Vision for more sustainable basic industries in 2050: the choice is ours

Letter of 15 May 2020 from the Minister of Economic Affairs and Climate Policy, Eric Wiebes, to the House of Representatives

Dutch, European and global climate policies have fundamental implications for industry. By 2050 industrial production will have to be climate neutral. At the same time, it is clear that the world will continue to need basic industrial products. We will still drive, travel, dress and use medicines, all of which are made possible by basic industries. The COVID-19 pandemic has highlighted the fact that basic industries supply countless essential products for preventing and combating infection and treating patients. Given their important role in the production chain, workers in basic industries have been designated as key workers during the COVID-19 pandemic.

Even with the world in the grip of COVID-19, it is important for both government authorities and the private sector to think about the longer-term prospects for the economy, and make preparations for the climate and energy transition. A vision for 2050 will give industry and investors clarity about the direction the Netherlands wishes to take in the long term. This will help them plan sustainable investments, and will also bolster the government's efforts to minimise the economic impact of COVID-19. By taking the lead in the transition – with industry – the Netherlands can significantly boost its own sustainable earning capacity and contribute to solutions for the global challenge of climate change.

The Netherlands therefore has the ambition and the opportunity to become the leading location (in Europe) for sustainable basic industries and other industries. We already have everything that is needed: from a highly-skilled engineering workforce to a favourable geographical location for the trade in and transport of industrial raw materials and goods; from the North Sea's potential for large-scale production of green electricity to depleted gas fields for the storage of hydrogen and CO_2 (CCS) – as well as a network of pipelines originally built to transport natural gas, which is also suitable for hydrogen and biogas. Whether we use this opportunity depends on the choices we make now. Waiting will only lead to more uncertainty and increase the likelihood that other countries will make the major investments needed. This letter therefore outlines a vision for the future of Dutch basic industries. It is the first part of a two-part vision for industry in 2050; the second, focused more specifically on manufacturing, will be presented to the House after the summer.

This letter first considers the importance of the basic industries for the Netherlands, how climate change is changing the context, and how the Netherlands is positioned to take on a new, leading role in the greening of industry. As such, this letter provides some of the further details of the growth strategy I sent to you on 13 December 2019.[1] Attention then turns to the opportunities offered by the transition and the steps we need to take now. In this connection, I would point out that this letter also links up with the three letters that I sent to the House on 30 March 2020 (on the role of gas in the energy system,[2] the biogas roadmap,[3] and the government's vision on hydrogen)[4], setting out the government's views on renewable gases, both now and in the future. Finally, this letter examines the European effort and a number of further actions. All of these matters have a bearing on the achievement of the vision set out in this letter. I have thus met my commitment to produce a comprehensive letter to parliament covering several industry-related climate issues.[5]

[1] House of Representatives 2019-2020, 29696, no. 7.
[2] House of Representatives 2019–2020, 32813, no. 486.
[3] House of Representatives 2019–2020, 32813, no. 487.
[4] House of Representatives 2019–2020, 32813, no. 485.
[5] This undertaking was given during the debate on the bill to amend the Gas Act, concerning the curbing of demand from large-scale customers for low-calorific gas (35328).

The importance of industry in the Netherlands

Basic industries[6] are and will continue to be of great importance for the Netherlands' earning capacity (€16.8 billion in 2017), direct employment (120,000 jobs in 2017) and position in many value chains. The activities of energy-intensive basic industries in our country are concentrated in five industrial regions: Rotterdam/Moerdijk, Zeeland (Terneuzen and surrounding area), the North Sea Canal region, the northern Netherlands (Eemshaven-Delfzijl and Emmen) and Chemelot (the area around Geleen in the province of Limburg). The activities of other basic industries like paper, glass, building materials and food are more dispersed around the country. In the above-mentioned regions in particular, basic industries have considerable importance in terms of added value and employment (see annexe 1, fig. 1a).

Dutch basic industries specialise in the production of largely homogeneous commodities and semi-manufactured goods, such as workable steel, aluminium, fuels, plastics, industrial gases, paper, glass, ceramics and basic ingredients for food products. These goods are subject to global, largely cost-driven competition, which has resulted in production on a very large scale, with high capital intensity[7] and very high labour productivity (see annexe 1, fig. 2). The production processes generally take place at very high temperatures and pressures, in enormous, complex plants which are very expensive to build for reasons of safety, reliability and operational life (plant construction costs generally range from hundreds of millions to several billion euros). Such investments take many years to prepare for and implement.

Besides direct employment, the activities of basic industries also generate turnover in their supply industries at a multiplier of 1.66 on average (see annexe 1, figure 1b). These industries include contractors and subcontractors for maintenance and construction, and business and logistics services. They, too, are characterised by a high degree of regional concentration. Rotterdam's port and industrial complex, for example, annually purchases over €1 billion worth of high-value business services (insurance, legal assistance, accountancy, etc.), 60 to 70% of which are provided by businesses in the Rotterdam-Rijnmond region.[8]

The basic industries also have a knock-on effect on knowledge ecosystems. Basic industrial sectors invest relatively high sums in R&D (see annexe 1, fig. 2). Companies like Tata Steel, Shell, Nouryon, SABIC and Dow Benelux are important players in public-private consortia for materials and chemicals,[9] for example, while Cosun and FrieslandCampina are actively involved in consortia at the interface of the food and chemicals industries. The basic industries are thus interwoven into the entire Dutch economy, which further magnifies their importance.

The wider importance of basic industries for employment and earning capacity is partly the result of Dutch industry's strong position in global markets. In the globalised economy, made possible by the steady lowering of trade barriers and transport costs, specialised companies all over the world add value at different stages of the production process until the 'end product' finally reaches consumers. These processes are known as value chains. The value of Dutch basic industries comes partly from their position in their respective value chains.[10] Basic industries are a key supplier for the high-value-added manufacturing industry in the Netherlands. The current global COVID-19 pandemic underscores the importance of basic industrial production nearby – for economic competitiveness and for the continuity and security of supply of vital medical devices and equipment. Basic industries also provide steel and coatings for ships and offshore wind turbines, plastics and composites for more energy-efficient aircraft, cars and medical scanners, glass and glass fibre, building materials, and ingredients and packaging for the food industry. The proximity

[6] In this letter, 'basic industries' comprises the following sectors: oil refining, chemicals, paper, basic metals, building materials and part of the food industry.

[7] See the playing field appraisal carried out for the purpose of the National Climate Agreement, which is an annexe to Parliamentary Paper, House of Representatives 2018-2019, 32813, no. 308.

[8] Erasmus Smart Port Rotterdam, Erasmus University, Utrecht University (2011). *Rotterdam World Port World City: Hoogwaardige zakelijke dienstverlening voor het Rotterdamse haven- en industriecomplex.*

[9] For example: the Advanced Research Center Chemical Building Blocks (ARC CBBC) and NWO's Electrochemical Conversion and Materials programme. See https://www.co2neutraalin2050.nl/bedrijven/.

[10] Timmer, M. and De Vries, G. (2015), 'Dutch Manufacturing Competing in Global Value Chains'.

of industrial suppliers is an advantage for high-value manufacturing in the Netherlands and neighbouring border regions, helping them compete in international markets. The value chains in the chemicals, mechanical engineering and metal industries, and the added value of service providers in these industries, together account for 26.4% of the Netherlands' total value-added export (see annexe 1, fig. 4).

The Netherlands produces relatively large quantities of basic products compared to other EU countries. This is evidenced, for example, by the fact that in the steel, chemicals and refining industries, some three-quarters of production is intended for export (see annexe 1, fig. 3).[11] However, a drawback of basic industries is that they are highly dependent on fossil fuels, and therefore account for a large proportion of carbon emissions. This is one of the reasons why Dutch greenhouse gas emissions per capita are substantially higher than the European average.[12] Most production processes in the basic industries have been modernised gradually over the past few decades, resulting in decoupling (higher energy- and emissions-efficiency and growth in production).[13] Nevertheless, absolute emissions from industry are still too high. The transition in the basic industries therefore plays a key role in the National Climate Agreement and in efforts to achieve the European climate goals.

Climate policy will fundamentally change basic industries worldwide

Dutch basic industries currently enjoy a good position in global markets. However, the international rules of trade are changing fundamentally as climate policies take effect. This will ultimately affect all countries, and the future of these industries will be determined to a large degree by the rate at which countries are able to adapt to the new reality. This means transforming today's polluting activities, or phasing out what cannot be transformed and building new, sustainable value chains.

The future of basic industries will be determined by new policy frameworks focused on sustainability and, in particular, by economic motives and the physical and energy-related requirements that technological solutions must meet. We cannot say for certain at this juncture what the situation will be in 2050. Various parties have thought about the future of our energy system and basic industries (for examples see annexe 2). New models are being developed to help us understand the complexity of ecological, physical and economic systems and their interactions.[14] The new reality as outlined in this letter is based on a set of forecasts which are themselves derived from evidence-based insights:[15] transport of energy and raw materials between countries will always be necessary; high thermal values can be achieved through zero-carbon or renewable energy generation until alternative low-temperature production processes become available; integrated and circular production processes lead to more efficient use of raw materials and lower emissions; the need for basic materials will remain, but their ecological footprint must be reduced. These insights are reflected below in the discussion of four key drivers of future development in the basic industries.

Changing demand

One vital factor is the change in market and consumer demand, partly in response to national and international climate policy. The carbon footprint of many end products is after all determined largely by the process emissions from and raw materials used in basic industries at the start of the

[11] In a study of emissions intensity (tonnes of greenhouse gas emissions for every euro of value added) in Dutch industry, Statistics Netherlands found that this figure would be lower if corrected for the average European sector structure. CBS (2018), 'Emissie-intensiteit broeikasgassen Nederlandse industrie.'

[12] Dutch greenhouse gas emissions calculated according to international standards were 12.3 tonnes per capita in 2017, compared to the EU28 average of 8.8 tonnes. https://ec.europa.eu/eurostat/databrowser/view/t2020_rd300/default/table?lang=en

[13] Greenhouse gas emissions from Dutch industry are now 34% lower than in 1990. There has been absolute decoupling over the period as a whole: lower industrial greenhouse gas emissions have gone hand in hand with increasing production. The volume of industrial production in 2017 was around 1.5 times higher than in 1990. Source: registration of emissions (RIVM e-PRTR, RVO). See www.bedrijvenbeleidinbeeld.nl.

[14] Work to this end is currently being done by the Organisation for Economic Co-operation and Development (OECD) in cooperation with the International Institute for Applied Systems Analysis (IIASA).

[15] Based on studies by the Netherlands Environmental Assessment Agency (PBL), the Netherlands Bureau for Economic Policy Analysis (CPB) and the Intergovernmental Panel on Climate Change (IPC), among others.

chain. If producers and consumers in the Netherlands and elsewhere are to reduce their carbon footprint, they need basic industries to produce sustainably. Customers of basic industries will gradually move towards a carbon-neutral footprint, so that eventually there will only be room in the market for sustainably produced basic materials (steel, plastics, glass, paper, etc.). This creates opportunities for both basic industries and for manufacturers and service providers (such as engineering consultancies). Making the Netherlands' basic industries more sustainable will not only help us but also countries further along the production chain to achieve the climate goals. Demand for Dutch industrial products and technologies would thus be expected to increase.

