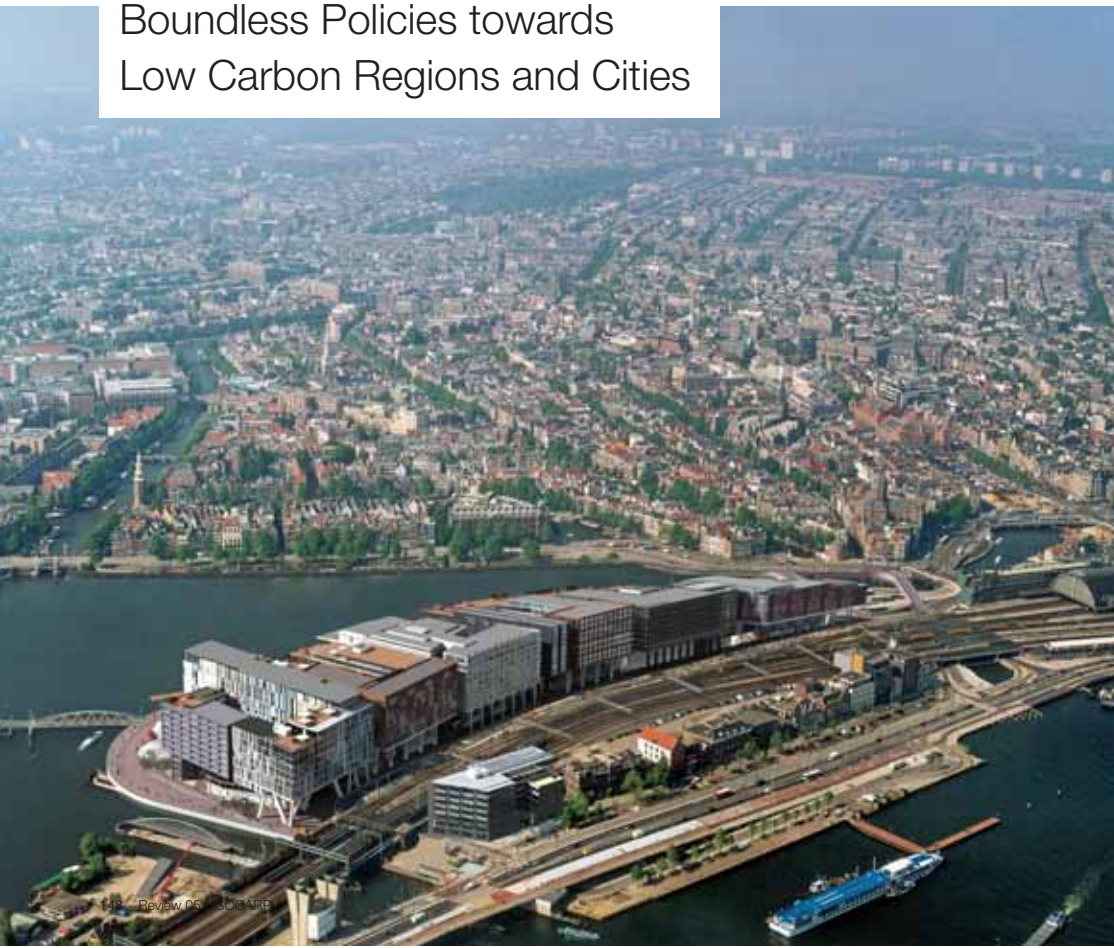


The Netherlands 2020

Boundless Policies towards Low Carbon Regions and Cities



Introduction: The Dutch Context

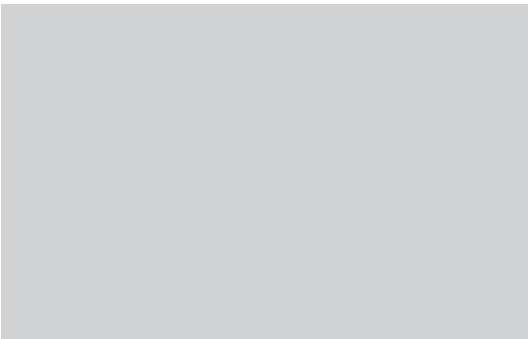
The Netherlands is a densely populated, low-lying coastal country and besides that it is the delta of the rivers Rijn, Maas and Schelde. There are also many smaller rivers and some 3000 polders. The metropolitan area 'Randstad', the heart of the Dutch economy, is largely situated below sea level. All these factors make our country vulnerable to rises in the sea level and periods of extreme rainfall or drought. The history of the Netherlands is characterized, among other things, by the 'struggle against water'. The prognosis of the rise in the sea level due to climate change has made the Netherlands sit up and pay attention. Alongside the existing *mitigation* policies (reducing greenhouse gas emissions), *adaptation* policies (reducing vulnerability and risks that arise from climate change) are now being developed. The Netherlands must also confront an approaching energy problem. Since 1960, the extraction of gas from underneath Dutch soil has greatly stimulated the economy and made the country relatively independent in the supply of its own energy needs. It is estimated that the Netherlands can draw on its gas reserves for the next 20 years. After this time, it wants to continue to supply its own gas requirements while continuing to play an important role in the supply of gas in Europe. To achieve this in a sustainable and durable way an *energy transition* (switching from fossil to sustainable energy) was formulated several years ago.

