradual transition possible the transport functionality also needs additional policy for greater fuel conservation, more renewable biofuels and greater use of zero-emission vehicles. More far-reaching measures will mainly affect the international segment, where there may be a question of competitive disadvantage or conflict with the internal market. For this reason European and international agreements will have to provide an important basis for further reductions in the mobility sector. The Netherlands is therefore committing to tightening European CO_2 standards and effective global mechanisms.

6.2 Transition path: choices and directions

In view of the Paris Agreement on climate change, intensification is needed and the Dutch government is going to implement it with a sustainable mobility programme on the basis of the transition path. Cutting CO_2 cost-effectively is the underlying principle in this regard. Innovation must be used to ensure that there are cost-effective options in the future too. Innovation also offers the Netherlands economic opportunities. This should be pursued for all modes where electrification is possible (in particular passenger transport, buses and urban logistics). In the transition period and otherwise using renewable fuels speaks for itself.

Transport


Biofuel
Waste processing for biofuel
Biofuel plant
Buffer role
Energy output
Smart grids
Self-driving vehicles
Hydrogen-electric feed into grid
Charging station
Biofuel
Hydrogen driving
Electric driving
Smart road surface
More energy efficient

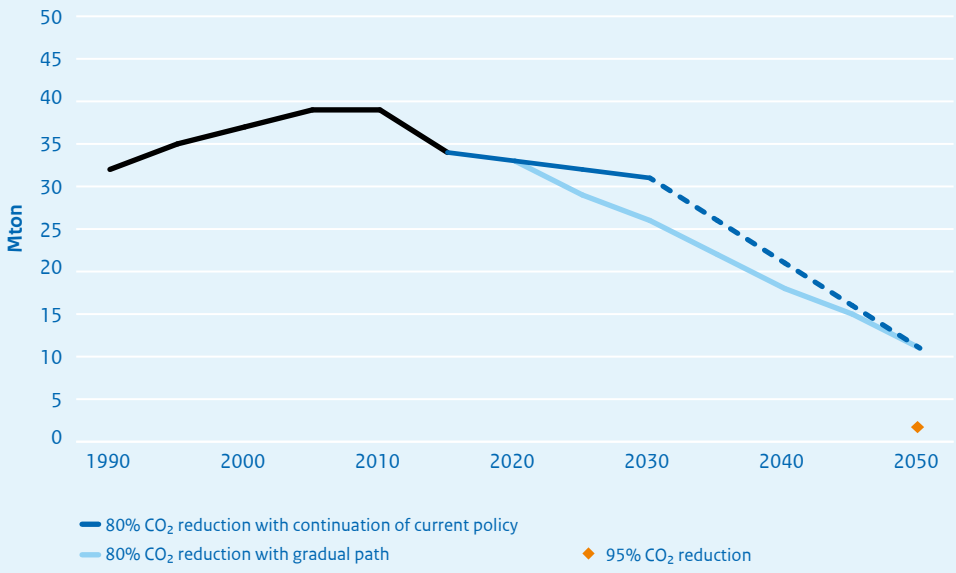
Aiming for zero emissions

The first step towards cutting CO_2 emissions is as far as possible choosing the means of transport that has no CO_2 emissions. This is why the aim must be for zero emissions wherever possible. On average a vehicle remains on the road for 15 years. The ambition is that all newly sold cars will be capable of running emission-free by 2035, so that the entire Dutch vehicle fleet is capable of running emission-free from 2050. By then public transport and the urban distribution network must also be capable of emission-free operation. The development to greater use of renewable and alternative fuels also requires large-scale upgrading of infrastructure (fuelling, charging, bunkers and roads) that is not yet profitable in a scaling-up phase.

Electrification and renewable fuels

For now all-electric drive technology is unsuitable for long-distance transport by road, water and air. Other renewable energy carriers will be used for transport of this type. Greater availability of renewable energy is required for mobility, not only for electrically powered vehicles, but also hydrogen and biofuels. If a means of transport that emits CO_2 is needed, the least polluting option must be chosen. We must make optimum use of

Figure 9 *CO_2 emissions in the Traffic and Transport sector*



Source: For the period 1990-2030 ECN (2016). An estimate has been made for 2050 on the basis of RLI (2015) and CPB/PBL (2015). The intervening years are based on a linear path.

logistical optimisation, intelligent transport systems resulting in fewer transport movements, more efficient engine technologies and behavioural interventions.

Focus on social costs and benefits

The development of the fuel vision and action agendas has involved the assessment of the different measures for their expected contribution to CO_2 reduction, air quality and earning potential, while the packages of measures have also been assessed in terms of cost-effectiveness relative to each other. A knowledge consortium consisting of TNO, ECN and CE Delft has estimated the social costs of the sustainable mobility transition at around €25 billion up to 2030. McKinsey has recently produced an estimate of the social costs of the transition to sustainable mobility of the same order of magnitude, that is €30 billion up to 2040. These costs are mainly the result of investments by the business community and will be borne by users.

The transition to a healthier, more climate-friendly and more efficient transport system will eventually bring benefits to the Netherlands (people, planet and profit). In a survey of the long-term earning potential these combined benefits have been estimated at between €3–6 billion per year by 2030 and there will be a social breakeven point somewhere around 2024.

- The sustainable mobility policy will be intensified, with cost-effective CO_2 reduction as the underlying principle.
- Implementation of the Sustainable Fuel Mix report is the starting point for the long-term climate task.
- Intensification will take place through the use of new technologies and the application of efficiency measures and behavioural interventions so that fewer movements take place and less fuel is consumed, particularly fossil fuels.

6.2.1 Implementation of Energy Agreement

The Sustainable Fuel Mix report

To implement the goals for the mobility sector 34 actions have been put into motion with the parties to the Energy Agreement. The most comprehensive of these is the Sustainable Fuel Mix report, which was drawn up in 2015 with an associated implementation agenda that has been agreed by more than 100 parties. The report sets out which sustainable technologies, vehicles and fuels can be used in individual segments, and how means of transport can be made more efficient.

Acceleration over the next five years has been agreed with the parties to the Energy Agreement in seven areas: electrically powered vehicles, road traffic efficiency, efficiency of ocean-going vessels and inland waterway vessels, driving on hydrogen, greening of

gaseous fuels, LNG in shipping, and biofuels in aviation, shipping and heavy road traffic. The national government is continuing the cooperation with front-runners in the industrial sector on various platforms and in Top Sectors.

Optimum mix of policy instruments

The challenge is to use the optimum mix of instruments in each transport segment:

- *Standards policy* often in an international framework, to tighten environmental performance cost-effectively and with a level playing field.
- *Supporting policy* often at local level, to create sales markets for new sustainable technologies.
- *Tax policy/pricing* to encourage users to choose sustainable solutions.
- *Innovation policy* to help Dutch market participants who themselves wish to invest in sustainable, but often still expensive technologies, put new products on the market and gradually bring about cost reduction and scaling up, with the chance that they will acquire strategic positions that increase the earning potential of the Netherlands.
- *Agreements* with market participants and other public authorities to work on improving sustainability together. This may involve both including sustainability as part of granting a concession and deals with other public authorities on investments.

6.2.2 Zero-emission mobility of individuals

Public transport by rail and bus

At the end of 2015 ambitions were laid down in the *CO_2 vision for rail*, which has been signed by public authorities and rail sector participants. It has been decided that the rail sector will work towards a fully carbon-neutral footprint across the entire rail supply chain by 2050. The use of renewably generated energy is self-evident, just like energy efficiency and prudent use of raw materials. The focus in the further improvement of sustainability is in the area of greening regional railway lines that have not yet been electrified and further limiting emissions in other mobility sectors by tempting more travellers to take the train and by carrying more goods by rail.

Raising the upper voltage from 1.5 kV to 3 kV is a promising measure for increasing the sustainable setup of the existing electrified main rail. Compared with other energy conservation and renewable energy measures in the various economic sectors, this measure has high CO_2 cost-effectiveness. The social costs and benefits and required investments will be analysed in 2017.