Financiers are aware of this, and are considering changes to the way they value business assets so as to adequately absorb the risk of 'stranded assets' in investment portfolios.[16] This could lead to changes in their investment portfolios, and thus also to changes in the stock market valuation of industrial manufacturers, to the benefit of sustainable companies. It is likely that this is already an incentive for corporate leaders to focus on sustainability and keep shareholders happy. We can therefore assume that the financial sector will in this way support policy aimed at making industry more sustainable.

Upscaling opens way to new technologies
Sustainable electrification, hydrogen and fundamentally different production processes, such as for bioplastics, will change the way basic products are made. For example, high-temperature heat may be generated differently or may no longer be necessary. Time will tell which technologies break through and become prevalent. What we do know for certain is that rapid scaling up will be required, alongside R&D, to substantially reduce the costs of, for instance, producing hydrogen fuel, biofuels and synthetic fuels, and generating and storing wind and solar power. Currently these costs are often too high for these technologies to be economically viable. Market demand is however essential. These technologies are being developed in several places around the world. It is important to identify where the Netherlands has a unique knowledge position, and where involvement in European or international research consortia would speed up development.

Large-scale use of hydrogen and green electricity and fundamentally different production processes will require a bold approach, not only from private companies, but also from the authorities. Every effort will have to be made to make new technologies and the required infrastructure available, with a view not only to the transition to 2030, but also – in particular – to the longer term (see under 'Seizing opportunities in four areas', below).

Renewable carbons
In order to be virtually zero-emission by 2050, we will not only have to shift towards power generation almost exclusively from renewable sources, but also to the large-scale reuse of carbon and use of non-fossil resources. Our vision for the future of basic industries must proceed from the idea that we have all the carbon we need, and that we will have to recycle it by means of carbon capture and utilisation (CCU), direct air capture (DAC), chemical and mechanical recycling, the large-scale addition of high-quality recyclate to basic products, or by means of advanced technologies that utilise biotic flows (cascading). (See annexe 3 for more information on these technologies). The degree to which industry has access to these sustainable sources will be a key competitive factor in the new global arena.

Circularity
All of this also means that the basic industries will have to become circular, partly due to qualitative changes in demand for end products, prompted by sustainability requirements for raw materials and production processes, and partly thanks to new technological possibilities. In the Circular Economy Implementation Programme, the government and other signatories to the Raw

[16] Stranded assets include fossil fuel reserves and manufacturing facilities that will no longer be used as a result of the transition from fossil to sustainable energy or circular feedstock. See, for example: https://www.imf.org/external/pubs/ft/fandd/2019/12/pdf/climate-change-central-banks-and-financial-risk-grippa.pdf; https://www.weforum.org/agenda/2020/02/fossil-fuel-monetary-policy-economics-reassessment/.

Materials Agreement have set out a progressive programme for the transition to a circular economy.[17] High-quality recycling of feedstock and other materials, and the circular design of finished products and semi-manufactures so that they can be reused in a subsequent phase will lead to carbon-neutral production of existing products, and also to completely new, as yet unimaginable products and business models that meet both new and existing needs.

Connected
Industry will also be increasingly physically connected with its immediate surroundings. Industry is already an important supplier of residual heat for the built environment. Companies are also exchanging residual flows to maximise reuse. Residual heat and captured carbon dioxide are supplied to the glasshouse horticulture sector, which has reduced its natural gas consumption as a result. Such practices are likely to increase. At the same time, the government is alert to 'lock-in effects' that might hamper other developments (such as the circular transition). The development of a new hydrogen infrastructure – vital for sustainable transport, flexibility in the energy system and for parts of the built environment – is expected to start in industrial clusters and expand from there.

The Netherlands an even more attractive location for business after the transition
The developments outlined above are taking place all over the world. The Netherlands is in an excellent position to respond, thanks to its geographical location, its knowledge and its infrastructure, and could potentially be even better placed after the climate transition. The Netherlands is eminently suitable as a showcase for climate-neutral basic industries, demonstrating that this is a realistic prospect for the future.

Important comparative advantages, now and in the future
The Netherlands has long been an attractive location for basic industries. Important factors include its infrastructure (particularly to and from the ports, and the pipelines between the clusters and neighbouring countries), the presence of depleted offshore gas fields for carbon storage, its skilled and well-educated workforce, and its stable political climate. The potential synergies of horizontal and vertical supply chain integration within industrial clusters is another key advantage. This can help companies save costs and/or generate extra income (from the sale of residual products, for example). These synergy benefits underlie the development of the five industrial clusters mentioned above, and also present opportunities for a future based on sustainable industrial activity.

Since 1959 the Groningen gas fields have been a strong driver behind the development of energy-intensive basic industries in the Netherlands and have given these industries comparative advantages ever since. Even though gas extraction in Groningen is now being scaled down, the clusters still provide a strong base for the future.

Several examples of how these competitive advantages might turn out for Dutch industry in the future are given below.

Large-scale production of green electricity in the North Sea
Many of the Netherlands' industrial clusters are by the North Sea, whose shallow waters are ideal for large-scale electricity generation by offshore wind farms. In the future, the clusters in Zeeland, Rotterdam, the North Sea Canal region and Groningen will thus have access to one of Europe's main sources of sustainable electricity (see annexe 2, *Energetic Odyssey*; the initiators behind this future vision are currently working on a long-term outlook for basic industries in 2050).[18] Large-scale production of renewable electricity has already led to a sharp fall in the price of renewable energy in the Netherlands.

[17] See House of Representatives 2018–2019, 32852, no. 76.
[18] These parties from the world of industry and science have initiated the establishment of a Sustainable Industry Lab, modelled on the Sustainable Finance Lab, a non-profit collaborative venture between knowledge institutions, industry and the Ministry of Economic Affairs and Climate Policy. The long-term outlook for the basic industries in 2050 is scheduled for completion in 2021.

In the future a growing proportion of industry will use electricity and green hydrogen rather than gas to generate heat. Green hydrogen will also become an important input for sustainable production. In both cases, the costs will fall as the price of green electricity falls too. In other words, parties that have access to green electricity will have a competitive advantage in the transition.

Deepwater ports: import of sustainable raw materials and export of products
The Netherlands, a flat river delta by the sea, with big markets in its hinterland, is an ideal transit location and indeed has long been a major transit hub. This means that Dutch industry has benefited for decades from the availability of low-priced raw materials which arrive in bulk quantities in the Netherlands for onward transport to the hinterland, suppressing prices in the delta itself.

At the same time, the Netherlands' deepwater ports also give its basic industries easy access to markets worldwide in order to sell its products. As explained above, in the future both the inputs and outputs of basic industries will change, but in this new, sustainable world the deepwater ports will still give Dutch industry a considerable competitive advantage.

Infrastructure for the transport of goods and energy
Infrastructure comprises not only facilities for processing enormous incoming flows of raw materials and energy carriers, but also good ongoing connections with customers further along the value chain, both in the Netherlands and elsewhere. To this end, the Netherlands has an extensive network of pipelines and electricity, inland navigation, rail and road networks. The network of pipelines is largely owned and managed by private parties, who use it to transport crude oil, fuel and chemical products between ports (Antwerp and Rotterdam), chemical clusters in the Benelux and Germany's Ruhr area.[19] Some 40% of European petrochemical production takes place in the Antwerp-Rotterdam-Rhine-Ruhr area (ARRRA) cluster, making it one of the largest in the world. Good infrastructural links provide a strategic advantage for industrial clusters in the Netherlands, especially those located near the German and Belgian borders, as well as for Germany and Belgium.

This infrastructure also provides a good basis for the transport of renewable raw materials, energy carriers and sustainable products in the future. The Rotterdam port area already has Europe's largest biofuel production cluster,[20] and our existing network of gas pipelines could be the basis for a European network for hydrogen and biogas transport.[21] Major flows of recyclable raw materials, such as waste plastic and sugar-based biotic flows, will also be traded, transported and processed here. In other words, the Netherlands is in an excellent starting position in terms of infrastructure, provided we are willing and able to rapidly adapt it. In the box below we describe how these insights have been incorporated into the Netherlands' carbon accounting.

Text box: National energy and carbon accounting
Measures to make basic industries climate neutral will be coupled with major changes to the quantity of hydrocarbons consumed in the Netherlands, or transported through the Netherlands for use elsewhere.

Hydrocarbons are compounds of carbon (C) and hydrogen (H). Almost all fuels, plastics, synthetic fibres and solvents are hydrocarbons. They are obtained by refining and cracking energy carriers – mainly oil and natural gas at present. Refining is a process whereby oil is distilled to separate out various hydrocarbons. Thermal cracking is a process in which certain oil fractions are heated

[19] See AT Osborne et al. (2018), 'Buisleidingen in Nederland. Een marktverkenning (eindrapport)'. This cluster is referred to as the ARRRA cluster.
[20] After adjusting for the size of national economies. Without this adjustment, the Netherlands would be fourth, behind Germany, France and Spain.
[21] See House of Representatives 2019-2020, 32813, no. 485.

without oxygen in order to break them down into compounds with fewer carbon atoms, which can then undergo further chemical processing. Gas is generally used for the heating process, thus releasing many carbon emissions. In the future, we will be able to use electricity for heating processes or green hydrogen for cracking, but these technologies still require a great deal of research and development (see also 'Seizing opportunities in four areas').

In 2018 the Netherlands imported over 10,000 PJ of energy carriers, and itself generated over 2,000 PJ, mainly through natural gas extraction and renewable electricity generation; the Netherlands used over 3,000 PJ domestically and exported over 8,000 PJ. The Netherlands now imports more natural gas than it produces domestically. Oil, at some 8,000 PJ, is the biggest imported energy carrier, followed by natural gas and coal. A large proportion of crude oil imports are refined into fuels, some of which are then exported. The Dutch basic industries use over 500 PJ of energy carriers as a raw material for products like steel and plastics.[22] The Netherlands' carbon accounting shows that the total flow of energy carriers passing through the Netherlands is three times greater than needed to meet domestic energy demand. The industries involved are oil and gas extraction, petroleum refineries and chemicals. The building materials, glass, ceramics and foodstuffs industries – all basic industries – use mineral and biotic resources, though they do use energy carriers for thermal processes.

The ambition of climate neutrality by 2050 will cause changes in the mass balance flows. It is not currently possible to know what exactly these changes will entail, but we can make some predictions. The Concawe refinery 2050 report scenario 2, for example, forecasts a 75% reduction in demand for petrol by 2050 relative to 2014. Reduced demand for diesel and heating oil and increased demand for kerosene are also predicted.[23] On this basis, we can expect to see a major reduction in imports and exports of oil and oil products, but not in the total flow of energy carriers passing through the Netherlands. The carbons that industry uses as inputs will have to be climate neutral. Greater energy efficiency could reduce quantities, but growth in demand due to, for example, population growth (in Europe) could cause an increase.