Boundless Policies

With these policies on mitigation, adaptation and energy transition, the central government would appear at first glance to react adequately to the climate issue. The Dutch government endorses the global and European climate treaties and also the resulting objectives. Through its climate policy, the Netherlands even aspires to act as an example in Europe. However, it is doubtful whether the Netherlands will be able to meet its own targets with the current efforts, let alone achieve the tougher targets that will likely be decided at the coming climate summit in Copenhagen. If the central policy is studied more closely and the results of previous efforts are analysed, it would appear that a great deal of work still needs to be done.

Much more effort is required before the Netherlands can actually develop in a way that it can become climate-proof in the very long term, will be protected against flooding and will remain an attractive place for investment and a healthy place to live, work and recreate. To achieve this, new policy is required at various levels; from national level, regional level, urban regional and city level, district level, down to the level of housing estates and industrial estates. This new policy needs to be boundless; boundless in the sense of looking beyond the limits of regional or urban areas, working on ideas and projects that break new ground and representing interests that go further than the borders. Certainly, the Dutch government has made a start with its (recent) policies for mitigation, energy transition and adaptation, but it is not enough. Fortunately certain regions, provinces and cities in the Netherlands have developed their own policies and plans which go beyond the national policies.

There even seems to be a race between various local authorities to become the most sustainable region in the Netherlands. Countless news items can be found on the Internet from towns claiming to be the most sustainable, whether it be in a



specific area such as sustainable procurement, a sustainable housing estate or the reduction of CO₂ emissions in the entire municipality. Specific joint agreements on this exist at European level. Thirteen larger Dutch towns have pledged, via the European 'Covenant of Mayors' [1], that they will have reduced their CO₂ emissions by more than 20% in 2020 through a formal commitment to go beyond this target with the implementation of their Sustainable Energy Action Plan. The cities of Amsterdam, Rotterdam, Utrecht, Den Haag, Haarlem, Den Bosch, Delft, Heerlen, Helmond, Zoetermeer, Breda, Nijmegen and Tilburg have already signed up. Amsterdam was one of the 8 finalists for the European Commission's Green Capital Award 2009 [2]. The provinces in the Netherlands also pay attention to the reduction of CO₂ emissions. The cars of the Province of Utrecht drive on green gas and the province gives climate subsidies to companies, municipalities and foundations that develop or share knowledge and techniques for mitigation and adaptation. Four other more northerly provinces even work jointly on this issue under the name Energy Valley.



Illustrations: Examples of past and present "energy landscapes" in the Netherlands. Top left: a lake remained after the exploitation of peat in the 16th century. Top right: the Beemster Polder was pumped dry with windmills in the 17th century. Bottom left: 20th century windmills in the Flevo Polder. Bottom right: the storage of natural gas in empty gas fields in Langelo (Pandion, Peter van Bolhuis).



The policies and plans of the region Energy Valley and the cities of Amsterdam, Rotterdam and The Hague are well documented and will be explained in this paper. Before we expand on these promising local policies, we will explain the national policies on adaptation, mitigation and energy transition and the criticism that exists on this. This paper will look at the approach of the Energy Valley region in particular. It is on such a regional scale, that the Netherlands is best able to effectively respond to the climate problem.

Dutch Adaptation Policies

The 'Delta committee 2008' was asked by the government to advise on how to protect the Netherlands against the consequences of climate change. In its vision, the Delta Committee also addresses the relationship between housing and employment, agriculture, nature, recreation, the countryside, infrastructure and energy. Security and sustainability are the two pillars for the strategy in the coming centuries [3]. Besides protection from water, the committee's advice emphasizes and points out opportunities for Dutch society. The urgency of the advice and its implementation is considerable. The Netherlands has a lot of catching up to do because it does not meet the current standard on acceptable flood risks. Furthermore, these standards have been superseded and should be adjusted upwards. On top of this, the climate is changing quickly, the sea level is probably rising faster than was first thought and it is expected that fluctuations in river outflow, sometimes extreme, will increase. The interests of the Netherlands in areas like the economy, social aspects and nature are significant and will continue to increase; if a dike were to burst, the resulting disruption would be tremendous. The Delta Committee takes the view that we must be prepared for an increase in the sea level measuring 0.65 to 1.30 metres in 2100 and between 2 and 4 metres in 2200.

The Dutch adaptation policy does explicitly consider spatial planning. In 2006 the ministries for Housing, Spatial Planning and the Environment (VROM), Transport, Public Works and Water Management (VenW), Agriculture, Nature and Food Quality (LNV) and Economic Affairs (EZ), together with umbrella organisations for the Dutch provinces and municipalities and district water boards, launched the programme 'Adaptation to Climate Change in Spatial Planning' (ARK). The parties aim to make the Netherlands climate-proof, an aim that is expected to be one of the greatest challenges in spatial planning in the twenty-first century. An important impetus for the ARK programme was a parliamentary motion dated 2005 which requested the government to develop a long term vision on spatial planning in the Netherlands [4]. Furthermore, spatial planning investments do not take sufficient account of the consequences of climate change, such as the rise in the sea level and increased outflow from rivers. In 2007 the cabinet

established the National Adaptation Strategy [5]. The National Adaptation Agenda, which will contain concrete projects to be carried out, will be presented in 2009. Then it's also possible to debate the effectiveness of the adaptation policy.