The national administrative agreement “Zero-Emission Regional Public Transport by Bus” was signed in 2016. It has been agreed that the parties will aim to have bus transport fully emission-free at the exhaust from 2030 and that by 2025 new buses will use 100% renewable energy or fuel that as far as possible is produced regionally.

Electrically powered vehicles and driving on hydrogen

The interdepartmental policy research into the cost-effectiveness of measures for climate targets (IBO CO_2) shows that European source policy is the most effective measure for achieving the Dutch targets. The Netherlands is campaigning hard in Brussels to tighten the CO_2 standards for passenger cars, which will bring the transition to zero-emission passenger cars closer.

Electric transport also offers the Netherlands economic opportunities. Total turnover in the electric transport sector grew to €820 million in 2014, with an added value of €260 million. Electric transport is a growing export product, with a variety of Dutch businesses active abroad. The businesses are world leaders in the area of charging infrastructure and export solutions to many European countries and others, including the USA.

The consumer market remains important in terms of green growth and market investments, especially in view of the position the Netherlands has as one of the top five in the world as regards percentage of electric vehicles and charging infrastructure.

Under the 2016-2020 Electric Transport Green Deal, the Dutch government is instigating a number of actions for the coming years in conjunction with parties from the Formula E Team, including improving the sustainability of the government vehicle fleet and preparing a long-term R&D innovation programme in the electric transport field, looking at areas such as freight transport and urban distribution, charging infrastructure and smart grids, new forms of passenger transport and light electric vehicles.

The first fuel-cell powered electric vehicles and hydrogen filling stations are starting to appear in the streets. The challenge is to develop a national network of filling stations over the coming years in conjunction with growth in the number of vehicles. Hydrogen is already being produced and distributed on a large scale in the Netherlands as an industrial gas and can serve well as storage and buffer of renewable energy. Greening the production of hydrogen is important.

Bicycles

The bicycle is an important link in short-distance personal mobility, in urban areas and for the first and final stages of a journey. With the advent of the electric bicycle and the speed pedelec, for many people the bicycle is also becoming an attractive alternative for medium-distance journeys. To promote use the Dutch government has opted for the spatial incorporation of good and safe (long-distance) bicycle links and an extra boost to cycle parks in cities. It is already possible for employers who wish to do so to use the tax-free margin in the work-related expenses scheme to provide a bicycle tax-free to employees. A Bicycle Agenda is being prepared for 2017.

Behavioural interventions

Research by CE Delft shows that it is certainly possible to achieve a quarter of the CO_2 reduction target for 2030 with measures aimed at behaviour. Behavioural interventions help drivers to drive more economically and less by car and in this way to save fuel and energy. Programmes such as Car Sharing, campaigns such as Choose the Best Tyre and behavioural interventions from the Optimising Use approach, such as avoiding rush hour, will all continue. Motorists can make smart and efficient choices using intelligent transport systems. There are still many gains to be made in business and commuter traffic and with local initiatives.

- There will be a commitment to CO_2 emission-free passenger transport by 2050. The Dutch government will promote the rollout of a national network of alternative fuelling and charging infrastructure.
- For rail and bus transport the CO_2 vision for rail and the administrative agreement entitled "Zero-Emission Regional Public Transport by Bus" are the starting points.
- For electric transport there is a commitment to European source policy and implementation of the 2016-2020 Electric Transport Green Deal.

6.2.3 Energy optimisation in international long-distance transport

The international nature of long-distance transport means that measures can have a direct impact on the competitive position of the Netherlands in relation to other countries. It has therefore been decided to focus on international agreements in this transport segment.

Aviation

Technological, operational and infrastructure improvements contribute to the reduction of CO_2 emissions in aviation, but are insufficient to achieve the long-term CO_2 reduction targets. In addition to CO_2 pricing at international level through the Global Market Based Mechanism (ICAO) and the ETS, to this end the use of renewable biofuel is promoted at national level. Biofuel, with an average CO_2 savings potential greater than 80%, is the most promising option for further improving the sustainability of aviation, while contributing to the competitive position of the Dutch aviation sector and presenting opportunities for the chemical industry and other industries in the Netherlands.

Shipping

In order to maintain the Dutch international competitive position in ocean shipping, the Dutch government has opted for a fair share of ocean shipping in the global efforts to combat climate change. To subsequently reduce CO_2 emissions, a phased approach has been agreed at international level, involving data collection and analysis, followed by decision-making on potential measures.

The investments in fleet renovation and innovation are low, which limits the options for improving the sustainability of the fleet. Consequently, the financial options for continuing to improve the sustainability of the inland waterways fleet and setting up a fund or some other form of financial support at European level will be explored. There will also be a commitment to LNG, biofuels and sailing more efficiently and more economically. This includes a commitment to the rollout of infrastructure for alternative fuels and quayside electricity.

Long-distance road transport

Renewable biofuels (gas and liquid) are needed for longer distances and heavy duty applications because zero-emission vehicles are not yet feasible in this segment. For freight transport the Low-Carbon Freight Transport Programme is starting, intelligent transport systems are being used to promote efficient transport (such as truck platooning) and there is a commitment to source measures (technology and fuel). Tax measures (Environmental Investment Rebate (MIA)/Arbitrary Depreciation of Environmental Investments (VAMIL) and fuel duties) give an incentive for CO_2 reduction. Opportunities exist for the Dutch manufacturing industry for vehicles and biofuels.

- International agreements are the underlying principle for CO_2 reduction for international long-distance transport.
- The use of renewable biofuels in aviation will be promoted nationally.
- The options for European and national financial incentives to improve the sustainability of the fleet and inland waterways fleet will be explored.
- There will be a commitment to sustainable biofuels, the Low-Carbon Freight Transport Programme and efficient transport for long-distance road transport.

6.2.4 Other CO_2 reduction activities

Zero-emission urban logistics in the Netherlands

To improve the sustainability of urban logistics it has been decided to set up “living labs” in 11 cities in conjunction with sector parties to research how the cities can be provisioned as cleanly, economically and efficiently as possible using a combination of new vehicles and more efficient logistical concepts. The lessons from the Zero-Emission Urban Logistics Green Deal will be used after 2020 for scaling up to achieve the ambition of zero-emission urban logistics by 2025.

Logistics top sector

In addition to addressing the modes of transport, adapting the logistical chain also provides opportunities for CO_2 reduction. A commitment to (more) efficient logistics and increasing the load factor of vehicles and vessels has great significance in terms of CO_2 reduction. The Logistics Top Sector is working on an integrated approach and monitoring

CO_2 reduction aimed at the climate target. The way in which and when CO_2 reduction can be achieved effectively and efficiently will be worked out for each market segment (goods transport type). A number of connected factors are important for each market segment: competitive conditions, regulation and consumer influence, vehicle fleet financing, length of the supply chain, density of product transported, logistical organisation and efficiency, energy conservation measures, and the (available) fuel and drive technology. Consideration will also be given to the sustainable mobility gain from future developments such as robotisation, truck platooning, distribution with small autonomous electric vehicles and drones.

Smart Mobility

The use of smart mobility (intelligent transport systems, eventually autonomous vehicles) presents opportunities to make transport efficient. It offers opportunities to save fuel, cut CO_2 emissions and improve traffic flows. More generally, intensifying the use of data will lead to greater efficiency in traffic and transport; it will for example prevent unnecessary waiting at locks or traffic lights and offers opportunities to increase the load factor of vessels and vehicles. It also presents opportunities in the movements chain: travel information to enable the traveller to make an optimum choice of means of transport mix and logistical information for synchromodality in goods transport.

Economic use of mobile equipment

Large quantities of fuel are consumed by mobile equipment in groundwork, road and hydraulic engineering, construction and the agricultural sector. The equipment accounts for 8% of total Dutch CO_2 traffic emissions. Parties, including the national government, that signed the “New Way of Operating” Green Deal in May 2016 want to limit these emissions by 10% by 2020 at the latest. This must for instance be achieved by changing the behaviour of drivers and operators and a positive impetus to promote low-energy working that has to come from contracting parties.