The North Sea enables the Netherlands to sustainably produce a large proportion of the energy required for domestic consumption (currently just over 3,000 PJ), including hydrogen from green electricity, although the Dutch part of the North Sea is by no means big enough to generate 10,000 PJ of energy. In addition, national availability of sustainable biomass is forecast to be 372 to 454 PJ a year by 2050.[24] If the Netherlands wishes to remain an energy carrier trading hub, imported energy carriers – some in the form of green fuels – will continue to play an important role for our own industry, but also for transit to Germany and other European countries. If we produce much less domestically, we will in the long run become a net importer of these materials and have no influence on how sustainably they are produced. Furthermore, we would then lose our key position in industrial value chains. To replace 8,000 PJ of oil and oil products by green molecules, the options are either to convert around 11,000 PJ of green electricity into 8,000 PJ of hydrogen, possibly in compounds with carbon, or to import biomass/biogas for some of the 8,000 PJ required.[25]

The government will focus on large-scale generation and conversion of green energy carriers (hydrogen and green electricity) and the processing of carbon into new products (CCU) or, until this is possible, CCS in depleted offshore gas fields. Biomass and biogas will play an important role

[22] https://www.clo.nl/indicatoren/nl0201-aanbod-en-verbruik-van-energiedragers. In 2016 the Netherlands imported over 11,000 PJ of energy carriers, and generated or extracted over 2,000 PJ domestically (gas and electricity); the Netherlands used over 3,000 PJ domestically and exported over 9,500 PJ. Approximately half of the crude oil imported is shipped to other countries as crude, and the rest is refined. Depending on the market, refineries produce 20% naphtha (for naphtha crackers), 20% diesel and 40% petrol. Refineries also produce refinery gas, kerosene, heating oil, bitumen and lubricants. Output can be optimised through hydrotreating or hydrocracking.

[23] https://www.concawe.eu/wp-content/uploads/Rpt_19-9.pdf See table 3.3.2. The report mentions various biomass routes and CCU (using hydrogen) as potential future routes. The VNPI roadmap identifies blue hydrogen, energy efficiency, CCS, electrification and use of residual heat as options for cutting carbon emissions in the near future. There are three longer-term scenarios involving CCS, green hydrogen and electrification.

[24] See: Netherlands Environmental Assessment Agency (2020), 'Beschikbaarheid en toepassingsmogelijkheden van duurzame biomassa', p. 17. https://www.pbl.nl/sites/default/files/downloads/pbl-2020-beschikbaarheid-en-toepassingsmogelijkheden-van-duurzame-biomassa-verslag-zoektocht-naar-gedeelde-feiten-opvattingen_4188.pdf.

[25] Biomass is more than just wood. River sludge, algae, dung and plant residues are also biogenic.

in this transition, after which the use of biomass for energy will be phased out. This is why the government is working on a sustainability framework for biomass. Greening the large quantities, in terms of volume and PJ, of energy carriers in our carbon balance will mean transforming the Netherlands from the 'oil hub of Northwest Europe' to the 'green energy, hydrogen and plastics recycling hub' of Europe, combined with climate-neutral basic industries. The Netherlands has the organisations, knowledge and position to play a key role in the global energy and climate transition, and to show how production by basic industries can be made more sustainable.

Opportunity or threat? It's up to us

As outlined above, the Netherlands has a perfect opportunity to become the 'place to be' for sustainable basic industries in the future, at least in Europe. This is broadly acknowledged by various industries that are continuing to invest in the Netherlands, including in innovation for sustainability. The refineries and chemicals industries, for example, are together investing in innovative separation technologies and new techniques for producing biobased feedstocks.[26]

So can the Netherlands simply assume it will survive as an attractive business location and leader in the greening of industrial value chains? No, it cannot – it will still be a major challenge to convince basic industries to choose the Netherlands as their location for investment in more sustainable production. After all, basic industries largely produce commodities for highly competitive markets at very low profit margins. Production occurs for the most part in international conglomerates that can choose to move their activities to other countries. Although they base their decisions on major investment projects on multiple factors, locations where green raw materials and renewable energy are in plentiful and cheap supply, such as the Middle East and North Africa, are an obvious choice. In recent years big investments in basic industries have primarily been made in the United States (in part because of the availability of cheap shale gas), the Middle East and regions in Asia that are close to growth markets like China.

It is therefore vital that the Netherlands emerges as a better location for basic industries than other places in the world (or at least in Europe). The Netherlands' advantage over newly industrialised countries is that production already takes places on an enormous scale in order to be economically profitable. In this sense, path dependence works to the benefit of Dutch industry, although it must not lead to the perpetuation of production processes that stand in the way of the climate goals. As mentioned above, our advantages are our existing infrastructure, synergy from connections with regional industrial clusters, knowledge ecosystems and the proximity of buyers. On the other hand, the phasing out of natural gas production in Groningen presents a challenge as cheap, sustainable alternatives to this source of industrial energy and feedstock will need to be duly found. The government's vision on hydrogen and the biogas roadmap indicate how we intend to achieve this. Existing basic industry locations in the Netherlands might thus be preferred over new locations in countries where none of this is available, or at least not to the same degree.

Whether we grasp this opportunity is up to us. Below, I outline some key elements of the Dutch strategy to ensure the sustainability of industry in the future.

Sooner rather than stricter

Delaying work on the transitions needed to tackle climate change will lead to more uncertainty and higher perceived risk for major investments in sustainable basic industrial production in the Netherlands. As set out in the National Climate Agreement, the Netherlands has opted to fast-track a more ambitious climate policy, compared to the rest of the EU, rather than adopting a stricter policy. By starting the transition needed for a sustainable future sooner than other countries, our companies can lead the field when it comes to sustainable production. This will increase our export opportunities in the future, including for manufacturers and service providers

[26] European Chemical Industry Council (2019), 'Molecule Managers: A Journey into the Future of Europe with the Chemical Industry'. See also https://hollandchemistry.nl/theme/climate/.

that help to make basic industries more sustainable. Companies in the Netherlands know what is expected of them and are also further refining the technologies needed for greening industries worldwide. Annexe 4 gives four examples of parties that have already begun. Of course the Netherlands will keep a watchful eye on developments in Europe (see 'International effort').

Monitoring the playing field during the transition
In order for our country to be a leader in the climate and energy transition, all industrial players in the Netherlands must participate. Many of them are already at the front of the European pack in terms of carbon emissions, and with smart policies they should be able to progress more quickly. It is however important not only that the leaders take extra steps – all parties will need to get moving. Only then will the industrial clusters benefit fully from the synergy effects. Government should safeguard the process with robust financial incentives. In accordance with the National Climate Agreement, this will have to be set up with due regard for the international competitiveness of basic industries during the transition.

The design for a sensible national carbon tax scheme is based in part on the playing field appraisal performed by PwC in 2019 and on the Social and Economic Council's advisory report on national climate measures for leading regional industrial enterprises.[27] The recommended mitigating measures have been taken on board and the government will also consider investment cycles. The online consultation for the legislative process was launched on 24 April, giving anyone who so wishes an opportunity to give their views on the proposal for the carbon tax scheme.[28] As stated in the National Climate Agreement, the government will base the tax rate both on the calculations performed by the Netherlands Environmental Assessment Agency (PBL) and on the new playing field appraisal that is expected before the summer.

The government will bear in mind economic developments when fleshing out the carbon tax for industry bill. The economy is currently reeling from the impact of the COVID-19 pandemic. We do not know how long this global pandemic will last, nor therefore how deep the resulting economic crisis will be. We do however know that industry is currently in a very difficult situation. The government has therefore decided on a more cautious introduction of the carbon tax. The reduction factor will initially be determined in such a way that companies are granted a relatively large tax-free allowance relative to their actual emissions. The total tax-free allowance for industry as a whole will initially be higher than necessary, so that the tax poses next to no additional burden on industry for the first few years. This cautious start is necessary because of the uncertain economic prognosis for the next few years, and complements the other measures already built into the carbon tax scheme which take account of companies' investment cycles.

For the sake of our international competitiveness, and in view of opportunities for cross-border collaboration, the government is closely following the European Commission's Green Deal plans. Strong European ambitions will further level the European playing field for the Netherlands. We therefore support an increase in Europe's carbon reduction goal to 55% by 2030. The debate on this point is expected to be concluded this autumn. In the meantime, the Netherlands will closely monitor developments with the Green Deal and the European industrial strategy. The Netherlands' international efforts to make industry more sustainable are discussed below.

In particular, a stricter European Emissions Trading System (ETS) or the introduction of a Carbon Border Adjustment Mechanism would have impact on the playing field.[29] The Netherlands also supports the central role of carbon reduction in the new European industrial strategy. It is very important for industries subject to fierce competition that an international approach be taken. We

[27] Annexes to Parliamentary Paper, House of Representatives 2018-2019, 32813, no. 308; annexe to Parliamentary Paper, House of Representatives 2018-2019 32813, no. 347.
[28] https://www.internetconsultatie.nl/co2heffingindustrie.
[29] This position is set out in the government's assessment of the Commission proposal for a European Green Deal. The government takes a positive interest in the proposal for a carbon tax at the external border (carbon border adjustment mechanism, CBAM). It also takes a positive view of the establishment of the Just Transition Mechanism (JTM), which is designed to support and bring around the regions hit hardest by the transition.

already have the ETS in Europe. The European Commission is expected to propose, as part of its Green Deal, that the ETS be made stricter, in terms of both carbon pricing and efficiency requirements as set by the benchmarks. These are to be tightened up around the middle of this year, for the years 2021-2026. The government will align its carbon tax with European policy: any tightening up of European policy means supplementary national legislation can be less detailed. The government will also call at European level for the ETS to acknowledge reduction measures that increase certain clusters' scope for action in the short term, such as transporting carbon for CCS by means other than pipelines. The government will also lobby for negative emissions achieved by the combination of biomass, CCS and CCU to be taken into account in the ETS.

To spread investment risks

The transition of basic industries to carbon-neutral production will require major investments by private parties. Where they make these investments will depend largely on the availability of infrastructure and grants for unprofitable demonstration and upscaling projects (see 'Seizing opportunities in four areas – scaling up of industrial technologies'). Infrastructure is vital for the supply of sustainable energy and raw materials, and for delivering products to customers. But CCS, CCU and the supply of heating to the built environment also require infrastructure that generally involves several stakeholders. Before making investments, industry requires clarity as to whether that infrastructure will be available in time. Building the infrastructure will generally require up-front investments that are recouped over several decades. As with the construction of dikes and railways in the past, it is appropriate for government to bear some of the risk if necessary. Furthermore, the government should resolve coordination problems by actively bringing parties together to build the necessary infrastructure if the risks prove too great for a single company to bear (see also 'Seizing opportunities in four areas – Infrastructure').

And reduce risks associated with security of supply

Economic considerations are not the only motivation. The Netherlands and other industrialised countries have a moral obligation not to export their climate problems to other parts of the world where the rules are less strict, while continuing to use products like steel, plastics and fuels over the coming decades. The Netherlands signed up to the Paris Climate Agreement and the UN's Sustainable Development Goals, and thus has a responsibility to become more sustainable. This is the principle on which the package of measures for industry in the National Climate Agreement is based. Large-scale export of sustainably produced goods will help provide solutions for the climate and energy transition, and reduce systemic risk in international value chains.

These systemic risks have recently been thrown into relief by the COVID-19 pandemic, although they had been a matter of concern for some time. Changes have occurred in the way governments and international companies view supply security risks and trade risks. There are concerns about the vulnerability of value chains to price fluctuations between continents resulting from strategic political considerations, as well as about the increasing chance of extreme weather. Alongside the coronavirus pandemic, a number of natural disasters in various places in the world have revealed unacceptable risks relating to the security of the just-in-time supply chain.[30] It is likely that industrial concerns' decisions to spread their investments will be motivated in large part by the wish to reduce these systemic risks in international supply chains. Long-term strategic control of industrial supply chains is a key reason for wanting to keep basic industrial production in the Netherlands, provided it becomes more sustainable.