Dutch Mitigation Policies

The mitigation policy of the Netherlands is linked to EU policy and aims at a 30% reduction in the emission of greenhouse gases by 2020, compared to 1990. This objective is in agreement with the course outlined by the IPCC in 2007 to limit the rise in the temperature since 1990 to 2 degrees Celsius. Besides this, the Netherlands aims to have 20% renewable energy by 2020. In the long term, up to 2050, the European Parliament advised on 4 February 2009 that the emission of CO₂ must be 80% lower than in 1990. The Dutch government has drawn up policy for 2050, but has not yet set definite targets. These depend partly on the results of the climate change summit in Copenhagen.

The Dutch mitigation policy on climate change in the short term, up to 2020, was formulated in the 2007 'Clean and Efficient' programme [6]. This programme was headed by the Ministry of Housing, Spatial Planning and the Environment (VROM) and implemented in cooperation with the Ministries of Economic Affairs, Transport, Public Works and Water Management, Agriculture, Nature and Food Quality, Finance and Foreign Affairs. By applying market incentives, standards, innovations and temporary incentives, the government wants to steer five sectors towards achieving climate targets. Examples of activities carried out, or intended to be carried out by the relevant Dutch ministries, in each sector are given below. These sectors are Industry and Energy, Traffic and Transport, the Built Environment, Agriculture and Horticulture and Other Greenhouse Gases.

Small-scale sustainable energy generation in the sector of **Industry and Energy** will be stimulated with limited specific subsidies and fiscal measures in 2008. New combined heat and power systems have been encouraged from 2008 onwards. Hot water supply in buildings and industry is to be made more efficient from 2008 onwards. Extra wind turbines are to be located on land and at sea between 2008 and 2011. The use of sustain-

able biomass and biofuel will be increased from 2008 onwards. The energy infrastructure will be improved before 2011. Fossil energy is to be made as clean as possible through the capture and storage of CO₂ from 2012. In the case of large-scale, energy-intensive industries, the emission trading system (ETS) will be applied.

There will be a greater use of sustainable bio fuels and other climate neutral fuels by 2020 in the sector **Traffic and Transport**. A target of 20% will be discussed. Kilometre pricing and volume policies will be introduced in phases until 2020. The energy efficiency of vehicles will be improved in phases until 2020. Changes in attitude concerning passenger and goods transport have been stimulated from 2008 onwards. In the sector of the **Built Environment**, existing housing will be provided with an energy label and made more energy efficient as of 2008. Energy performance standards (EPC) will be gradually increased in new buildings until they become energy neutral by 2020. The generation of sustainable energy in existing

buildings will be stimulated through the provision of subsidies from 2008 onwards. Agreements with housing corporations will be entered into regarding improvements in energy performance in rented accommodation as of 2008.

Energy consumption and the emission of greenhouse gases in the sector of **Agriculture and Horticulture** will be reduced between 2008 and 2011 by using more efficient techniques and fermentation. From 2008 onwards, the agricultural processing industry will save energy by implementing innovations. In the greenhouse farming industry, energy-saving techniques will be applied between 2008 and 2011. Greenhouse farms and other functions will be clustered together to develop the 'energy generating' greenhouse as of 2010. Emissions of **other greenhouse gases**, such as nitrous oxide and methane from the chemical, agricultural and other sectors, will be limited from 2008 onwards. From 2008 onwards, the possibility of taxes on the gases HFC (fluorocarbon) and SF₆ (sulfur hexafluoride) will be considered.

The Dutch Energy Transition

In the long term, up to 2050, the Netherlands is working on a programme called 'Energy Transition'. Energy Transition originated from the fourth National Environmental Policy Plan in 2001 and its objective is to bring parties together and combine know-how [7]. It deals with the streamlining of legislation and regulations and the provision of financial support to viable projects. In the coming years, the Netherlands wants to develop into an 'innovative engine' in order to achieve the transition towards a system of sustainable energy management. This ambition will be supported in the long term through cooperation between the government, the business sector, institutes of knowledge and social organisations. Ensuring that our energy supply becomes sustainable is a global process. The Netherlands recognizes the opportunity to participate in this process. If the country were to miss this opportunity, it will lose out on economic activities in the coming years. In the long term it will have to pay and continue to pay for an outdated energy system.

The ultimate objective of the Dutch Energy Transition is rather vague: "A fully sustainable energy supply by 2050 in the Netherlands. Renewable energy sources will then supply the majority of our energy. The emission of waste products will be in balance with what the 'system earth' can absorb." The Transition action plan will be amended annually according to current developments and new insights. Besides a technological component, the plan also has a clear social component that will require a substantially new attitude in society towards energy production and consumption and that will lead to different and new relationships. The Energy Transition programme is split into seven platforms: Mobility, Bio-based raw materials, Chain Efficiency, New Gas, Sustainable Electricity Supply, Built Environment and Greenhouses as Energy Source [8].

Box 1: How much CO₂ is emitted in the Netherlands?

In the Netherlands, 210 to 220 Mt* CO₂ is emitted each year. In 1990 this figure was 215 Mt; in 1996 it peaked at more than 230 Mt CO₂; in 2005 the figure was 212 Mt CO₂. The current Dutch climate policy is founded on the reduction of greenhouse gas emissions, and in particular CO₂. By 2020 the level must be thirty percent lower than it was in the reference year 1990. This translates into an emission level of 150 Mt CO₂ in 2020. If no adjustment was made to policy, the level in 2020 would be 245 Mt CO₂. The intentions of the G-8 countries and agreements reached in Copenhagen will perhaps necessitate a reduction of 50% by 2020 and 80% by 2050 for industrial countries. For the Netherlands this would then be 110 Mt CO₂ by 2020 and 45 Mt CO₂ by 2050.