- The results from the “living labs” will be scaled up after 2020 to improve the sustainability of urban logistics.
- The Logistics Top Sector will coordinate work on an integrated approach to and monitoring of CO_2 reduction aimed at achieving the climate target.
- Smart mobility is being used to make transport efficient.
- The “New Way of Operating” Green Deal is the underlying principle for CO_2 reduction in the use of mobile equipment.

6.3 Innovation

Committing to innovation in good time for the long-term transition paths within the different modes of transport is necessary if the targets for 2030 and 2050 are to be achieved cost-effectively. In each individual market there are challenges involving the vehicles, the fuelling infrastructure and the energy carriers. For biofuels (bio-ethanol, biodiesel and biokerosene) the step must be taken towards advanced production and value chains. Innovation is also needed for scaling up renewable production, storage and distribution of electricity, hydrogen and gas (bio-LNG and bio-CNG). Electrically and hydrogen-electrically powered passenger cars are still relatively expensive and continue to have limitations in use. The first market launches are currently taking place for electric and hydrogen-electric applications in buses, delivery vehicles and lorries, with public transport buses pointing the way. The Dutch manufacturing industry can invest in some of the technology development and innovations that are needed in vehicles and to this end can seek co-financing from European, national and/or regional funds. Innovation in the logistics top sector aims at linking physical goods flows and information flows, removing transport need, pooling cargo, efficiency in logistics and increasing the load factor of vehicles and vessels.

7

How will the energy transition be organised?

7.1 Common task

The energy transition is a process of change that will cut deep into the economy and society, in all sectors and at all levels: from households and businesses to the international infrastructures. It is also a complex process with many dependencies. The transition will only be achieved if the interested parties – national government, municipal and provincial authorities, the general public, businesses and other actors in society – are each willing and able on their own responsibility and competence to contribute to it and work together.

It cannot be taken for granted that parties are willing to cooperate and contribute. This requires trust, of the parties in each other and in the government. This trust will largely have to come about in the transition process. The energy transition will have to be set up in such a way that achieving the goal – a low-carbon energy supply by 2050 – is accompanied by a process in which the general public and businesses have a sense of ownership and are willing to realise that transition together.

The Energy Agreement signed by 47 parties was an important first step in this process of embarking on the transition together. Both the Energy Report and the Energy Dialogue were strong follow-ups. Good initiatives are now developing in various corners of society and the willingness to contribute to the success of the energy transition is increasing. This took concrete form, for example, in agreements at the National Climate Summit in Rotterdam, where businesses and municipalities committed themselves to far-reaching plans for drastic CO_2 reduction.

A start has been made, but the major challenges still lie ahead of us. These challenges must be tackled together again since the government cannot achieve the energy transition on its own. The citizens, businesses and civil society organisations will have to implement the transition and for them, in particular, this will be a major operation. Eventually they will have to organise their business processes differently, use emission-free means of transport, insulate their homes and switch to different energy sources.

Government role

The government does have its own unique responsibility in the energy transition. First of all the government – as emerged strongly from the Energy Dialogue – must be reliable, maintain course and monitor progress. It must also:

- where necessary, take normative, enforcing and sanctioning action *(vision and leadership)*;
- give direction and set frameworks *(framework setting)*;
- where necessary, above all also offer flexibility and adjust policy *(reflexive and adaptive)*;
- point out, encourage and allow other parties to accept their own responsibility *(ownership)*;
- within the international and European frameworks cooperate in dialogue with local authorities and society *(common cause)*.

The question now is how the government, the citizens, businesses and civil society organisations will organise themselves to produce a low-carbon energy supply that is affordable, reliable and safe by 2050.

7.2 International and European cooperation

7.2.1 International

The global transition requires a new international positioning on energy from the Netherlands, acknowledging geopolitical opportunities and threats, global climate action, trade and investments, and security of supply. Commitment to international energy governance remains important in this regard. This is where collective efforts are made towards further coordinating regulation, preventing market distortions and monitoring free energy transmission. The Netherlands will remain active in relevant multilateral forums such as the IEA, IRENA and the Energy Charter. Consideration will also be given in 2017 to whether membership of the "Clean Energy Ministerial" is opportune.

There will also be a commitment to greening energy investments in emerging economies and developing countries. To this end, cooperation will for instance take place with development banks such as the World Bank, the EIB and the FMO (the Dutch Entrepreneurial Development Bank), and also with private capital providers and institutional investors. For the coherence of our international policy the Dutch government will decide how to deal with public bilateral contributions to the exploration of new stocks of fossil fuels in relation to the emission allocations. The Netherlands is strongly lobbying for renewable energy in the boardrooms of multilateral banks and opposing the most CO_2-intensive energy projects.

With Dutch climate financing, the Netherlands will be focusing on those who still have to adopt a modern energy supply. The Netherlands has set a target for 2030 of giving 50 million people access to renewable energy, and in particular to help the poorest countries with low-carbon growth.

The Netherlands will position itself in the emerging market for sustainable and energy-efficient infrastructure, the "New Climate Economy". The development of relationships with suppliers of renewable energy and energy conservation technologies is becoming increasingly important. The Dutch government wants to be involved with businesses, research institutions and civil society organisations in this light. Energy relationships with fossil-fuel suppliers remain important, but will increasingly be dominated by the transition to a low-carbon economy. In the relationship with countries that depend greatly on revenue from oil and gas there will be a commitment to reforming the energy sector through diversification and improving the sustainability of their economies. The Netherlands will give extra attention to countries that are dependent on oil and gas

revenues for the greater part of their national income, where the global energy transition could lead to instability and conflict.

7.2.2 European

In 2015 the European Commission announced a strategy to create a single Energy Union. This will serve a number of purposes: improving the security of energy supply, completing the internal energy market, reducing the demand for energy, making the European economy low-carbon, and furthering research and innovation in the energy sector. The European Commission published a range of legislative packages in 2016 under the flag of the Energy Union. Various important legislative proposals aimed at the climate and energy goals are still to come:

- The amendments of ETS and non-ETS legislation are currently being debated. For the EU as a whole these proposals implement the economy-wide climate target that the EU has proposed for the Paris Agreement. The scope is therefore broader than the Energy Agenda.
- For late 2016 a legislative package is on the agenda with the amendments of the Energy Efficiency Directive, the Renewable Energy Directive and the Energy Performance of Buildings Directive. It also contains a proposal designed to improve the operation of the European electricity market.
- Said package also includes a legislative proposal for the governance of the Energy Union. It includes the requirement that all EU Member States must draw up a national energy and climate plan. This will have a broader scope than the Energy Agenda and will also cover non-energy-related CO_2 emissions (e.g. from agriculture) and CO_2 absorption (e.g. through afforestation).
- On 20 July 2016 the European Commission published a communication about the European strategy for low-carbon mobility. For the coming period a series of detailed proposals is planned with a view to contributing to greater efficiency of the transport system, low-carbon alternative energy for transport, and low-carbon and CO_2-free vehicles.

Strategic input by the Netherlands

Agreements on cross-border issues, such as ETS, high-temperature heat and international transport, are logically made at international or European level. This requires a strategic input from the Netherlands in the above areas, with a commitment to aiming effectively for CO_2 reduction. The Dutch government thus does not consider it desirable to convert the European targets related to energy conservation and renewable energy for 2030 into binding national targets. In the EU's external energy policy the Netherlands will seek greater focus on diversification towards more renewable energy sources.

7.2.3 Regional cooperation in Northwestern Europe

The Netherlands is also aiming for the expansion of cross-border energy infrastructure and connection of energy markets in the Northwestern European region. This will lead to more efficient pricing and easier incorporation of renewable energy sources in the energy system. It will also contribute to ensuring the security of supply. The cooperation at Pentalateral (gas and electricity) and North Sea levels and in the Electricity Neighbours Group does not just concern the physical connections. It is also about harmonising rules and regulations and cross-border cooperation between governments, national regulators, network operators, trading platforms and market participants. Northwestern European cooperation also provides an opportunity to take steps faster in the ETS sectors (power and light and energy-intensive industrial sector).