Geopolitical challenges and the drive for more sustainability can each prompt a need for a new vision for basic industries. In this letter, both these considerations lead to the same conclusion: by focusing on a timely transition now, we will not only be able to capitalise on our unique starting position, we will also be able to expand on it, thus contributing to our future prosperity.

[30] See for example Schumpeter (2020), 'Plan V', *The Economist*, 7 March 2020.

Seizing opportunities in four areas

What do we need to do now to turn the 2050 challenge for the basic industries into an opportunity? It is forecast that industry will have to invest €10 to €15 billion simply to meet its climate commitments up to 2030. But the public sector also has a role to play in solving coordination problems (e.g. building infrastructure and developing knowledge), reducing the risks associated with upscaling and with demand for sustainable heat/energy being lower than anticipated, and providing long-term investment security through legislation. The government will have to take control in four areas: innovation, upscaling, infrastructure and legislation.

1. Innovation

The availability of new technologies is vital for the sustainable transformation or development of industries, both to keep costs under control (see also the following section on upscaling) and to enable climate-neutral production in sectors where this is not technically possible at the moment. For the next several years, efforts will focus on a limited number of technological developments that are broadly viewed to have great potential for the greening of basic industrial production (see also upscaling of industrial technologies). Rather than leaving technological development to the market, as in generic innovation policy, the government is taking a deliberate risk by investing in accelerating certain technologies, accepting that these could be overtaken by other technologies that unexpectedly break through (nationally or internationally) and are adopted more quickly. To limit this risk of 'backing the wrong horse', Mission-Driven Top Sector and Innovation Policy will work, via the Top Sector Alliances for Knowledge and Innovation, with parties in the field who are best placed to identify new developments. Moreover, through the Integrated Knowledge and Innovation Agenda for the energy transition, the policy will strive to make greater progress on the underlying roadmaps. This will give them scope to work on innovation and incorporate variations into the innovation process, something which cannot be done on the basis of detailed lists of actions issued by ministries. Certain programmes for key technologies are also essential to this transition, particularly in the medium term. They include the Electrochemical Conversion and Materials programme (ECCM), which is designed to help significantly reduce the cost of producing hydrogen through electrolysis. These programmes are very important for the climate, knowledge development and economic potential, and deserve generous public and private support both now and in the longer term.

The government will also focus on non-technological innovation. The transition to a better climate using improved technologies also requires socioeconomic changes, such as changes in consumer behaviour, which could be achieved through product labels providing information about the climate footprint, for example. To ensure innovations are actually used, it is vital to know what kind of setting they are intended for: what systems will they influence, what values will apply to users, and how will they be accepted? Think, for example, of how a change in industry's energy mix might help balance the electricity network. User-centred design can also help ease the switch to new, sustainable products. These aspects of innovation must be integrated and developed along with the technological issues to ensure successful implementation. Non-technological innovation of this kind also forms an integral part of the Integrated Knowledge and Innovation Agenda.

2. Scaling up of industrial technologies

Current research and innovation policy mainly targets the early phases of technology development, building on the Netherlands' robust knowledge infrastructure, ranging from basic research to pilot studies. The bottleneck occurs after a new technology has been proven in a demonstration project but needs to be applied on a large scale. In basic industries projects of this kind cost hundreds of millions of euros, and still have a fairly high risk of failure, technical or otherwise. Such high-risk-high-cost projects do not generally attract private funding, and have difficulty getting off the ground without government assistance. This is not only a matter of promoting technology development (technology push), but also – above all – of creating large-scale demand (market pull).

To this end, the government must first introduce policies that stimulate demand for sustainable basic industrial products, such as source policy (possibly at European level). An example of source

policy is the mandatory biofuel blending rate. Another option would be gradually tightening up standards on, for example, vehicle emissions and the power consumption of electrical appliances. Central and local authorities will also have to initiate demand themselves (sustainable innovative government procurement), as set out in annexe 4, example 4. The government regards public commissioning and procurement as important means of helping to resolve social issues, and of leading by example. The strategic government-wide procurement strategy ('Procurement with Impact') presented to the House on 28 October 2019 by the Minister of the Interior and Kingdom Relations, in conjunction with the State Secretary for Infrastructure and Water Management, lists several actions designed to contribute to greater sustainability by means of public commissioning.[31] Secondly, the government wishes to offer a wider range of incentives for large upscaling projects.

The main technologies for the greening of basic industries are described below, as well as an indication of how the government intends to tackle obstacles to commercial upscaling.

Hydrogen

The government's vision on hydrogen focuses on accelerating development of sustainable, climate-neutral hydrogen as an integrated part of our energy and raw materials system. This will affect the transition to a sustainable economy that makes optimum use of the strengths of several Dutch regions as hydrogen hubs, based on the existing infrastructure with its international connections (logistics, ports, storage and gas pipelines), the major development potential of the North Sea for offshore wind power, the robust chemicals and manufacturing industries, and our strong position when it comes to knowledge of gases. Backing hydrogen will also help prevent congestion, balancing and back-up problems in the electricity network. An early focus on hydrogen could strengthen the business case for renewable energy generation and expand the earning capacity of key industries like energy, chemicals and distribution. Promising developments towards a hydrogen-based economy are taking place in the industrial clusters in Groningen-Eemsdelta, Amsterdam, Rotterdam, Zeeland and Limburg.

To enable upscaling, operational support will be needed during the transition from demonstration to rollout, alongside investment support. The government therefore intends to facilitate upscaling by using some of the resources in the budgetary envelope for climate policy for temporary operational support. As of 2021, some €35 million a year will be disbursed through this instrument, making the Netherlands one of the first countries in the EU to take substantial steps in this transition and make major investments as early as 2021-2023 in a portfolio of demonstration projects of various scales and scopes, which demonstrate the potential of hydrogen throughout the value chain. The focus will be on the different elements of the value chain and on rapid upscaling. Pilot projects with an electrolysis capacity of several megawatts will be launched for a range of applications, plus a number of demonstration plants with a capacity of around 100 megawatts – a first in Europe. This will pave the way for further development of electrolysis plants on a gigawatt scale well before 2030, in line with the hydrogen ambitions set out in the National Climate Agreement (3-4 gigawatts installed by 2030). The projects will focus primarily on industrial use of hydrogen and greening of the chemicals industry, but will include links to non-industrial use in transport and the built environment.

It is the government's ambition to position the Netherlands as the main hub of the international hydrogen value chain. It plans to achieve this by producing and using hydrogen as a sustainable source of energy and as a resource for greening production and products in the northern Netherlands (the first recognised hydrogen region in Europe) and in other regions with chemical plants and heavy industry. The powerful combination of hydrogen generation and distribution and its use throughout the production chain, as well as the collaboration with Flanders and Germany, could help the Netherlands build a leading international position.

[31] House of Representatives 2019-2020, 30196, no. 679.

Carbon capture and storage (CCS)

The capture, transport and storage of carbon dioxide produced by industry (CCS) is regarded by both industry and government as necessary for the achievement of the 2030 goal. Capture and transport can also serve as a springboard for the recycling of carbon (CCU). As of this year, CCS projects are eligible for grants under the new Renewable Energy Grant Scheme (SDE++) which cover inevitable losses. The government expects this to give a considerable boost to the upscaling of CCS over the coming years, and thus to reductions in the Netherlands' carbon emissions, as agreed in the National Climate Agreement.

To accelerate the development of CCS projects in the short term, state holdings (e.g. port authorities, Gasunie and energy authority EBN) are also actively involved, alongside parties in industry. Their participation will lead to the acquisition of the required technical, financial and economic knowledge and expertise, which will give commercial parties sufficient confidence to participate in carbon transport and storage activities.

Europe has designated several Dutch CCS projects as Projects of Common Interest (PCI). To facilitate these projects, land use decisions need to be made and permits must be issued. A special procedure known as the Central Government Coordination Scheme (RCR) will be followed for this purpose. It is designed to accelerate decision-making on major European and national energy projects, without compromising due care requirements. The Ministry of Economic Affairs and Climate Policy is currently coordinating the RCR procedure for the CCS project Porthos[32] in the Rotterdam port area. This ministry is working with the Ministry of the Interior and Kingdom Relations on a provincial land-use plan that will designate a location for the carbon infrastructure and compressor station. The strategic environmental assessment (SEA) and the draft provincial land-use plan will be available for public inspection at the same time as the other draft permits. The Athos project[33] for carbon capture at Tata Steel in IJmuiden was also recently awarded PCI status and will therefore also qualify for the RCR procedure.

Under the Energy Top Sector Industry Studies scheme, total funding of €6 million a year is available for companies to perform feasibility studies for new CCS projects. The implementation of pilot projects can be funded through the Energy and Climate Innovation Demonstration (DEI+) scheme. European funding is also available, including from the Connecting Europe Facility (CEF) and the Innovation Fund.

Carbon can be transported to storage locations by pipeline, but also by ship or lorry. The last two options are currently, however, not recognised within the European ETS. The government is currently lobbying at EU level for this shortcoming to be resolved as soon as possible. In the meantime it plans to recognise carbon capture using transport by ship and truck in the national carbon tax system. Transport by ship could be a good solution for industries located inland or unable to connect to a pipeline.

Electrification

Electrification and electrochemical conversion offer a promising route to a climate-neutral industry. Electrification of industry, mainly through the use of heat pumps, electric boilers and energy efficiency technologies such as membrane separation and vapour recompression, could significantly reduce industrial greenhouse gas emissions by 2030. A number of these technologies will receive an SDE++ grant for the first time this year. The Energy Investment Tax Credit (EIA) and the grant scheme for Accelerating Climate Investment by Industry (VEKI) provide support to other technologies. A great deal more innovation is required for electrification, however. The Climate and Energy Innovation Agenda's Multi-year Mission-driven Innovation Programmes, MMIP 7 and 8, will provide the necessary guidance.[34]

[32] https://www.rotterdamccus.nl/.
[33] https://athosccus.nl/.
[34] MMIP: Multi-year Mission-driven Innovation Programme 7: zero-carbon industrial heating systems; and MMIP 8: electrification and radically reformed processes.

Electrification will help boost the flexibility of the energy system. In process industries the use of electric boilers and hybrid dual-fuel systems, which can switch between gas and electricity, offer particular potential in this regard. A number of companies and knowledge institutions are working on pilot plants for electric cracking, which is currently a very energy- and carbon-intensive process.[35] The carbon emission reduction potential of most electrification technologies depends on the electricity mix in the Netherlands, however. Until this is made fully sustainable, electrification will only cause a shift in emissions from industry to the electricity sector. Given the current electricity mix, only heat pumps and certain separation technologies can reduce carbon emissions. Clearly, therefore, additional electricity demand and supply will have to grow in parallel. I will take this into account.

To tap the potential of electrification, we need to invest in the electricity grid, particularly in and to the industrial clusters (see also 'Infrastructure'). Synergy could be achieved by placing the onshore grid connection points for offshore wind power at industrial clusters on the coast. In its vision on hydrogen the government announced a study into linking offshore wind power projects with hydrogen production. One way to achieve this could be through combined calls for proposals.