In 2005 the emission was 212 Mt CO₂. Of this amount, 29 Mt CO₂ was attributed to the built environment, 101 Mt CO₂ to industry and the generation of electricity, 39 Mt CO₂ to traffic, 7 Mt CO₂ to agriculture and 36 Mt CO₂ was made up of other greenhouse gasses (H₂O(g), CH₄ en O₃). According to the government's programme Clean and Efficient, in 2020 this figure must be 150 Mt CO₂, which will be comprised of 15 to 20 Mt CO₂ from the built environment, 70 to 75 Mt CO₂ from industry and the generation of electricity, 30 to 34 Mt CO₂ from traffic, 5 to 6 Mt CO₂ from agriculture and 25 to 27 Mt CO₂ from other greenhouse gasses.

* One Mt (Megaton) equals one billion kg or one million tonnes.

Box 2: Definitions and ambitions

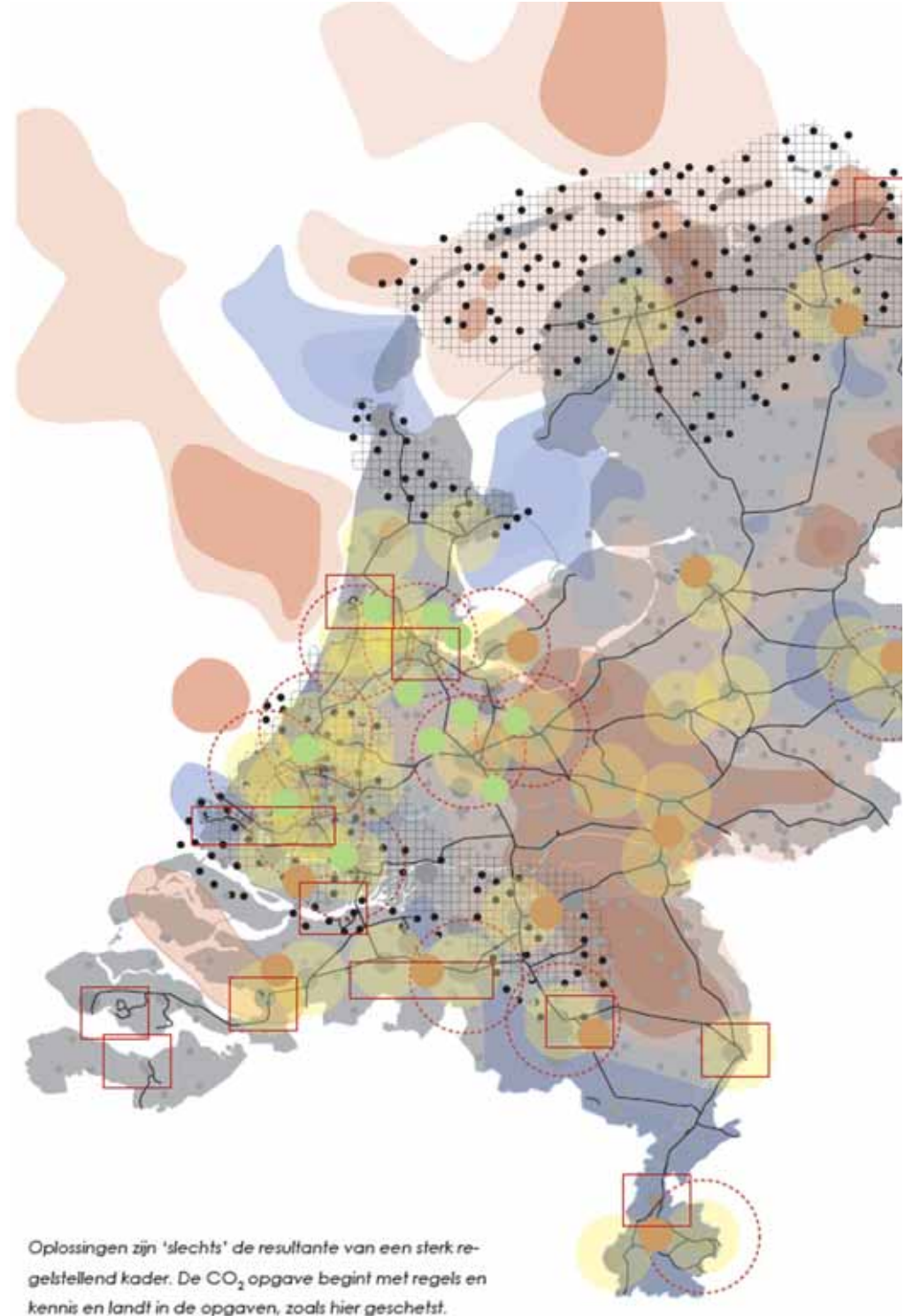
The following three ambitions are often voiced in the Netherlands: CO₂ neutral, climate neutral and energy neutral. These terms are often used interchangeably as if they mean the same thing, though this is most certainly not the case. CO₂ neutral is understood to mean: a situation where fossil energy consumption (and related CO₂ emissions) measured throughout a year is no more than zero and no energy is consumed that is not put back into the system from a renewable source. Climate neutral refers to a situation where the above definition of neutrality encompasses all greenhouse gasses. Energy neutral goes one step further because in this case the total energy requirements of a company or a whole area must come from renewable sources and the storage of CO₂ in new forestry areas or underground is not permitted.