7.3 National context

At national level the energy transition first and foremost requires a clear government view of the ultimate goal and a consistent policy. This creates certainty for investors, policymakers and other actors (such as the citizens) in society. The Dutch government has described its vision in the Energy Report and translated this into concrete actions in this agenda. The vision will be elaborated in greater detail in the national Energy and Climate Plan referred to above. The Energy and Climate Plan will be drawn up together with (market) parties in society, and with local authorities, in coordination with neighbouring countries.

7.3.1 State level

The provision of long-term certainty about the ambition and responsibilities of the parties in the energy and climate transition is essential. In this Energy Agenda the Dutch government is giving its long-term vision by formulating its ambitions for 2030 and 2050, specifying concrete measures and outlining further prospects and future lines of thinking. Although there is great unanimity in society about the ultimate goal by 2050 (low-carbon energy supply), there are still many different views of the appropriate transition path and associated measures. It must be ensured that the energy transition is an unstoppable development, one that continues when there is a change of government, whatever that government's ideology. It is important that the citizens, businesses and local authorities sense the urgency and grasp opportunities to take further steps in the transition to a low-carbon society.

Statutory embedding of goals, institutions or policy may contribute to this. It reflects political commitment and stresses the sense of urgency of the transition. The long-term climate targets of the energy policy are, however, already embedded in law through ratification of the Paris Agreement on climate change. The EU will now translate them

into concrete targets for 2030 and 2050. As a result these goals are already legally binding for the Netherlands. At national level statutory embedding can contribute to the clarification of roles and responsibilities, for example by establishing administrative processes and institutional checks and balances.

Shared ownership and a common sense of responsibility can also be organised by means of periodic societal agreements, following on from the Energy Agreement for sustainable growth, the Fuel Mix Report and – on a smaller scale – the Green Deals. Given the subdivision into the four functionalities and the further decentralisation of the transition, implementation in subagreements or regional agreements with customised functionalities is an obvious strategy. The evaluation of the Energy Agreement shows that this approach can be successful in achieving targets. Stakeholders have committed to embarking on the course towards a long-term energy transition. Periodic implementation of agreements allows changes in the international context to be acknowledged, as well as technological innovations and developments in society.

Reliable and widely accepted fact-based knowledge is important for furthering the climate and energy transition. In its advice, "Climate policy for the long term", the Scientific Council for Government Policy recommends setting up a Climate Authority for consulting, monitoring, coordination and social dialogue. The Dutch government is implementing such broad social embedding by continuing to work out the details of the Energy Agenda together with social partners. In addition, according to the Dutch government a politically independent and recognised "financial expert and monitoring function" can be fulfilled by better equipping the Netherlands Environmental Assessment Agency (PBL) to this end. This is in line with the recently chosen approach by which ECN's financial expert and monitoring function will go to the PBL from 2018. In this way a collective and broadly accessible "knowledge function", which includes knowledge development and knowledge sharing, can provide support to parties contributing to the energy transition. A knowledge agenda will be developed for this purpose.

Initiatives in society are on the rise to implement the energy transition in concrete form in the own living environment. This social movement requires a responsive and open approach from the government that provides scope for such initiatives. It is important that government, together with other parties, continues to invest in greater awareness and social acceptance of the climate and energy transition. This starts with a clear narrative about the urgency and necessity of the transition, consistent policy, and sharing knowledge and best practices. Continued dialogue in society with greater focus on social innovation and societal initiatives may contribute to this.

In the coming months the Dutch government will keep engaging with parties, with reference to the Energy Agenda, to discuss further details regarding institutions and transition paths, which will ultimately include considering how to embed the organisation structure of the energy transition.

7.3.2 Regional

There are different reasons why the energy transition is also very much a process taking place at regional level. The transition has a spatial aspect and there are regional differences in housing stock and available energy options. The transition also has major consequences for the immediate living environment of citizens, this also emphasizes the importance of local consultation.

Spatial aspect

A low-carbon energy supply needs more space than the current energy supply. This requires good spatial planning policy and cooperation at all levels. The Dutch government must therefore allow regional and local authorities and civil society parties room to manoeuvre. On the other it must use financial and spatial frameworks to aim for solutions that are more effective and more efficient at supraregional or national level. The proposal of the Dutch government for the Environment and Planning Act – expected to come into force in 2019 – is a step forward in this respect. It focusses on environmental visions and regional or thematic programmes drawn up by national government, the provinces and municipalities, with the energy transition as one of the main themes.

Regional differences in housing stock and energy options

Provinces and in particular municipalities, in cooperation with network operators, will fulfil an important role in the choice of technology for space heating and the investment decisions on energy infrastructure. The decisions will have a strong regional component because the existing housing stock is extremely diverse and the available energy options differ regionally, so that customisation is necessary. Given the impact on people, this requires properly legitimised democratic decision-making with scope for input and alternatives from the local community – in particular through local initiatives.

Dialogue with municipalities, the general public and businesses

The transition has major consequences for people's living environment. Many parties are already actively contributing to the energy transition and busy developing new initiatives. Municipalities will play a part in intensifying the dialogue with their citizens and businesses about the urgency and nature of the change due to the transition and about the perspectives for action. The transition is taking place within a broader societal transition, in which society is better and better able to organise itself. This social innovation creates new forms of entrepreneurship that can act as a catalyst for the energy transition.

The success of the energy transition will in large part depend on how the local community is involved. Linking spatial functions, constructive involvement of the citizens and residents experiencing shared ownership are of essential importance in this regard.

7.4 Follow-up process

The coming months will be used to further shape the discussion of the transition in conjunction with the citizens, businesses, civil society organisations and the various public authorities. In the ultimate organisation of the energy transition, agreements will have to be made about ambitions, roles, responsibilities and rules for cooperation, such as the method of decision-makingand horizontal and vertical escalation. The outcomes of this process in combination with the detailed transition paths will show the actual outlines of the structure of the energy transition. It will also produce a partnership with all the parties concerned and a basis for drawing up the national Energy and Climate Plan together.

8

How will the energy transition be incorporated spatially?

The previous chapter explained how government is proposing to organise the energy transition in conjunction with other public authorities and the parties concerned. It set out in broad terms what powers and processes will come into play at European, national and regional level. The energy transition will have a great impact on the physical living environment and will lead to a major spatial planning task. This chapter looks at the spatial challenges and opportunities of the energy transition and the use in this regard of specific powers and processes.

8.1 Physical characteristics of the energy transition

Energy transition visible to everyone

The transition to a low-carbon energy supply by 2050 is a major operation with great spatial effects. This will be reflected in our landscape, often in places where we live, work and enjoy leisure activities and where wildlife, agriculture and water are also present. In this regard renewable energy generation usually requires more space than fossil energy. Current examples of visibility include wind farms, solar panels on roofs and electricity transmission lines, but also biofermenters, heat pumps and solar panel farms.

Transformation of areas

In the urban environment the energy transition will be visible in the buildings themselves, as well as in the transformation of areas. Heat grids and geothermal heat boreholes, for example, are a less visible, but no less significant new claim on space. Under the ground energy "competes" with functions such as pipelines, drinking water extraction and the extraction of minerals.

Space must be found offshore, among all the other functions requiring it (such as shipping, fishing and wildlife), for wind turbines, solar panels and technologies such as tidal technology and biomass production. Finally, the energy transition requires new and different infrastructure, such as good international connections, storage facilities and a network capable of coping with different energy sources (gas, electricity and heat).