Circular technologies

By 2050 the raw materials used in basic industries will be net climate-neutral and circular. Work is already underway on the various technologies required to achieve this, including biorefining, chemical recycling and CCU (see annexe 3 for more information).

With regard to plastic products and packaging and other major material flows, efforts are focused on improved design, reuse and recycling. Various collaborations are emerging between waste processors, recycling companies and chemical companies with a view to investing in the chemical recycling of plastics. Large-scale demonstration projects for the conversion of plastic waste into new raw material for the chemicals industry will be carried out over the next few years, with support from the Ministry of Economic Affairs and Climate Policy. In 2020 the Ministry of Infrastructure and Water Management is supporting chemical recycling through the DEI+ scheme for circular economy and the 'Versnellingshuis', which advises companies wishing to become circular.

Carbon capture and utilisation is a commercial technology that is used in horticulture, the food industry and the chemicals industry. CCU applications in the building materials industry are currently being scaled up from pilot to demonstration level.

Biobased feedstock is already being used on a commercial scale in the production of biofuels. Demonstration projects for new technologies like pyrolysis and gasification of biomass for fuels and chemicals will be set up over the next few years. The use of biogenic feedstock for plastics production is already possible on a commercial scale in the Netherlands. Lack of demand for recycled and sustainably produced plastics is often a stumbling block for chemical recycling or biobased processes. Measures such as source policy (including at European level) are needed to tackle this problem.

Challenges

The challenge is to build at least one or two plants on a commercial scale for each technology in the next four years. The government wants to launch flagship projects for CCU, chemical recycling, electrification and biobased feedstock, with a view to building a national track record for these technologies. To ensure that multinationals choose to locate these technologies in the Netherlands, the country must be able to support major upscaling faster and more effectively.

The quality of funding is a problem with upscaling projects. There is plenty of private financing, but not with the required risk profile. Banks are generally reluctant to invest in first-of-a-kind

[35] https://petrochem.nl/achtergrond/stoomkrakers-op-stroom/.

applications because of the risks. The government therefore intends to fund flagship projects with grants or other financial instruments, taking into account the very long depreciation periods for industrial investments. Some of the plants to be built over the next few years may remain in use until after 2050. It is therefore important to ensure at this point that those investments are made in such a way that they contribute to the ultimate goal of carbon-neutral industry by 2050. This will also require financial and policy-related involvement on the part of central government and/or other public bodies like InvestNL and, possibly, a National Growth Fund.

It is also clear that a more customised approach is needed. Grant schemes for operational activities, like SDE++, are not always suitable for the technologies this transition needs. Companies that perceive their chances of success in an SDE++ call as low may also be reluctant to plan large investments in the Netherlands. Alternative instruments are therefore currently being considered for process efficiency, biogas production and green hydrogen production.

3. Infrastructure
The Netherlands' excellent infrastructure is a key factor in its attractiveness for basic industries. Adaptations, both large and small, will have to be made to this infrastructure in order to achieve the goals of the National Climate Agreement and attain climate neutrality by 2050. Some adaptations are already being made. Network managers are, for example, investing in a better electricity infrastructure.

More will however need to be done, and this will require central government to play a more active role than ever. Besides major adaptations to existing infrastructure, new infrastructure must be put in place to process incoming flows of sustainable energy and energy carriers, distribute semi-manufactured goods and transport used materials, like plastics, for reuse. Technologies like CCS, CCU and transporting residual heat to the built environment also require infrastructure, generally involving several public and private parties.

First, building new infrastructural networks requires major up-front investment. Such projects have a payback period spanning several decades. Many industrial enterprises are unwilling and unable to bear such risks, and cannot justify the long payback period. In this sense, the situation is similar to other infrastructure like dikes, roads and railways. Central government should play a key role here, which extends to bearing risks where necessary, so that public and private financiers are able to invest in this infrastructure.

Second, building infrastructure generally involves commitment from and collaboration between various stakeholders, including parties in industry, network managers, financiers, and national and subnational authorities. In its role as process director, central government should bring together all parties in order to set up infrastructural processes relevant to industry if stakeholders are unable to do so in a timely manner. The transition can be accelerated if all stakeholders coordinate their investment plans at an early stage. This should be matched by industry parties' commitment to and investment in a sustainable revenue model in the Netherlands. Both are needed in order to achieve the climate ambitions and ensure good economic prospects for basic industries in the Netherlands.

The government is convinced of the urgent need for good infrastructure for hydrogen, electricity, carbon dioxide, steam and heat in order to comply with the climate agreements made with industry and as an enabling condition for healthy basic industries in 2050. It therefore established a Climate Agreement Taskforce on Infrastructure for Industry (TIKI) to advise on this matter, based on the ambitions set out in the growth strategy published on 13 December.[36] The Taskforce will present its advisory report in mid-May, after which the government will formulate its response, to be presented after the summer.

[36] House of Representatives 2019-2020, 29696, no. 7.

The government's vision on hydrogen provides a framework for decision-making by companies and investors. The Netherlands will produce some of its hydrogen requirements itself; it will also import hydrogen, some of which will be for domestic use. Import is necessary because of the limited amount of renewable energy that the Netherlands can cost-effectively produce and use for hydrogen production. After all, renewable electricity is also necessary for other purposes. On the other hand, domestic production is prudent with a view to supply security, independence and employment. Involving Germany's Ruhr area and Flanders through the ARRRA will enable a greater scale of production and transport. From this broader European perspective, the government envisages the Netherlands becoming a central hub for green energy carriers (see also the box on national carbon accounting). This will require pipelines, as well as the ports and connection points for offshore wind power.

The government is working on an Energy Network Programme (PEH), aimed at ensuring the physical space needed for the national energy infrastructure is available in good time. The energy transition will require more physical space but as this is limited, choices will have to be made which, for central government, involve weighing key public interests like public safety, security of supply, manageability of costs and quality of the living environment. The PEH will therefore be the instrument for coordinating spatial development for the energy transition in the years up to 2050.

4. Legislation

The three areas explored above and the ambitions outlined will necessitate changes to legislation. First, the legislative framework setting out what government requires of companies must be clear and consistent over many years. The Climate Act provides this clarity for climate policy as a whole. Reduction pathways up to 2030 provide clarity for companies subject to the carbon tax. In addition, the obligation to take energy-saving measures that pay back within less than five years is now being transformed into a carbon reduction obligation.

Second, the legislative framework must consider companies' reality (e.g. the long lead time for investments and available technical possibilities) and international competitiveness. This does not only concern Dutch legislation – the EU also plays a key role in this. As indicated above, the Netherlands is calling among other things for the ETS to be tightened up, to safeguard its competitiveness within Europe. Furthermore, stepping up the EU climate target, perhaps to 55% emission reduction by 2030, could lead to amendments to European directives, like those on the ETS, energy efficiency, renewable energy and an energy tax. These directives influence the scope for action that Dutch industry has in the transition to climate neutrality by 2050. Opportunities for funding, grant schemes and state aid frameworks, such as the guidelines for state aid in the interests of environmental protection and energy,[37] should offer scope for supporting new technologies, including hydrogen, CCUS, heating, chemical recycling and electrification. It is also important that negative emissions and scope 2 and 3 emissions be acknowledged in European legislation.[38] The government will take account of the impact of carbon emission reductions on sectors and companies that work together in the value chain.

Third, it is important that legislation does not raise obstacles unintentionally. It is therefore important that central government constantly monitor where adjustments may be needed. Steps the government has taken to this end include the government-wide Circular Economy programme and a bill on sustainability initiatives submitted to the House by the State Secretary for Economic Affairs and Climate Policy.[39]

[37] EEAG: Environmental and Energy State Aid Guidelines.
[38] The European Circular Economy Action Plan was published on 11 March 2020. You will be informed of the government's views on this plan via the BNC process.
[39] House of Representatives 2019-2020, 35247, no. 3.

Follow-up actions
This letter outlines the government's vision on the steps needed to ensure the Netherlands' basic industries are fit for the future. This vision will inform my work on policy on the greening of basic industries at national and international level. This policy will take shape over the coming period.

As mentioned in the long-term vision on climate which I discussed with the House in February, the government is taking strides towards the 2030 goals with the Climate Act, the National Climate Agreement and the Climate Plan, while at the same time launching processes to prepare for the longer term and for the choices that will have to be made over the coming years. We do not have all the answers, or sufficient grasp of certain matters at present. Nevertheless, there are many social ambitions and ideas about the transition in the longer term which together give an impression of the long-term challenges we face. The various elements of policy being developed in response to these long-term challenges have been or will be presented to the House, including:

- A letter on the implementation of the National Climate Agreement, including an overview of forthcoming climate and energy products;[40]
- Included in this overview:
    - A letter to the House on how the government will implement the Urgenda judgment (24 April 2020)[41]
    - Consultation on the carbon tax bill (started 24 April 2020)
    - Letter to the house on the Energy Network Programme (imminent)
    - Government-wide vision on market regulation for the energy transition (before the summer)
    - The government's response to the TIKI recommendations (after the summer; the Taskforce's recommendations will be sent to the House on 15 May).

International efforts
This transition is bigger than any one company, cluster or country. It is a global challenge, and the Netherlands will have to tackle it in collaboration with other European countries. But it must be done in such a way that we can continue to enjoy the economic benefits of basic industries in the future.

The European policy context is also in flux and has a bearing on the long-term prospects for industry. Clearly, the new geopolitical context and the wish to become more sustainable are both reflected in the Green Deal and the European industrial strategy. In December 2019 the European Council endorsed the objective of achieving a climate-neutral EU by 2050, in accordance with the 2015 Paris Agreement. It also emphasised that the transition to climate neutrality will bring significant opportunities, such as potential for economic growth, for new business models and markets, for new jobs and technological development.[42] The new European Commission published the Green Deal in December 2019, which contains various policy plans for achieving this climate goal and also considers the transition of European industry.[43] On 10 March 2020 the Commission published the European industrial strategy[44] for a sustainable, digital and competitive European industry in a changing world. The Netherlands will closely monitor how these policy proposals play out in practice. As mentioned under 'Legislation' above, an incentivising and appropriate European legislative framework is essential for the transition of European and Dutch industry. The government is committed to working with the European Commission, member states and European and international industry on creating the necessary conditions for basic industries to reduce their carbon emission while remaining competitive during the transition to climate neutrality by 2050.

[40] House of Representatives 2019-2020, 32813, no. 483.
[41] House of Representatives 2019-2020, 32813, no. 496.
[42] Poland was unable to commit to working towards this goal at this stage, so the European Council will return to this matter in June 2020. See: https://www.consilium.europa.eu/nl/meetings/european-council/2019/12/12-13/.
[43] For the Dutch position see the BNC file on the Green Deal: House of Representatives 2019-2020, 35377, no. 1.
[44] For the Dutch position see the BNC file on the European industrial strategy.

We need good cooperation both at European level and with our immediate neighbours for this transition to be a success. The Netherlands is therefore investing a great deal of attention in both bilateral and trilateral cooperation with Belgium and Germany, such as through collaborative projects and facilitating the cross-border infrastructure required for the industrial transition. These collaborations take place in various forums, including the Dutch-German industry forum and the trilateral chemicals industry collaboration with Flanders and North Rhine-Westphalia.