Critics of the Dutch Mitigation Policies and the Energy Transition

The above mentioned mitigation and transition plans would seem to address a broad scope of climate issues in the long term, although they seem to lack much commitment. Various parties in the Netherlands are even quite critical of the government's policies. Among other things, they have considered the present state of the country's knowledge infrastructure and the probability of success if this course of action is adopted.

In May 2009, at the request of the Ministry of Housing, Spatial Planning and the Environment (VROM), the agencies Posad and Except published the strategic study 'CO₂2040', on the Netherlands becoming CO₂ neutral by 2040 [9]. The study indicates that the measures the Netherlands will take to become CO₂ neutral within thirty years, will have to be far more wide-reaching and far more radical than they are at present. Firstly, we need to make clear how much energy we - society, households and individuals - actually consume and how much CO₂ we produce. The study also demonstrates that the serious objective of achieving a CO₂ neutral built environment will require far more than merely the application of standard measures and technologies such as lowering the EPC of individual (new) houses. Spatial planning and the choice of locations for functions and buildings must be geared to a far more intensive and intelligent use of residual heat and geothermic conditions in urban areas. In addition, the study calls for a revolution in the field of public transport. As an example, they point to the scope and the reliability of the metro network in Stockholm compared to the public transport network in Dutch urban regions.

Illustration: The Netherlands becoming CO₂-neutral according to Posad and Except is the result of many different projects like exchanging waste heat in industrial areas and using geothermal energy (Posad and Except, 2009).



Oplossingen zijn 'slechts' de resultante van een sterk regelstellend kader. De CO₂ opgave begint met regels en kennis en landt in de opgaven, zoals hier geschetst.

Figures provided by Statistics Netherlands (CBS) also demonstrate that the underlying situation with regard to 20% sustainable energy by 2020, for example, is not satisfactory. In 2006 only 2.7% of the total energy consumption in the Netherlands came from renewable energy sources. This is significantly lower than the 'EU-15' average which was 6.8% in 2006. [10] The Netherlands Environmental Assessment Agency (PBL) and the Netherlands Energy Research Centre (ECN) predicted in 2008 that under the current policy, only 7% sustainable energy will be used in the Netherlands by 2020 [11]. The two advisory bodies mentioned above also cooperated via the Platform Communication on Climate Change (PCCC) with three Dutch universities, the Royal Netherlands Meteorological Institute (KNMI) and the Netherlands Organisation for Scientific Research (NWO) to produce the report 'The state of the climate 2008'. This report is critical of the Dutch climate policy. It places a few question marks against the technology for CO₂ Capture and Storage (CCS). This technology has not yet been sufficiently developed for large-scale deployment and could be at the expense of investments involving energy saving and renewable energy. In spite of this, the government continues to pursue this technology in order to achieve its objectives and even to justify the current development of two coal-fired power stations [12].

The Energy Valley Region

The region known as Energy Valley comprises the provinces Friesland, Groningen and Drenthe and the northern half of the province Noord-Holland. Since the extraction of natural gas 50 years ago, this northern region of the Netherlands has developed a substantial energy sector with 400 companies, 25,000 jobs and 350 projects being developed in both the public and private sector [13]. In October 2007, Minister Van der Hoeven of Economic Affairs and Minister Cramer of the Ministry for Housing, Spatial Planning and the Environment, signed an energy agreement with the provinces of the Energy Valley. This agreement is based on the objective of 40 to 50 Petajoules sustainable energy and a 4.5 Megaton reduction in CO₂ emissions by 2011. This is to be achieved by implementing a wide range of projects in the

built environment involving energy infrastructure and storage. By doing this, the region will make a substantial contribution to the achievement of the national objectives on climate and energy by 2020. The main objective of Energy Valley is to reinforce the economy and employment prospects in the north of the Netherlands by further stimulating sustainable energy activities. The emphasis is on energy conservation, the production of clean fossil energy, the development of sustainable mobility and new energy technologies.

Achieving environmental advantages, such as the reduction of CO₂ emissions, is not an objective in itself, but a welcome consequence of the sustainable energy economy. Energy Valley does not only address and implement the national energy transition policy, but it also has the ambition to de-

velop into an internationally leading energy region through its integral approach to conventional energy activities, knowledge, innovation and energy transition. In addition, the organisation representing Energy Valley functions as an information centre and intermediary for businesses, government bodies and institutes of knowledge. One of the most interesting working themes of Energy Valley is the Smart Power System. A broad syndicate of companies and institutes of knowledge is working on the enhancement of efficiency and intelligent linking of the many small decentralized energy generators in the north of the Netherlands. Electricity generation by a combination of wind turbines, co-generation and solar energy jointly form a potential power station. Important features of the Smart Power System are the large-scale introduction of

the High Efficiency Boiler and the development of a Smart Power Grid. The High Efficiency Boiler is a steam producing central-heating boiler which, compared to current technologies, gives a saving on energy costs and which can achieve a substantial reduction in CO₂ emissions. The Smart Power Grid is an intelligent and fine-meshed electricity network that links energy generators and energy consumers. The Energy Valley is involved in the development of applications for the Smart Power Grid, tests them in practice and deploys them on a large scale in five large housing estates.