Innovative spatial design and regional management

The new demand for space, combined with the current and future claim on space of other functions, underlines the huge extent of the operation and the need for innovative spatial design and management at regional level by provinces and municipalities. As far as possible we will have to seek combined use of space and combinations of functions. The further details of the transition paths for the different functionalities will also reflect the associated regional demand for space and generating potentials. The available environmental qualities will also be considered. This may produce different results for the various transition paths of the energy functions.

Besides the arguments of cost-effectiveness, technical feasibility and safety, the impact on the quality of the environment of a particular technology or solution will also have to be an important aspect in ultimate decision-making. At local level a combination of different energy functions could produce benefits compared with separate functions.

8.2 Integration of the energy transition in spatial policy

Integration at all levels

The physical task outlined requires the energy transition to be integrated into spatial policy at all administrative levels. The power to make the spatial choices required lies

only partly with national government. Besides national government, provinces and municipalities will have to incorporate the energy transition in their Environmental Visions, Environmental Plans and where necessary in regional or thematic programmes. Public authorities will as far as possible integrate the energy transition and combine it with other social tasks. The investment opportunities will be determined in part by when construction, renovation and reconstruction take place. In this way national government, provinces and municipalities will contribute in stages to the climate and energy targets of the Netherlands for 2050.

Facilitating municipal and provincial authorities

In recent years municipal and provincial authorities have worked hard on drafting integrated spatial policy related to the energy transition. During the Energy Dialogue and the National Climate Summit in 2016 they also expressed a strong desire to increase efforts in the coming period. The Dutch government values this commitment and ambition and is opting for a joint approach, under which it is happy to facilitate and support regional and local public authorities where the spatial task so requires.

Careful and reasonable assessment

Despite the smartest possible design work, combining functions, conservation options and the smart connection of renewable generation to existing infrastructure, environmental quality could come under great pressure or social resistance may arise. In these cases the competent authority concerned must make a careful and reasonable assessment, while applying the underlying principles of stakeholder management.

8.2.1 Stakeholder management

For the Dutch government area characteristics and area values are underlying principles for decision-making about energy plans and projects. The spatial incorporation of energy projects takes place within the frameworks of integrated spatial design on a regional scale, for which a participative decision-making process must be followed. In the case of large-scale projects the decision-making will also be improved by broad application of the underlying principles of the Vision for Stakeholder Management 2016.

Application of National Coordination Regulations

The application of the National Coordination Regulations (NCR) will be optimised, with the Minister of Economic Affairs consulting the local and regional authorities for each project on the implementation of the decision-making process and the implementation of the decision-making procedure. Evaluation of the NCR in energy projects, about which the Dutch House of Representatives will be informed in early 2017, shows that national coordination is an important tool for streamlining and accelerating decision-making. The effectiveness of national coordination does, however, depend on the situation and the way in which it is applied.

Under the new Environment and Planning Act national coordination will be regulated by project decisions. The underlying principle for project decisions is that these are only taken by government in the event of a national interest. In this case the roles, tasks and responsibilities of the competent authority and the initiator of the energy project in question will be allocated and explained by the State. The government will also consult the local and regional authorities for each project on the implementation of the decision-making process and the implementation of the decision-making procedure.

The Dutch government will act on new initiatives for NCR projects for onshore wind and solar, provided that these initiatives meet two conditions. Firstly, there has to be administrative agreement with the province and municipalities concerned that the initiative is in keeping with the regional ambitions of the energy transition. The second condition is that initiator and competent authority apply the underlying principles for environmental management, as described in the Vision for Stakeholder Management 2016.

8.2.2 Benefits and burdens

Energy projects have an impact on the physical living environment. In many cases these projects also involve a number of safety risks. Regional public authorities are therefore requesting assessment of the division of benefits and burdens. The energy sector is addressing concerns of the general public and regional public authorities, as reflected by the surveys in the various sectors.

The Netherlands Wind Energy Association (NWEA) has, for example – together with the Wildlife and Environmental Federations, the Netherlands Society for Nature and Environment, ODE Decentraal, Friends of the Earth Netherlands and Greenpeace Netherlands – signed the Code of Conduct for Support and Participation for Onshore Wind Energy. This code of conduct was evaluated in 2016. The evaluation shows that eight project developers out of ten allow surrounding residents to participate financially in the construction of new wind turbines. People can participate financially in nearly all wind energy projects.

The oil and gas industry is also currently working on a code of conduct. In this, the Netherlands Oil and Gas Exploration and Production Association (NOGEPA) addresses measures in the vicinity of a mining site. Public authorities are also seeking wider attention for investments in regional socio-economic projects. Consideration will shortly be given, in conjunction with the oil and gas industry, to whether and how this can be implemented.

In 2017 research will be conducted into the way in which the division of benefits and burdens can be assured in general terms in energy projects and which specific measures can be taken in this regard.

8.3 Spatial choices

As far as possible, government is committed to joint agreements about the use of the space above and below ground. By working out details of transition paths for each functionality, national government will give direction where regional and local public authorities have asked for it in the Energy Dialogue. In this way they can include energy in their own Environmental Visions and Environmental Plans. At the same time government wants to set an example by using State land (under its own jurisdiction), waters and property as much as possible for the realisation of the energy transition.

8.3.1 Subsurface Structure Vision

The subsurface is increasingly being used to meet social needs, in particular in the area of energy supply and the drinking water supply. Interests and activities under the ground must be coordinated with each other and also with the aboveground interests and activities. Public authorities must therefore coordinate their actions with each other. The Subsurface Structure Vision provides clarity in advance about how the government assesses developments in the area of the energy supply or the drinking water supply. The Subsurface Structure Vision is therefore largely about developments that are still uncertain. The Subsurface Structure Vision does not indicate where activities will take place, but addresses whether activities may be or are in principle ruled out. For the energy transition this provides a framework for underground activities such as geothermal heat and heat grids.

8.3.2 National Environmental Vision

The Dutch government is working in the framework of the Environmental Vision on a National Environmental Vision (NEV) in 2019. The spatial opportunities and conditions for the energy transition will be laid down in it, in relation to other national tasks. The energy transition will be included in the NEV as one of the strategic tasks. Before the end of 2016 a survey will be started of the spatial impact and spatial opportunities of the energy transition at national level in which both the possibilities below and above the ground have been included.

8.3.3 Commitment to State land, waters and property

Much renewable energy and energy conservation can be realised on State land and buildings. The opportunities that exist for energy on State land, buildings or waters will be surveyed as part of the NEV. Apart from the existing actions, stock will be taken of what other options there are on State property, possibly with different technologies. An example of this is the development of solar panel farms on State waters.

8.3.4 Support of the regional approach

It is advisable that, on the one hand, the progress of the regional energy plans is compared with the national targets and, on the other, statements can be made about the costs and benefits of the regional approach compared with more supraregional and national projects. This requires a programmatic and area-focused approach. In 2017 the Dutch government will evaluate the approach of regional energy strategies in conjunction with the Association of Netherlands Municipalities, the Association of Provincial Authorities and the Association of Regional Water Authorities, and on the basis of this see whether the approach can be applied nationally and the support this requires. The Dutch government will also examine what support municipalities and provinces need to make the energy transition an integral part of their own environmental visions and plans. It will also consider what is needed to produce readily accessible national data and knowledge for an effective regional approach (Energy Atlas).

- The energy transition is a major spatial planning task, in which, on the one hand, we are committed to an "energy transition that strengthens the quality of the living environment' and, on the other, we want "energy-inclusive spatial planning" leading to energy-inclusive investment decisions in the spatial domain.
- The spatial opportunities and conditions for the energy transition will be laid down, in relation to other national tasks, in the National Environmental Vision in 2019. The Subsurface Structure Vision provides the framework for underground activities such as geothermal heat and heat grids.
- Besides existing actions, we are going to take stock of the other options that exist on State property, possibly with different technologies.
- In 2017 the Dutch government will evaluate the approach of regional energy strategies in conjunction with the Association of Netherlands Municipalities, the Association of Provincial Authorities and the Association of Regional Water Authorities, and on the basis of this see whether a programmatic and area-oriented approach can be applied nationally and what support this requires. It will consider what is needed to produce readily accessible national data and knowledge for an effective regional approach (Energy Atlas).
- In 2017 there will be research into the way in which the division of benefits and burdens can be embedded in energy projects in general terms and which specific measures can be taken in this regard.