Conclusion

The Netherlands' relationship with the basic industries appears to have changed profoundly over the past few years. Industry's popularity as a source of employment and prosperity in the Netherlands can no longer be taken for granted. The debate on how to tackle climate change has been a key factor in this. The Climate Act and the National Climate Agreement provide a new, clear framework within which we can work together to shape the transition.

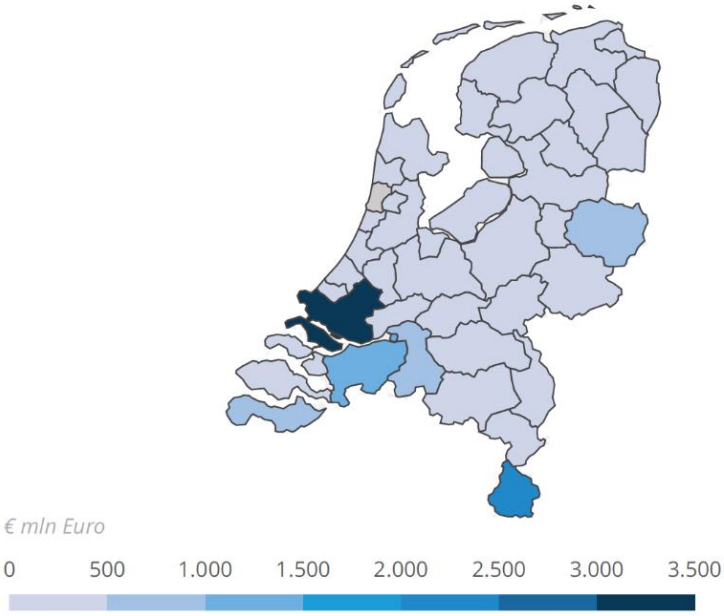
In this letter the government has outlined new prospects for and underlined the importance of sustainable, climate-neutral basic industries in the Netherlands. The transition to climate neutrality will require major efforts from industry and government, both financially and in terms of practical collaboration, with central government actively steering this process. But the transition also creates enormous opportunities for the Dutch economy and for the Netherlands to contribute to solutions to the challenges of climate change. The transition of its own basic industries will enable the Netherlands to become a testbed and accelerator for sustainable industry worldwide, while at the same time strengthening its strategic position in industrial value chains. The government is confident that the Netherlands will make this transition a success over the coming decades, but that means taking substantial steps now, guided by this government vision for industry.

Annex 1: Data on basic industry in the Netherlands

1a) Value Added and Employment per region

Toegevoegde Waarde 2017

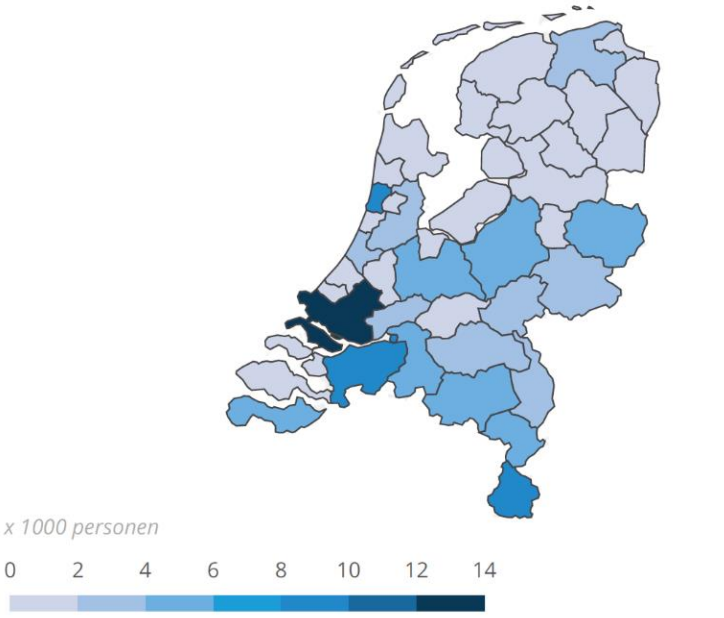
SBI: Papier-, Aardolie-, Chemie- Bouwmaterialen- en Basismetaalindustrie



Bron: Inschatting op basis van CBS, bewerking EZK, IJmond onbekend

Arbeidsvolume Werkzame Personen 2017

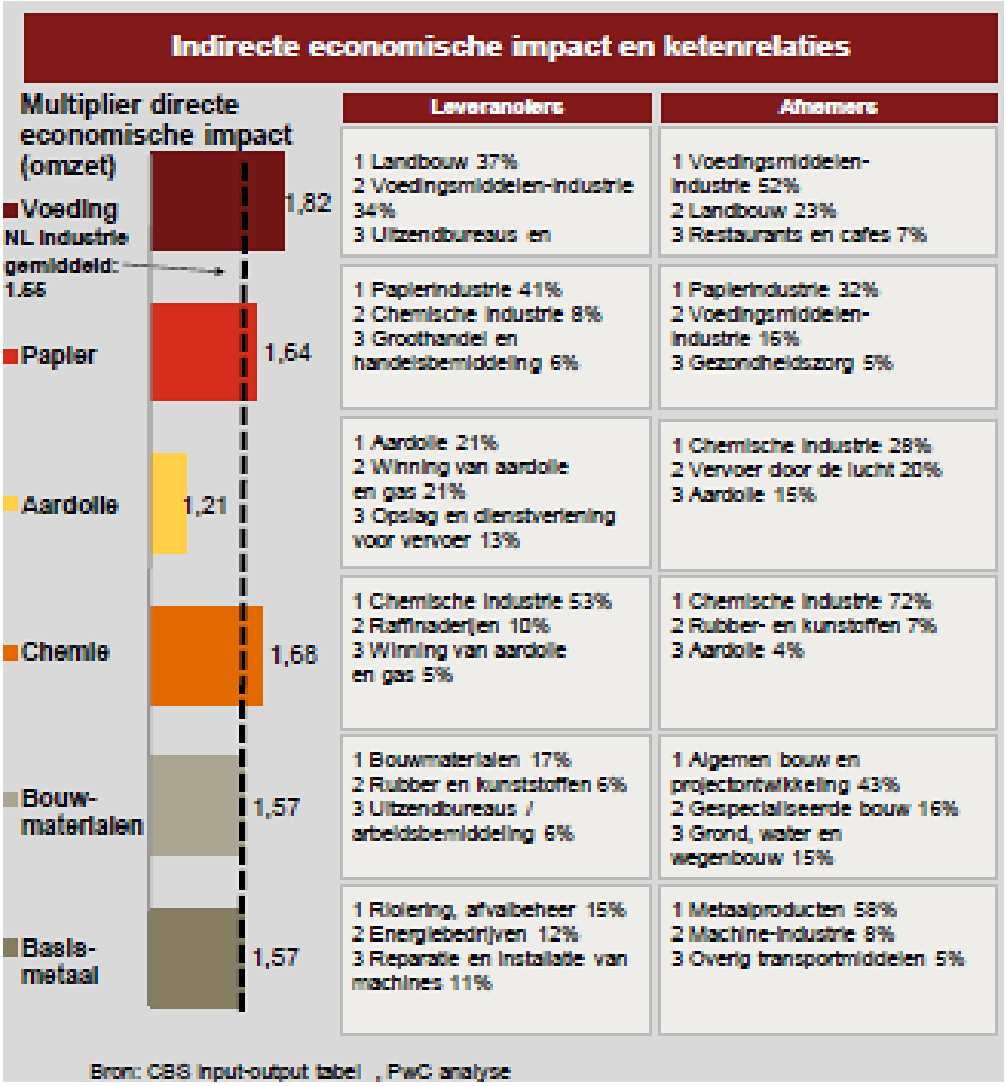
SBI: Papier-, Aardolie-, Chemie- Bouwmaterialen- en Basismetaalindustrie



Gemaakt met Localfocus

Bron: Bron CBS, bewerking EZK

1b) Indirect economic impact of basic industry (data 2015)



2) R&D-intensity en labour productivity Dutch industry

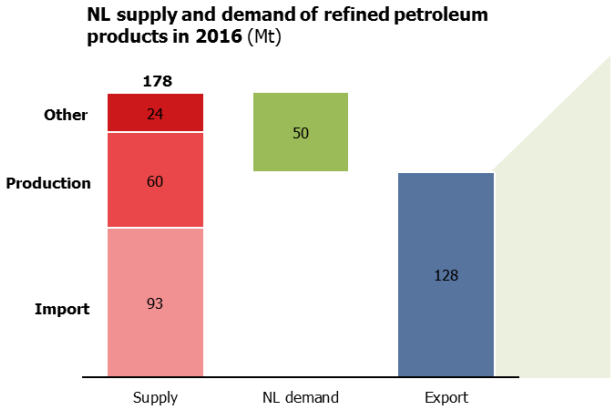
(data 2016)	R&D-intensity	Labour productivity
All activities	1,3	62,6
Industry	6,0	66,3
- basic industry	4,9	98,2
- other industry	6,3	60,6

3) Export position Netherlands of basic metals, chemistry (ethylene and fertilizer) and refineries (below)

	IJzer en staal	Ethyleen	Kunstmest
Export (%, totale productie)	75%	85%	89%
Export naar EU (%, totale export)	84%	78%	73%
Import vanuit EU (%, totale import)	96%	62%	79%
Bronnen: CBS Statline; Tata Steel (2018); Meststoffen Nederland (2015); DOW Benelux (2015).			

Bron: CPB (2019). Achtergronddocument - Effecten van een belasting op luchtverontreiniging voor drie sectoren

Nederland is de grootste exporteur van petroleum-producten in Europa; 72% van de producten wordt geëxporteerd



- Aardolie speelt een belangrijke rol in de Nederlandse economie. Dat komt vooral door de aanwezigheid van grote havens, raffinaderijen en de petrochemie.
- Nederlandse raffinaderijen bedienen voor een groot deel de aardoliemarkt in Europa, maar zijn op wereldschaal actief.