Illustration: The Energy Valley Region



What makes Energy Valley so interesting is the way in which a whole region of the country on the one hand, and the business sector on the other hand, both benefit from the boost to the economy as a result of initiatives from Energy Valley. Opting for the largest possible scale and actively searching out favourable combinations of existing activities and new technology has led to forces combining to form a joint identity that stimulates the imagination. This insight shows us that effective energy policy goes hand in hand with economic development and does not automatically stop at the administrative and governmental borders of towns, municipalities and provinces. The large-scale wind farms at sea, in the northern area of this region, the three new power stations at Eemshaven and the development of the regional Energy Transition Parks illustrate that Energy Valley represents a powerful economic structure. Den Helder, Harlingen and Delfzijl are the designated home ports for the construction and maintenance of wind farms at sea. The three power stations will deploy the latest techniques in the area of Carbon Capture and Storage (CCS), achieved among other things by the application of pre combustion. During pre combustion, fuel is first converted to CO₂ (carbon dioxide) and H₂ (hydrogen). H₂ is passed to the gas turbine and CO₂ is separated, captured and stored in empty gas fields. In the regional Energy Transition Parks, businesses and institutions exchange flows of energy and heating. This is done, for example, in the south east of the province of Drenthe where links are set up between the renewed oil extraction in the old oil field at Schoonebeek, the exploitation of soil warmth, greenhouse farming in the region and building work at the Noorderdierenpark Zoo in Emmen.

The Energy Valley Foundation was set up in 2003 by the government, the business sector and knowledge institutions to develop the economy and increase employment opportunities in the energy sector in the north of the Netherlands by applying sustainable innovations that are linked to regional opportunities. It supports initiators by assisting them in setting up projects, finding partners for cooperation and obtaining access to available funding. The Foundation receives financial backing from sources includ-

ing the European Community, the Ministry of Economic Affairs, the four provinces concerned and the four biggest municipalities in the north: Assen, Groningen, Emmen and Leeuwarden. The purpose of Energy Valley is to reinforce the economy and increase employment opportunities by stimulating more energy activities in the north of the Netherlands. Its objective is to steer the region towards becoming a prominent international energy region through an integral commitment to conventional energy activities, energy transition, knowledge and innovation. To achieve this, Energy Valley functions as a contact and intermediary for businesses, government bodies and knowledge institutions.

When conventional energy activities and energy transition are combined with businesses, government bodies and knowledge institutions that act together, the result is a remarkable number of initiatives and insights. For example, the gas fields in the north of the Netherlands that will soon be empty are to be used for the temporary storage of gas that is extracted elsewhere. Besides this, the gas fields are used to store large amounts of CO₂. Yet another initiative is the overlap of energy production from fossil sources and from biomass. **Biogas still needs to be generated to be added to the natural gas network.** The use of so-called "Green Gas" from biomass in pipes where until recently only natural gas flowed, will quickly increase in volume. Not only will many agricultural business that are established in the north of the country profit from this, but also businesses that have organic waste products.

'Amsterdam, leader in sustainability'

At present, Amsterdam has two main climate-related objectives. It is aiming for a 40% reduction in CO₂ emissions for the entire city by 2025 compared to 1990. The municipal organisation itself will be climate neutral by 2015. In the 'Environment Plan Amsterdam 2007-2010, Amsterdam: leader in sustainability' dated April 2007, climate policy is considered together with policy in the areas of air, sound, sustainable consumption and manufacture, soil and public parks [14]. The objective is a clean, compact, healthy and liveable city. As part of the Clinton Global Initiative, Amsterdam has been cooperating since 2007 on a programme called Con-

nected Urban Development. The measures should be reproducible in other cities and countries. In the report 'Amsterdam's new climate' dated August 2008 [15], the achievements up to now of the current climate projects are outlined and new projects are listed that the city has planned or set up in cooperation with business and social organisations since 2007. These include enhancing the efficiency of city buildings, street lighting and council vehicles and using sustainable energy.

In cooperation with key parties in the building sector, Amsterdam will make 40% of its newly built houses climate neutral by 2010 and 100% by 2015. To achieve this, standard building procedures will be amended. When the development of an area commences, an energy vision will be drawn up. This will include the best measures for that particular location concerning urban heating and cooling, underground storage of heat and cold, sustainable energy generation, favourable positioning of buildings in relation to the sun. The answers to these criteria will play a role in the award of projects to developers. In the case of existing buildings, of which only 8% were built after the implementation of the energy performance standard and 50% are owned by housing corporations, much can be achieved with CO₂ emission reduction. Agreements were made in 2009 to achieve a 31% reduction by 2018 through maintenance and renovation work. Amsterdam is as well striving for reduction in small to medium-sized businesses and in the ICT, transport, harbour and education sectors.



Illustrations: The Oosterdokseiland is one of the metropolitan projects with which Amsterdam presents itself as a leading city in sustainability (Bouwfonds MAB Ontwikkeling, Erick van Egeraat Architects, CIID Visualisations).

The Rotterdam Climate Initiative

The Rotterdam Climate Initiative is the climate programme of the city of Rotterdam. It was launched in 2006 and its aim is to achieve a 50% reduction in CO₂ emissions by 2025 compared to 1990, preparing for climate change and reinforcing the Rotterdam economy [16]. The Rotterdam Climate Initiative is founded on five pillars. The pillar Sustainable City focuses on the use of sustainable energy in the built environment. The aim is to make this built environment energy neutral by 2025. The aim of the pillar Energy Port is a harbour and industrial area that is clean and sustainable and

which acts as a junction point for the collection, transport and storage of CO₂. According to the pillar Sustainable Mobility, all traffic and transport must be made as clean and sustainable as possible. The pillar Energizing City focuses on the behaviour and changes in attitude of the people who live, work or visit Rotterdam. The pillar Innovation Lab is concerned with innovation and the development of know-how. In the international arena, Rotterdam must present itself as *the* city in the areas mitigation and adaptation.