9

How do we provide for the required renewal?

In the previous chapters we have made clear that the challenge of having a low-carbon energy system by 2050 is profound. Many innovations are needed to realise this transition in a responsible and affordable manner. However, developing these innovative energy solutions and making them marketable may well be an important contribution to the earning potential of the Dutch economy. The Netherlands can contribute to the energy transition elsewhere in the world in this manner.

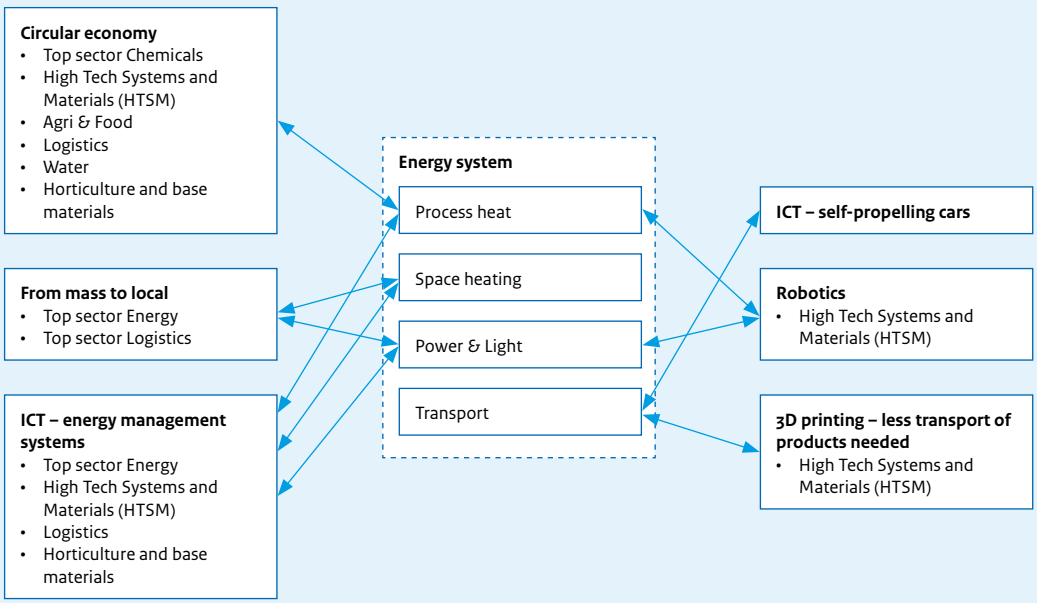
The innovation challenges differ from one energy functionality to another. For the high-temperature heat and transport functionalities entirely new solutions are needed to attain sustainability. In the case of low-temperature heat and power and light it is more about continuing to develop innovations to realise further cost-price reductions and about implementation, where the attention is more on socio-institutional issues.

9.1 Committing to the social challenge of CO_2 reduction

A bright spot on the horizon is needed for an effective innovation process on which all parties can focus their investments and innovative capacity. The choice to target CO_2 reduction provides this common goal for all the parties involved. The effects of focusing the energy innovation tools on CO_2 reduction must be analysed. The energy innovation tools will be evaluated in 2017. Attention will be given specifically to the question of whether the energy innovation schemes contribute sufficiently to CO_2 reduction in broad terms or whether the schemes require adjustment or expansion.

The social challenge of CO_2 reduction will also have a more important place in top sector policy. This is because other developments are relevant for the social challenge of CO_2 reduction than the developments (for example in other top sectors) in the Energy Top Sector.

Figure 10 *Social challenge of CO_2 reduction in the top sector policy*



9.2 Innovation required as part of each transition path

Taking stock of innovation challenges

The innovation challenges will be analysed as an important part of the further elaboration of the transition paths for each functionality. The available knowledge of the Energy Top Sector and the National Science Agenda will be used for this. The use of tools and resources for innovation will then proceed primarily on the basis of the innovation tasks outlined, with explicit prior assessment of which parts of the innovation tasks we must commit to in the Netherlands and which not.

Strong need for clear choices

The Energy Dialogue shows that parties investing in research, development and demonstration have a strong need for clear choices by government, aimed at the long term and with long-term (financial) certainties.[5] The parties can then commit to a programme in the long term and invest in it. When developing new products and services there is often talk of a lack of market (perspective). There is not as yet any (large-scale) infrastructure available and non-technological aspects must be taken into account (for example, attractiveness and size of a heat pump). This requires a programme approach for each functionality, of which the commitment to innovation is an integral part.

The Netherlands is a knowledge economy that gains from permanent investments in basic research, applied research, good research facilities for applied knowledge institutes and R&D across sectors and social challenges. This too deserves attention in addition to the programme approach for each functionality. Given the speed at which developments take place, the Advisory Council for Science, Technology and Innovation (AWTI) also recommends provision of better incentives for the development of relatively unknown, but potentially highly promising technologies in the framework of CO_2 reduction.[6] The Dutch government will work out a proposal to this effect in 2017.

5 See also Energy Dialogue, NWA and AWTI advice on energy innovation (2016).

6 See also AWTI advice on energy innovation (2016).

9.2.1 Long-term mission-driven innovation programmes

Providing long-term certainty

The government can provide long-term certainties for energy innovation by committing itself to a number of long-term, mission-driven innovation programmes. There may be several innovation programmes for each transition path. A decision on the themes for which it will be opportune to start these (or in any event an initial number of) long-term innovation programmes will be made in 2017. Clear objectives and clear and transparent indicators will be formulated for each programme, on the basis of which proper monitoring and adjustment can take place. The long-term innovation programmes will in principle focus on all phases: basic research, applied research, R&D, demonstration phase and initial rollout phase. The government role will also be indicated; for example, the role of legislator (standardisation), launching customer and driver of innovative spending.[7]

Rollout support

In general the initial rollout phase follows the demonstration phase of a technology or service. The costs in this phase are relatively high in comparison with the costs in the previous innovation phases because ever greater installations must show whether the technology is widely applicable and reliable. Energy Dialogue participants in particular recommend better covering the risks in this phase. In practice it seems that scaling up promising technologies such as high-grade gasification, geothermal heat and mono manure digestion require customisation, since the problem areas vary greatly from one technology to another. Where and to what level government aid is appropriate must be determined on a case-by-case basis. In this regard market participants bear the "normal" entrepreneurial risk. The government will also only support the market launch if there is a genuine prospect of a broad rollout under "ordinary" market conditions.

Box 5. Example of a mission-driven innovation programme

The joint effort for the cost reduction of 40% in offshore wind is a good practical example of the effect of mission-driven innovation programmes. A road map for offshore wind has been drawn up with all the parties concerned, with a separate innovation programme, a separate category within the SDE+ and construction of the required infrastructure at sea. In this example there is a joint ambition and government provides that clear direction and organises the necessary conditions.

7 See also Sustainable Growth Study Report.

9.2.2 Strategic international cooperation

For a small country such as the Netherlands, from a strategic perspective it is pre-eminently important to cooperate internationally. This strengthens the knowledge base, leads to economies of scale, accelerates the innovation process and provides economic opportunities. It may also be attractive to be the first to use innovations developed abroad and therefore act as a test bed. By focusing the use of resources, the Netherlands can respond faster to promising international cooperation projects and draw research funds to the Netherlands; for example by taking advantage of the European Commission's largest research and innovation programme (Horizon 2020), in bilateral cooperation projects with neighbouring countries, and by cooperating in a targeted manner under the Mission Innovation initiative.