Title: The Netherlands are a major exporter of petroleum products in Europe; 72% of products is exported.
Source: VNPI (Vereniging Nederlandse Petroleum Industrie)

4) Contribution of sectors to global value chains: Exports of NL value added by exporting sector (% of all NL value added exports), 2014

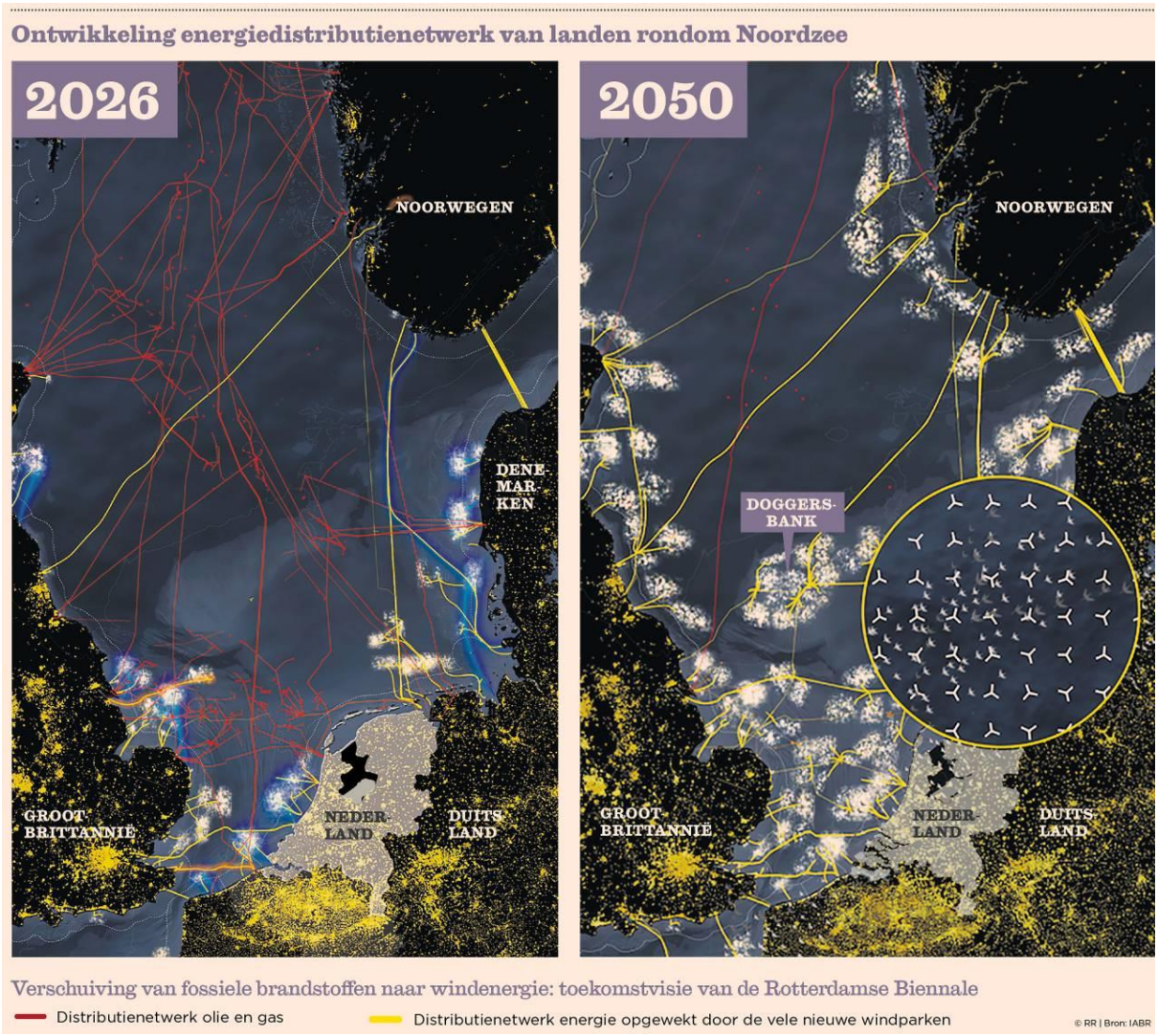
	from own sector	from other sectors	Total
Agriculture and mining	11.5	2.6	14.1
Food	6.3	6.6	12.9
Chemical	6.8	4.3	11.1
Machinery and metal	7.8	7.5	15.3
Transport	1.5	1.2	2.7
Other manufacturing	2.4	1.4	3.7
Trade and construction	0.7	8.3	9.0
Business services	26.9	3.7	30.6
Other services	0.4	0.1	0.5
Total	64.3	35.7	100.0

Bron: Timmer, M. en de Vries, G. (2015). Dutch Manufacturing Competing in Global Value Chains.

ANNEX 2: Examples of energy and industry scenarios for 2050 (in Dutch)

Energetic Odyssee

Energetic Odyssee is een toekomstvisie die in 2016 tijdens het Nederlands voorzitterschap aan EU-ministers werd gepresenteerd[45]. De Energetic Odyssee zet de Noordzee centraal als bron van hernieuwbare energie voor alle omringende landen, op basis van wetenschappelijke inzichten rond energetische (brandstof-) en chemiesystemen. Voor kostenefficiënte transitie maakt het toekomstbeeld zoveel mogelijk gebruik van bestaande infrastructuur en kennissterktes.



Bron foto's: Financieel Dagblad

IEA-scenario's

In de IEA Energy Outlook 2019[46] wordt een drietal scenario's geschetst voor de vraag naar energie in de wereld uitgesplitst naar current policy (huidige beleid/ business as usual), stated policy (wat als het beleid dat nu is aangekondigd wordt uitgevoerd) en sustainable development (wat als we de doelstellingen Parijs willen halen). In al deze scenario's wordt rekening gehouden met een forse groei van de vraag naar energie (met name in Afrika) en een blijvend belang van olie in de scenario's. In het duurzaamheidsscenario is het daarom van belang dat energie- efficiëntie en elektrificatie (met name door zon-PV en offshore wind) fors worden gestimuleerd.

[45] In opdracht van de IABR2016, heeft H+N+S i.s.m. Ecofys en Tungsten Pro een plan gemaakt voor de gehele Noordzee, waarbij deze wordt getransformeerd tot een bron van hernieuwbare energie voor Europa. http://www.hnsland.nl/nl/projects/2050-energetic-odyssey

[46] https://www.iea.org/reports/world-energy-outlook-2019

De IEA noemt recycling van staal, aluminium, cement en plastics als belangrijke kans om efficiëntie te vergroten ('material efficiency'), maar digitalisering is ook belangrijk om de energiesystemen (met name vraag en aanbod van elektriciteit) goed te kunnen balanceren en zo ook aan efficiëntie bij te dragen. Daarnaast wordt CCS gezien als een belangrijke mogelijkheid om versneld CO_2-emissies te reduceren in de industrie[47].

Sector Chemie
De topsector Chemie heeft met oog op een duurzame toekomst een analyse gemaakt van alle technieken die de sector in haar transitie kunnen helpen, naar bijdrage aan emissiereductie en stand van ontwikkeling[48]. Deze vormt de basis van de roadmaps in het missiegedreven innovatiebeleid (IKIA missie C). In de routekaart voor de Chemie naar 2050 heeft de chemiesector al onderkend dat er naast duurzame energie het voor de chemie van belang is dat er juist voor de chemie naar groene grondstoffen moet worden gewerkt[49].

[47] https://www.iea.org/fuels-and-technologies/carbon-capture-utilisation-and-storage
[48] https://hollandchemistry.nl/theme/climate/
[49] https://vnci.nl/themas/thema-detail?dossierid=3145760769&title=C.Klimaat+-+Routekaart+2050

ANNEX 3: Sustainable options for chemistry, fuels and refining (in Dutch)

Ruwe olie wordt op dit moment in de raffinaderijen verwerkt tot diverse producten. Zo'n 85 procent van de output bestaat uit brandstoffen als diesel, benzine, gasolie, stookolie en LPG voor de Europese markt of wereldwijde handel. De andere 15 procent is nafta, basisoliën en bitumen. De nafta wordt omgezet in aromaten of olefinen en dient vervolgens als grondstof voor de chemische industrie.

Alternatieve koolstofbronnen

Grofweg kan inzet van fossiele koolstof vervangen worden door:

- inzet van gerecycleerde koolstofproducten;
- inzet van koolstof uit verbrandingsprocessen (CCU);
- koolstof uit biomassa; of
- koolstof uit de lucht (Direct Air Capture, DAC).

Recycling

Het potentieel van recycling is groot. De ambitie van de EU is dat alle plastic verpakkingen in 2030 herbruikbaar of recyclebaar zijn en daarvan moet 55 procent worden gerecycled. Een schone plasticstroom is maar een aantal keer te recyclen, daarna is de kwaliteit van de polymeren onvoldoende. Via chemische recycling (oplossen, depolymeriatie, kraken en vergassen) is het mogelijk het product opnieuw op te bouwen. Ioniqa is een bekend Nederlands voorbeeld. Vanwege verliezen in de keten en entropische principes, zal er echter altijd input moeten zijn van 'virgin' koolstof (en energie).

CCU

Deze koolstof kan verkregen worden door de CO(2) af te vangen bij verbrandingsinstallaties. Bijvoorbeeld via het zogenaamde Fischer-Tropsch proces kan men koolwaterstoffen synthetisch produceren uitgaande van koolstofmonoxide en waterstof. $(2n + 1)\ H_2 + n\ CO \rightarrow C_nH_{2n+2} + n\ H_2O$. (Het Everest project van Tata en Dow is hierop gebaseerd, waarbij de fossiele CO uit de restgassen van hoogovens afkomstig is). Aanbod van CO_2 lijkt geen probleem, zuivere biotische CO_2 bronnen zijn commercieel het meest interessant, daarnaast is er relatief veel (hernieuwbare) energie en waterstof nodig.

Biomassa

Naast koolwaterstoffen van minerale oorsprong is het ook mogelijk om alle belangrijke koolwaterstofverbindingen te maken uit biologische grondstoffen, plantaardige en dierlijke bronnen. Technologisch is bijna alles al mogelijk, met bekende voorbeelden zoals BioPET, BioBTX en PEF, maar commercieel hebben veel bioplastics het nog moeilijk. In Nederland zijn bedrijven als Corbion (PLA) en Avantium (PEF) toonaangevend.
Biomassabronnen zijn zeer divers, waaronder bronnen die weinig met voedsel concurreren, zoals houtachtige gewassen (lignine) en bronnen als zeewier en algen en andere micro-organismen die direct grondstoffen produceren. Photanol is in Nederland een bekend voorbeeld hiervan.
Beschikbaarheid van biomassa voor de chemie is vanwege de aanzienlijk kleinere volumes minder problematisch dan bij biobrandstoffen en bio-energie. Daarbij geldt dat het desondanks belangrijk is om goede duurzaamheidscriteria voor bioplastics te hanteren. Deze zijn de afgelopen jaren ontwikkeld.

Direct Air Capture (DAC)

Koolstof uit de lucht vangen zonder de tussenkomst van een organisme is DAC. De verschillende DAC technieken hebben met elkaar gemeen dat CO_2 uit de lucht chemisch gebonden wordt, waarna het koolstofdioxide na verhitting in hoge concentratie vrijkomt en kan worden opgeslagen of

gebruikt. Wereldwijd zijn diverse start-ups actief, maar de ontwikkeling bevindt zich nog in een pril stadium. Na het vangen en het concentreren van CO_2 volgt nog de stap van CCU, waarin de CO_2 gebonden wordt aan bijvoorbeeld waterstof, zodat er basisgrondstof ontstaat voor de chemie. Beide processen zijn zeer energie-intensief en zijn alleen duurzaam als gebruik wordt gemaakt van groene stroom en groene warmte.

Negatieve emissies

Het uit de lucht nemen van CO_2 via biomassa of DAC zou ook gecombineerd kunnen worden met CCS of andere vormen waarbij de CO2 langdurig wordt vastgelegd via CCS, in bouwmaterialen of via het gebruik van hout als bouwmateriaal in houtskeletbouw. Doordat op deze manier per saldo CO_2 aan de atmosfeer wordt onttrokken kan dit eventuele onvermijdelijke restemissies compenseren.

Brandstoffen versus chemie

In principe kan elke hierboven besproken koolstofbron gebruikt worden om (synthetische of bio) brandstoffen te maken. Grote verschil is het volume en de prijs. Het energie en grondstofgebruik van de alternatieven is hiermee ook relevanter. Voor biobrandstoffen is bij zeer grootschalig gebruik, landgebruik en concurrentie met voedsel een belangrijk nadeel. Bij synthetische brandstoffen is een aandachtspunt de ruime beschikbaarheid van goedkope CO2 en CO2-vrije elektriciteit en waterstof.