One of the achievements of the Innovation Lab

is a new methodology that enables designers and clients to develop a CO₂ neutral city. The Rotterdam Energy Approach and Planning (REAP) project propagates the optimum use of residual heat and waste products [17]. Its methodology links houses, shops, offices, sports facilities, schools and other amenities located in one neighbourhood to each other in order to utilize residual heat and cooling. One example is the utilization of residual heat from a supermarket or office block to heat adjacent apartments. The project also investigates the possibilities of producing biogas from

residual water or waste streams of homes and gardens. According to the REAP methodology, achieving an energy neutral built environment is a simple and cost effective way to tackle the climate issue, cheaper even than CO₂ storage, for example. The methodology provides a step-by-step procedure to make all housing estates in the Netherlands energy neutral.

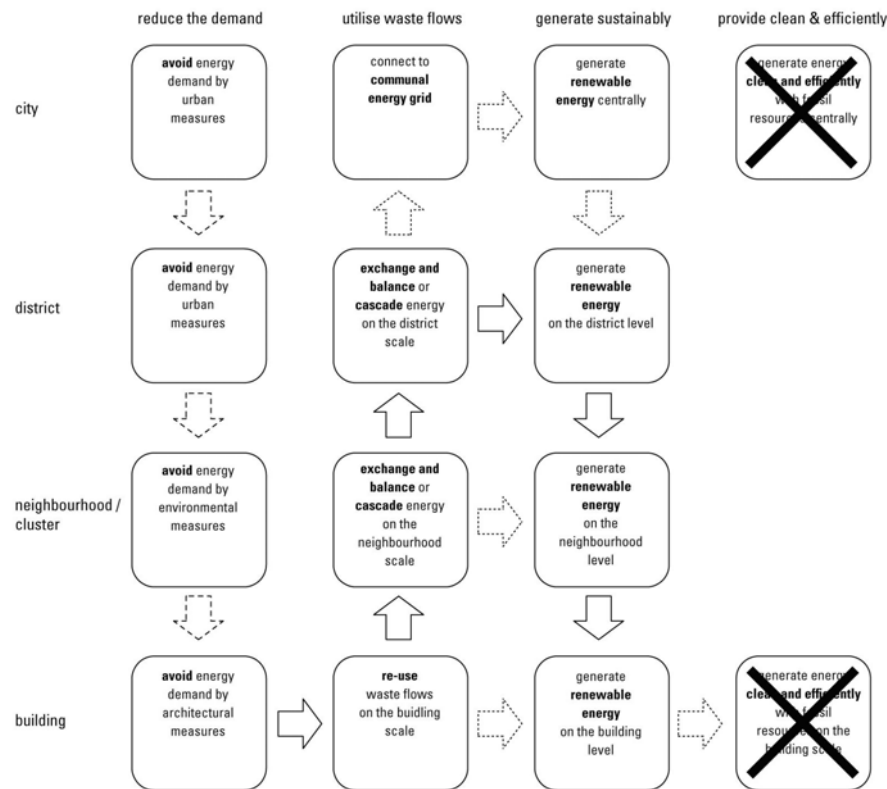


Illustration: Diagram of the REAP methodology (DSA Doepel Strijkers Architects and JA Joubert Architecture)

Box 3: Serious business or window dressing ?

For a city that wants to brand itself as a vital and exciting city, it is sometimes hard to be unequivocally consistent with its own policies and ambitions. Once a year, racing cars such as Formula One cars, parade and race on a 4.600 m long racing track in the streets of down town Rotterdam. On this track the former Formula One driver David Coulthard and the twofold world champion Fernando Alonso raced their Formula One cars with at speeds of up to 250 km/h (150 mph) through the streets of Rotterdam. This popular burning rubber event attracts half a million visitors, among which was prime minister Jan Peter Balkenende, who in August 2009 opened the fifth Bavaria City Racing event with the mayor of Rotterdam, Ahmed Aboutaleb, driving a Ferrari California. In its very essence, this racing event is in sharp contrast to the climate programme of the city of Rotterdam. The event is not quite an example of promoting Sustainable Mobility or the acclaimed focus on the behaviour and changes in attitude of the people who live, work or visit the Energizing City of Rotterdam. Earlier that August, researchers of the Wageningen University and Research Centre started to measure and map the city climate of Rotterdam on a carrier tricycle loaded with measuring instruments. The aim of their research is to get a comprehensive picture of the so called 'heat islands' in the city. This research is commissioned by the Climate Adaptation Programme of the city of Rotterdam. This programme also stimulates the installation of green roofs on a large scale in Rotterdam. Roof gardens have a renowned positive effect on CO₂ emissions as they insulate the building and thus save energy. In addition, the plants extract CO₂ from the air and particulate matter adheres to their surface, resulting in cleaner air. Organising a racing event and promoting green roofs at the same time raises an awkward question. Becoming a climate proof city, is it serious business or is it window dressing ?



Illustrations: City Racing and research for 'heat islands' in August 2009 in Rotterdam.