9.2.3 Non-technological innovations important for renewal

Current energy innovation policy is strongly focussed on technological innovations. Developments in society, however, show that there is also a need for a different type of innovation that is targeted more at social, economic and institutional developments. During the Energy Dialogue there were various requests to broaden the innovation approach with such different forms of innovation and to integrate them into the technological programmes. In working out the transition paths for each functionality in detail the aim will as far as possible be an integrated approach of technological and social innovation and conditions (for instance using the top sector Socially Responsible Innovation programme). Since the region has an important role in the social embedding of the technologies, the role of the region will be expressly considered when determining the programmes.

9.2.4 Organisation and cooperation

In recent years the top sectors have successfully contributed to the creation of sustainable partnerships between businesses, knowledge institutes and the government.[8] The Energy Top Sector is the only one with a dual objective, that is accelerating the energy transition and strengthening the earning potential of the Dutch business community. In 2017 realising the innovation tasks will be discussed in conjunction with the Energy Top Sector parties concerned. This will closely follow the process of giving further shape to the organisation of the broader transition.

[8] See AWTI advice: Making more flexible, differentiating, choosing sharper – Balance of the top sectors 2016.

The new Netherlands Energy Research Centre, resulting from the pooling of the energy research of the ECN Foundation and TNO, will also assume a pivotal role in the energy sector and as a partner of universities, other (applied) knowledge institutes and the business community.[9]

Where the Netherlands commits to innovative solutions for the energy transition and in some areas may perhaps even be an international front-runner, this has a direct impact on the opportunities for our employment and export position. If we want to be able to use and maintain innovations in the Netherlands and capitalise on our market opportunities, then the Netherlands must have a well-trained and versatile workforce. This requires flexibility and cooperation with the business community in creating the educational curricula in secondary and higher vocational education and at universities. It also requires attention within businesses for the continuous development of knowledge and skills of their staff.

Box 6. Dutch expertise

A number of examples of areas in which the Netherlands can play a strong role in the transition to low-carbon energy management are:

- offshore wind, in particular construction and installation of support structures;
- solar PV technology;
- efficient compact equipment for heat production and storage in the built environment;
- biomass processing for energy applications using gasification and digestion, but also conversion of biomass for high-grade applications;
- intelligent, integrated electricity systems (smart grids).

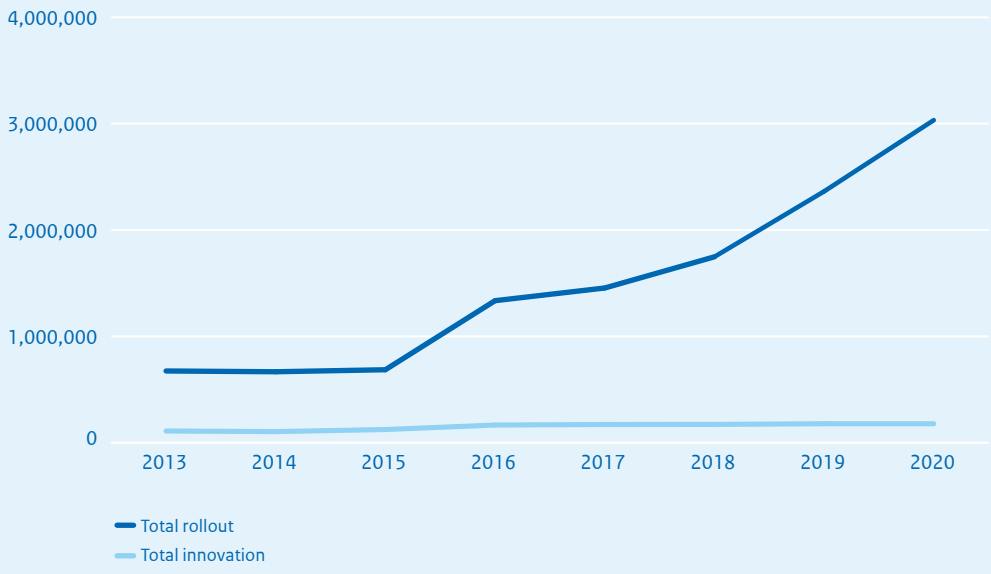
9.3 Resources for innovation for cost-effective transition

It was noted in Chapter 2 that by putting the challenge of a low-carbon economy by 2050 centre stage, a greater emphasis on the policy aimed at the (continuing) development of new technologies and the exploitation of economic opportunities seems obvious. The AWTI advice and the Energy Dialogue revealed – a broad consensus – that there are reasons to increase the commitment to the entire innovation chain, from basic research to initial rollout, in the coming years. This will allow the transition to proceed efficiently and cost-effectively. The AWTI and the National Science Agenda recommend increasing public funds by some €250–300 million per year.

[9] See Parliamentary Papers II, 2016-2017, 30 196, no. 476.

Large-scale rollout of renewable energy will be promoted through the SDE+. This large-scale rollout is a driver for innovation. This does not, however, alter the fact that investments in innovation are necessary to make a cost-effective transition possible. Since the social revenue of innovation is often greater than the revenue for an individual business, a role has been set aside here for the government. In the coming years we will therefore have to see to what extent the balance of resources between rollout and innovation is appropriate to cost-effective transition paths towards 2050.

Figure 11 *Resources available for rollout and innovation 2013-2020 (x €1,000)*



10

The importance of an affordable energy supply and a social agenda

10.1 Costs of the energy transition

There are different approaches to looking at the financial consequences of the energy transition. The transition to a low-carbon society in any event requires significant investments in research, innovation and application of technologies in the field of energy conservation, energy storage, renewable energy, infrastructure and carbon capture and storage. The ultimate costs very much depend on such matters as the development of fossil energy prices, the cost of learning processes, and cost reductions due to new technologies. The costs are also probably highly dependent on the degree to which forms of international cooperation and the associated economies of scale can be exploited. This section discusses a number of different reports and approaches.

In the recently published World Energy Outlook of the International Energy Agency[10] estimates were made of the investments required globally. To achieve a temperature increase not exceeding two degrees Celsius by 2050, globally $40 trillion ($4 trillion less than in the basic scenario) are needed in investments in the energy sector, mainly in renewable energy and low-carbon options. A further $35 trillion ($12 trillion more than the basic scenario) are needed in investments in energy efficiency. The one-and-a-half degree target from the Paris Agreement on climate change makes this task even more ambitious.

McKinsey says[11] that the capital and operating costs for the Netherlands in the period 2020-2040 should be around €10 billion per year to achieve 60% CO_2 reduction in 2040 (80% in 2050). This is the sum total of investments in transport, built environment, industry and energy system adaptations consisting of further development of renewable forms of energy and network adaptations. This represents around €2.5 billion per year of additional costs compared with the basic scenario. In the event of a more ambitious target of 95% reduction of greenhouse gases by 2050, according to McKinsey 80% reduction would have to take place by 2040. The task in this case is estimated at around €15 billion per year. This assessment however is based on the Netherlands not cooperating internationally and that only existing technologies will be used to improve the sustainability of the energy supply to a large degree, that is without cost reduction through innovation. As a result a newer technology such as CCS is also disregarded.

It was estimated by PBL and ECN in 2011[12] that in the basic scenario the direct costs of moving towards a low-carbon energy supply come to €10 billion per year. The margin of uncertainty is relatively large however, that is between €0–20 billion per year. These direct costs consist of two parts. On the one hand the cost associated with the consumption of

10 International Energy Agency, 2016, World Energy Outlook 2016

11 McKinsey & Company, 2016, Accelerating the energy transition: cost or opportunity

12 PBL and ECN, 2011, Towards a clean economy by 2050: routes explored; ECN and SEO, 2012, Costs and benefits of climate policy 2050.

energy feedstocks. On the other the costs associated with the purchase and the use of the installations with which energy carriers are produced, the infrastructure for the transport of energy carriers and the factories, buildings or appliances in which energy is used.