Vraagvermindering plastics en Plastic Soep

Vanuit Europa en Nederland wordt ook ingezet op vraagvermindering naar plastics. Met name milieuproblematiek zoals de plastic soep is een wereldwijd een sterke driver om anders en efficiënter met plastic producten om te gaan. In het nationale Plastic Pact is afgesproken 20% minder in 2025. De hoeveelheid op de markt gebracht plastic per jaar neemt nog steeds toe, zo is de hoeveelheid plastic verpakkingen tussen 2013 en 2017 bijvoorbeeld met 10% toegenomen van 463 kiloton naar 512 kiloton plastic verpakkingen per jaar (Afvalfonds Verpakkingen, 2018; Nedvang, 2014).

Overzicht fossiele energietoepassingen en alternatieven.

Toepassing	Aandeel (% totale hoeveelheid fossiele energiedragers)	Biomassa alternatief	Ander koolstofarm alternatief
Elektriciteits-opwekking/wkk	29%	Mee-/bijstook Bio-WKK Vergassing	Zon Wind Water Kern(fusie)
Warmte (tot 120^0) Huishoudens, tuinbouw	22%	Bio-WKK Biomassaketel	Geothermie, Warmtepompen Zonneboilers, Elektrificeren
Industriële warmte (vooral stoom)	15%	Biomassaketel Biogas	Aardwarmte (IJsland) Elektrificeren, waterstof, Nucleair
Personenvervoer, lichte bedrijfsvoertuigen	10%	Biobrandstoffen Biogas	Batterij elektrisch Brandstofcel waterstof
Vrachtvervoer over de weg	4%	Biobrandstoffen Biogas (LBG)	Batterij elektrisch, Brandstofcel waterstof
Luchtvaart • **Verbruik NL** • **Bunkers**	0,1% 5% (*)	Biobrandstoffen	Modal shift, Synthetische brandstoffen
Scheepvaart • **Verbruik NL** • **Bunkers**	0,5% 17% (*)	Biobrandstoffen Biogas (LBG)	Modal shift, beperkt batterij elektrisch, brandstofcel waterstof

Toepassing	Aandeel (% totale hoeveelheid fossiele energiedragers)	Biomassa alternatief	Ander koolstofarm alternatief
Chemicaliën en kunststoffen	20%	Biobased chemicaliën, Biobased kunststoffen	CO_2 (CCU, DAC)

Tabel Verbruik energiedragers naar toepassing[50].

[50] Smedema 2015: Vooruitblik op 2016, TKI-BBE

ANNEX 4: Examples of advanced sustainable projects, firms and (provincial) government (in Dutch)

1. Rotterdamse aantrekkingskracht op koplopers in verduurzaming

Restwarmte uit de haven benutten voor stadsverwarming. Een proefproject voor afvang en opslag van CO_2. Productie van biobrandstof en investering is een bedrijf dat in 2030 klimaatneutraal wil zijn. Dit zijn enkele duurzame initiatieven die rond het Rotterdamse haven- en industriecomplex ontstaan.

Als grootste Europese haven en internationaal knooppunt voor handel, product- en grondstofstromen vindt in het haven- en industriecomplex van Rotterdam ook veel uitstoot van CO_2 plaats. Een ogenschijnlijk nadeel, maar door de concentratie van veel energie-intensieve industrie, de gunstige ligging, efficiënte haveninfrastructuur en mogelijkheid tot samenwerking is Rotterdam ook een logische plek om juist hier proefprojecten voor CO_2 reductie te ontwikkelen. CO_2 die in het Rotterdamse haven- en industriecomplex wordt gereduceerd, werkt door in vele industrieketens en kan als voorbeeld dienen voor andere industriecomplexen en havens.

Rotterdam ontwikkelt zich tot Europees biobased cluster van formaat en ziet zijn aantrekkingskracht op duurzame bedrijven groeien. Onder hen ook de Finse biobrandstof raffinaderij Neste. Zij maken, naast de traditionele biobrandstoffen uit bio-afval, steeds vaker hernieuwbare biobrandstoffen. Onder andere uit algen. Deze nieuwe grondstof is relatief makkelijk te kweken met zonlicht en neemt daarbij ook veel CO_2 op. De techniek om hier vervolgens voldoende, betrouwbare biobrandstof van te maken, is het resultaat van jaren onderzoek en doorgaande innovatie. Met resultaat. De uitstoot van broeikasgassen (zoals CO_2) door hernieuwbare biobrandstof kan tot 90% lager liggen dan reguliere brandstof uit fossiele bronnen. Neste is een van de bedrijven dat zich in Rotterdam volop ontwikkelt binnen de energietransitie en investeert in verdere verduurzaming van hun producten. Kenmerkend is dat deze bedrijven ook andere producenten meenemen en zo zorgen voor verdere duurzame ontwikkeling in het Rotterdamse ecosysteem.

2. Gevestigde orde vindt zich opnieuw uit: Nouryon

Nouryon is in oktober 2018 ontstaan vanuit Akzo Nobel en meer dan 150 jaar kennis van essentiële chemie. Zij produceren chemicaliën voor dagelijkse benodigdheden als papier, isolatiemateriaal, medicijnen, zout, wasmiddelen, micronutriënten voor voedselsupplementen en persoonlijke verzorgingsproducten zoals zonnebrandcrème. Om maar een paar voorbeelden te noemen.

Natriumchloride (NaCl); de scheikundige naam voor keukenzout en pekel voor gladde wegen, wordt onder andere door Nouryon in Delfzijl en Hengelo gemaakt. Dit zout wordt geproduceerd uit ondergronds gewonnen pekel, wat vervolgens moet 'indampen' zodat het zout kan uitkristalliseren met de juiste, gelijkmatige korrelgrootte. Voor dit proces is stoom onder grote druk nodig. Stoom die voorheen werd geproduceerd met het stoken van grote hoeveelheden aardgas. Intussen wordt hier steeds meer een alternatieve energiebron voor gebruikt. De stoom komt vrij uit verbanding van biomassa en afval, en wordt via speciale pijpleidingen direct ingezet bij het verdampen van pekel. Door slim gebruik van stoom en groene energie verlaagt Nouryon zijn jaarlijkse uitstoot van CO_2 met 300.000 ton en 80 miljoen kubieke meter aardgas. Dat is vergelijkbaar met het energieverbruik en uitstoot van ruim 35.000 huishoudens.

3. In 2030 al klimaatneutraal: Innocent Drinks

Innocent Drinks is een Brits bedrijf dat in 1999 begon met het maken van smoothies en gezonde sappen. Het bedrijf investeert momenteel ruim €250 miljoen in een nieuwe fabriek in Rotterdam die al in 2030 volledig klimaatneutraal moet produceren. Alle onderdelen van het logistieke- en het productieproces worden in dit licht ontworpen. Zo haalt de nieuwe fabriek ongeveer 200.000 vrachtwagenbewegingen per jaar van de weg en worden koeling en verhitting met maximale efficiency en een minimum aan energieverlies uitgevoerd. In het productieproces gebruiken ze alleen duurzame energie, die ze gedeeltelijk zelf opwekken. Het bedrijf streeft ook naar CO_2 vermindering in de keten. Vanaf het begin wordt gekeken naar het minimaliseren van CO_2 impact van verpakkingen en restmateriaal, onder andere door hergebruik.

Het bedrijf is in 2002 begonnen met de ontwikkeling van een volledig recyclebare plastic fles voor hun smoothies en sappen. Een project van de lange adem. De verpakking mag immers niet teveel kosten, moet de sappen houdbaar houden, geschikt zijn om machinaal te vullen en goed te transporteren zijn. Alternatieve verpakkingen, zoals glas of karton, zorgen ook voor uitstoot en andere uitdagingen. Glas is zwaar en kwetsbaar. Voor karton is steeds nieuw papier (bomenkap) en een nieuw plastic laagje nodig. Innocent zet daarom in op een volledig gerecyclede plastic fles. Hun eerste 100% gerecyclede fles voldeed in 2007 niet aan de kwaliteitseisen, maar intussen maakt Innocent Drinks zijn flesjes van 50% gerecycled plastic en 15% plant plastic. Het doel is om in 2022 op 100% gerecyclede flessen te komen. Daarvoor werkt Innocent Drinks nauw samen met leveranciers en daagt de industrie uit om betere materialen te ontwikkelen.

4. Overheid als *launching customer* voor een CO_2 vastleggende weg

Het verminderen van onzekerheid en creëren van nieuwe markten is bijna net zo belangrijk als innovatie zelf om verduurzaming binnen de industrie te versnellen. Bedrijven zullen hun investeringen moeten terugverdienen en zonder afnemers blijft het bij goede intenties op papier. In dit voorbeeld laat de Provincie Zuid-Holland zien hoe beslissend de rol van een afnemer in zo'n geval kan zijn.
In 2018 moest de provinciale weg N211 bij Poeldijk vernieuwd worden. De provincie daagde de markt uit: kom met duurzame technologie waarmee de N211 meer CO_2 bespaart dan uitstoot. Tegelijk werd hier een echte testlocatie geboden voor nieuwe, duurzame oplossingen. BAM Infra nam de uitdaging aan en trok in zijn kielzog verschillende innovatieve bedrijven uit de regio mee. Samen zochten zij naar nieuwe technieken, oplossingen, materialen en toepassingen om CO_2 te besparen en materialen opnieuw te gebruiken.
Het oude, teerhoudende asfalt werd met schimmels gereinigd, in plaats van verbrand. De weg is extra vlak en met een vernieuwde textuur aangelegd, waardoor weggebruikers minder brandstof gebruiken. De restwarmte uit het wegdek wordt gedeeld met naburige bedrijven. Bouwmaterialen zijn zoveel mogelijk hernieuwbaar of hergebruikt uit de oude weg. Lantaarnpalen en bushokjes wekken zelf energie op. Ook de damwand, die de weg van de vaart ernaast scheidt, was aan vervanging toe. Ook hier zijn innovatieve technieken toegepast, door de nieuwe damwand met een kathodische bescherming licht elektrisch te laden, wat roest voorkomt. Hierdoor was minder staal nodig voor de damwand zelf. De oude betonnen damwand is verkruimeld en hergebruikt als fundering van de nieuwe weg. Uiteindelijk bespaart deze weg 14.000 ton CO2, waarmee het doel van 4.000 ton ruimschoots is overschreden.
Met ruim 135.000 kilometer openbare weg in Nederland en bijna 7 miljoen kilometer aan wegen in Europa, ligt hier een wereld aan mogelijkheden. Enerzijds voor het terugbrengen van CO_2 uitstoot op grote schaal in wegaanleg en wegonderhoud. Anderzijds liggen er economische kansen voor de Nederlandse bedrijven die deze oplossingen hebben ontwikkeld. Voorwaarde is wel dat onder andere overheden zich meer bewust worden van hun rol als afnemer. Ook zij hebben de mogelijkheid om de markt uit te dagen en daarbij verduurzaming en maatschappelijke uitdagingen centraal te stellen. Dit voorbeeld laat zien dat de energietransitie ook weer andere transities in werking zet.