The Hague, the 'Sustainable Global City by the Sea'

The Municipality of The Hague is on the verge of a large-scale operation to ensure that the city becomes climate neutral by 2050. The Hague has the best prospects of all the cities in the Netherlands to become climate neutral, because it is situated on the coast and it has the most hours of sun and wind. Below the city there are endless opportunities for the extraction of geothermal energy. In the recent paper 'The Hague: towards sustainability' sustainability has become one of the pillars of 'Global city by the sea' [18]. This is an enthusiastic spatial vision that has given the city great self-confidence and a new identity. The Hague is an internationally orientated city and wants to achieve a global climate improvement with these objectives. This is to be achieved with six wide-ranging, integrated themes: the council as a sustainable organisation; energy; urban development; public areas; mobility; and the international city The Hague.

Illustrations: Four collages of different sustainable techniques and prototypes of residential areas in Erasmusveld. Top left: infrastructure and biogas. Top right: autarkic building. Bottom left: bioclimatic high rise buildings. Bottom right: intensive and dense low rise housing. (Atelier 2T Architects, 2008).





The achievements in The Hague can be seen in Duindorp, a redeveloped residential estate situated in the dunes at Scheveningen, between The Hague and the North Sea. Around 800 newly built houses in Duindorp utilize the temperature of the seawater for heating - a world première. One of the recent spearheads of the city is the future residential estate Erasmusveld which will have 600 to 800 houses [19]. The office Atelier 2T Architects was assigned by the Municipality of The Hague to broadly investigate how the housing estate could become the most sustainable residential area in the Netherlands. Under the motto 'ignorance is one of the most significant threats to sustainability', the assignment led to an encyclopaedic and visionary report on opportunities and possibilities for sustainable and self-supporting environments. Atelier 2T Architects believes that strong ambitions in the area of sustainable spatial planning can only be implemented in cooperation with new visions

involving the ecological infrastructure, energy, water and waste. The numerous impressions and collages in the report 'Sustainable Erasmusveld' strikingly demonstrate that sustainability must run parallel to new and convincing urban development and architectural typologies.

Illustrations: Top: Erasmusveld in The Hague, designed by H+N+S landscape architects. Bottom: bioclimatic tower, as sketched by Atelier 2T Architects.



Towards Low Carbon Regions and Cities

The studies and initiatives mentioned above demonstrate that spatial planning and urban planning can contribute significantly to climate-proof cities and a CO₂ neutral built environment. Through urban restructuring, the use of intelligent links in the local generation of sustainable energy, the utilization of residual heat and drastic improvements in public transport, it is possible to effectively reduce greenhouse gas emissions. The beckoning perspective of Low Carbon Regions and Cities is certainly attractive, but a great deal will have to happen to achieve this. Available knowledge, speed of action and a degree of enthusiasm are all areas that require attention; not only from administrators, managers, designers, engineers and builders but also from consumers. This is sometimes forgotten.

The Netherlands needs to make a number of mental leaps. You don't build a city with bricks, but with people [20]. Attention needs to be shifted away from energy efficient houses and towards energy generating housing estates. A lot is happening in the Netherlands, but the approach is

more that of 'all for one' instead of 'one for all'. Cooperation and renewed concepts, innovation without restrictions and, in particular, investment in creative processes are needed for taking the next steps towards Low Carbon regions and Cities. Achieving *Low Carbon Regions and Cities* is not just a question of technology, but it requires taking a fresh look at sustainable regional development and communication with its inhabitants and its businesses - regional development and communication that are actually effective and that will help the Netherlands on its way to becoming a more sustainable society.

Illustration: The Climate Neutral Region, one of the perspectives for the Amsterdam Metropolitan Area (Development Scenario 2040 Amsterdam Metropolitan Area, 2008).



The road to Low Carbon Cities goes through Low Carbon Regions. The case of Energy Valley makes perfectly clear that in The Netherlands the size and scale of a region offer more opportunities than the size and the scale of a city. It justifies the questions whether the policies for 40% reduction in CO₂ emissions in 2025 (Amsterdam), 50% reduction in CO₂ emissions in 2025 (Rotterdam) or becoming climate neutral in 2050 (The Hague) make sense without a regional context. Looking for the answers

and solutions for dramatic CO₂ reductions in cities in the next decade and becoming CO₂ climate or energy neutral cities by, say 2050, you will need more than the city on its own. The network of energy will have to provide individuals, businesses and institutions with the possibility of generating and exchanging energy.

Spatial and strategic visions on a national and regional scale for The Netherlands, as described in the National Spatial Strategy [21], and the 'Randstad 2040 Structural Vision' [22], are clear and straightforward on the topic of adaptation but vague and noncommittal on the topics of mitigation and energy transition. The Randstad 2040 Structural Vision was presented as a stimulus for a Randstad Metropolitan Area that can measure up in all respects to other urban areas in Europe, while at the same time being sustainable and climate resilient. The Randstad 2040 Structural Vision is being worked out in more detail in two parts. The northern wing of the Randstad, with Haarlem, Amsterdam and Almere, is considered as The Amsterdam Metropolitan Area [23]. The southern wing of the Randstad, with Leiden, The Hague, Delft, Rotterdam and Dordrecht, is considered as the Gateway of the Delta [24]. Both wings of the Randstad could take Energy Valley as their example in how to cope with mitigation and energy transition. Similar to the Internet Revolution, the Energy Revolution might change society and the governance of regions and cities in the Randstad in particular. Smart innovations and combining sustainable energy solutions in housing with industry, agriculture, water and waste management, offshore activities and public transport systems requires changes in attitude and behaviour as well as acting and cooperation on a regional scale. •