Ecofys has calculated that the transition in the built environment will lead to an increase in system costs of €5–15 billion per year. Major investments are needed in all the scenarios for more far-reaching measures to cut emissions in the built environment. These investments will not all pay for themselves at national level (excluding energy tax) and this will lead to a national cost item. In the scenario with the highest investments the additional system costs are the lowest, around €5 billion per year. In other scenarios the additional system costs rise to €15 billion per year.[13]

Given these different approximations, there is a need for a more extensive study of the expected costs. The Dutch government will use the underlying principles as formulated in this Energy Agenda to analyse the social costs and public expenditure involved with the transition towards a low-carbon society in 2050. The results are expected in the first half of 2017.

10.2 Affordability

It is important that the energy transition remains affordable for the general public, businesses and the government. Greater SDE+ expenditure will for example lead to a higher energy bill from the storage of renewable energy. The Dutch government is therefore committed to policy by which the transition can be made cost-effectively. The cost savings achieved from offshore wind show that this is possible.

Below is an indication, based on the NEV 2016, of the development in the renewable energy levy and the effect of the cost savings achieved with offshore wind on the energy bill for an average household to 2023. The ultimate impact the energy transition will have on the energy bill and the public finances in the medium to long term is surrounded by many uncertainties. This too will therefore be analysed in further detail in 2017.

Indicative energy bill of an average household in €

	2015	2020	2023
Renewable energy levy	20	135	145
Effect of offshore wind cost saving	0	-1	-23

[13] Ecofys, 2016, Quantification of future scenarios for the built environment

10.3 Financing in the energy transition

An attractive investment climate that contributes to a low-carbon energy supply needs the government to ensure the right conditions, operating on the basis of a long-term vision. The government is promoting the cost-effective energy transition with a coherent package of measures and frameworks (such as pricing through ETS and taxes, operating subsidies, innovation subsidies, standardisation and obligations).

With the right mix of tools and frameworks projects have clear-cut risk-return ratios for financiers. In such cases no further government intervention is necessary in principle in terms of actual financing of projects (e.g. in the area of wind energy and projects in the area of gas and electricity infrastructure).

In other cases there are problems in the area of financing, because of which investments do not materialise in the market and as a result of which government intervention may be desirable:

- Great (technological or policy-related) risks are a problem area for obtaining long-term financing. This comes into play in different areas, such as geothermal heat, the construction of heat infrastructure or innovative projects in the gap between the demonstration phase and the rollout phase.
- A lack of coordination between different players dependent on each other. This may, for instance, be due to limited scale of projects, the lack of familiarity with the technologies and the lack of familiarity of the initiators at banks.
- A lack of expertise among developers in the financial structuring and assessment of risks around project proposals, as a result of which there is no connection between developers and financiers.
- The risk-return ratio is higher than the market is willing to finance, as a result of which financing or the right financing structure does not come about.

The government is helping to resolve the said problem areas, for instance through the Netherlands Investment Agency (NIA). One of the aims of the NIA is the support of public and private parties in the preparation and development of investment projects. In this way the connection between project developers and financiers, such as the Netherlands Investment Institution, will be better assured.

At the same time a trial has recently started with an Energy Transition Financing Facility (ETFF). This facility can provide subordinated loans under the Corporate Finance Guarantee Scheme for projects that are not currently coming on-stream fast enough because of too little (risk-bearing) capital being contributed (up to in total €100 million for now). The European Investment Bank has shown interest in collaborating on the ETFF, for example in the form of co-financing or through a guarantee.

The Dutch government will also be bringing forward a proposal for a national financing institution before the end of its current term of office. As previously indicated, problems regularly arise through a lack of coordination, expertise and availability of (risk-bearing) capital. Whether, and to what degree, a solution to these issues can be provided by a national financing institution will be worked out in detail.

The task facing Europe and the Netherlands to bring about the energy transition is substantial. The Energy Agenda sets out the choices there are and what steps must in any event be taken. The transition paths for each functionality leading up to 2050 have also been outlined. We must use the coming years to work this out in further detail together with all concerned.

10.4 The social consequences of the Energy Agenda

As has emerged in the previous chapters on different elements, the energy transition will involve social consequences for the Netherlands in addition to financial consequences. Almost everyone will notice the consequences directly or indirectly. This transition will, for instance, have consequences for the price of energy, but also for the houses in which we live and the cars we drive. A number of these developments have already started and others will follow in the coming years. New homes will be equipped with heat pumps, solar collectors and additional insulation and requirements will be made concerning the maximum pollution produced by cars.

The energy transition will also have consequences for the business community in general and more specifically for businesses that use energy intensively in the form of fossil fuels. New technologies, energy conservation and other behaviour will lead to a different composition of energy production and therefore also to a different workforce composition. For some occupations this will mean a decrease in employment. At the same time there will also be additional employment because demand will emerge for new professions. This includes the growing demand for workers who can build and maintain wind turbines as a result of the advent of wind energy farms. The skill requirements of people working in the energy sector and energy-intensive industrial sector will change as a result of these developments, which will ensure that the adaptability of the workforce will be of growing importance in the future. This underlines the importance of life-long learning.

The government, employers and employees and the educational institutions must together seek to ensure that a prospect of a new job is also offered to those at risk of losing their job. This will not always be in the same place or in the same sector. There is a role in this for all parties to ensure that this is coordinated as well as possible.

It is difficult to predict precisely what consequences the energy transition will have for the labour market. This is the conclusion of the SER in its survey “Man and technology: together to work” (please note that the government response to this is in preparation). The Dutch government is therefore closely monitoring developments in the labour market and has an eye for the dynamics that the energy transition will bring about in the labour market. The SER will be asked to research the different aspects of the social agenda in more detail. By acting early and collectively as government, employees, employers and public institutions, we can seize the opportunities of the energy transition and ensure that as many people as possible benefit from it.

In this regard, the Dutch government and the social partners are committed to measures that increase the sustainable employability of employees and improve opportunities in the labour market. To facilitate this social partners have set up Education and Development Funds to encourage retraining and refresher training. There are also training vouchers for the self-employed or employees wishing to attend training focusing on a skills-shortage occupation. Initiatives are also being developed with civil society to increase sustainable employability. The National Technical Pact 2020, for instance, is using a structural approach to contribute to a well-trained labour force with sufficient smart and skilled engineers. For those who are unable to make the switch within the labour market immediately, however, the Employee Insurance Agency offers personal service and it is possible to attend necessary training and retain unemployment benefit.

Appendix

Appendix – list of promises and motions

Promise details	Promise	Where promised
18-12-2012 SDE legislative proposal debate	There will be constant attention for the burdens for the general public and businesses and for the competitive position of the business community.	Chapter 10
27-10-2016 Continuation of Budget Debate Economic Affairs, Economy and Innovation part	Employment and training will be considered in the Energy Agenda in relation to the energy transition for the period 2023-2050.	Section 10.4

Motion details	Motion	Where promised
06-10-2015 Second stage Electricity and Gas Act debate 34 199, no. 48	Requests the government to see how the statutory obligation to connect to gas can best be converted into a statutory obligation to connect to heat and to inform the House of Representatives about this before the summer of 2016.	Chapter 5
27-10-2016 Continuation of Budget Debate Economic Affairs, Economy and Innovation part 34550-XIII, no. 54	Requests the government to indicate in the Energy Agenda how the obligation to connect to gas is going to be deleted from the relevant legislation and regulations in the short term.	Chapter 5
27-10-2016 Continuation of Budget Debate Economic Affairs, Economy and Innovation part 34550-XIII, no. 55	Requests the government to analyse the desirability in the Energy Agenda of giving municipalities the management to produce plans for making existing districts gas-free.	Chapter 5
16-11-2016 Tax plan 2017 34 552, no. 67	Requests the government to take measures so that district heating systems do not face an increase in energy tax when switching from gas-fired boilers to the use of renewable sources.	Section 5.2.6 and announced research

Notes

Published by

Ministry of Economic Affairs
P.O. Box 20401 | 2500 EK The Hague
The Netherlands

www.rijksoverheid.nl

Illustrations:
Today Designers, Utrecht

Design and production:
Xerox/OBT, Den Haag

March 2017 | 101724