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Low carbon Harbourplan

LO·PINOD
LOGISTICS OPTIMISATION FOR PORTS

The Interreg IVB North Sea Region Programme
Investing in the future by working together for a sustainable and competitive region

European Regional Development Fund
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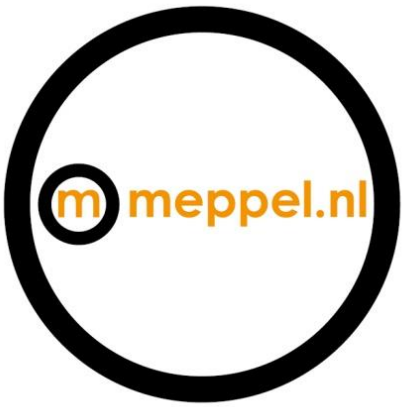
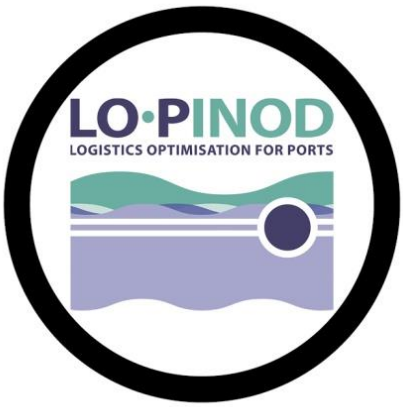
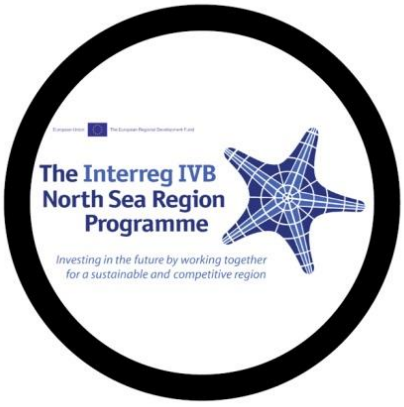






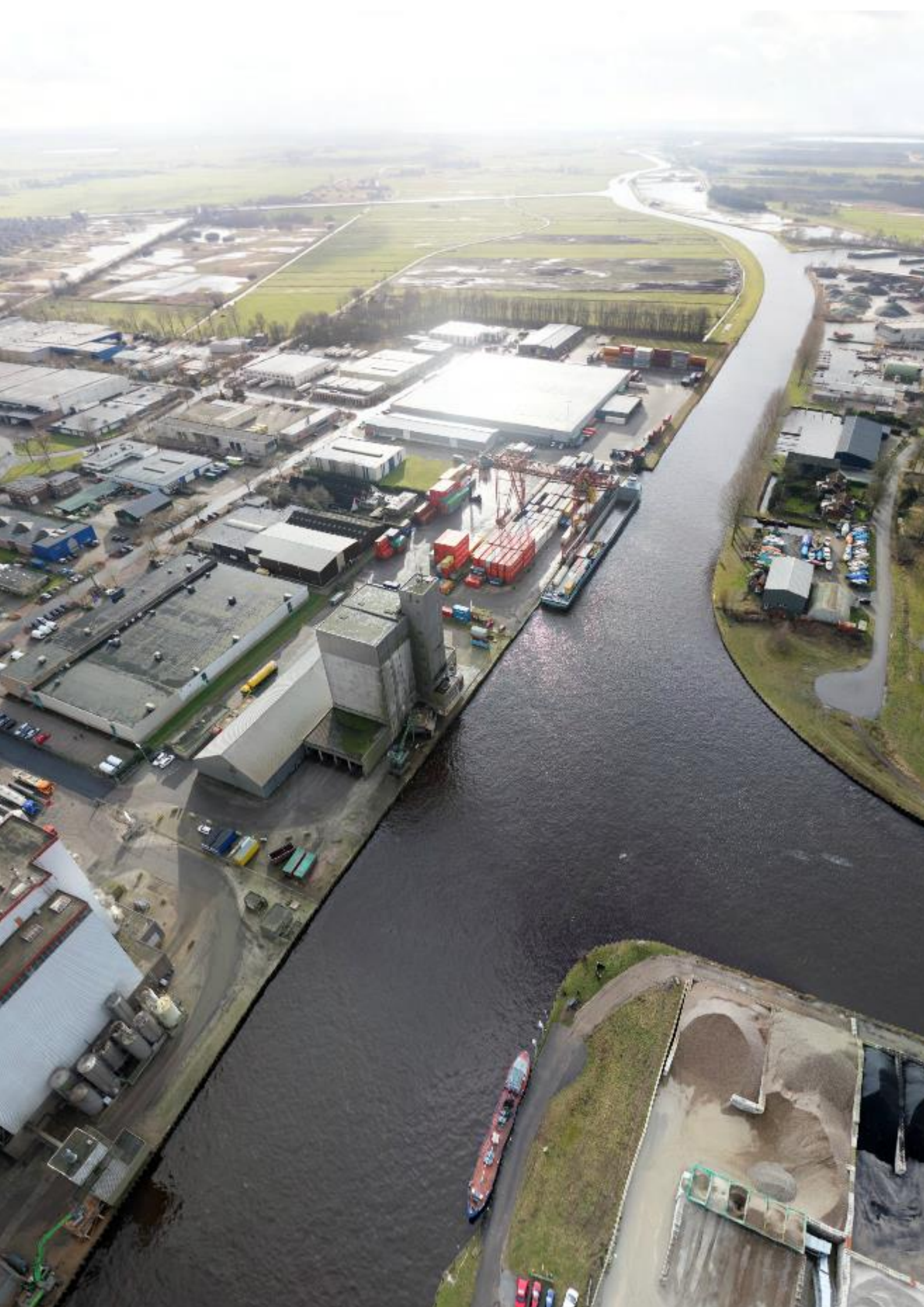
Low Carbon Harbourplan

Sustainable applications in local ports

Municipality of Meppel, 1 september 2014

Low carbon harbour plan Meppel

Sustainable applications in local ports



Summary

Objective

LO-PINOD (Logistics Optimisation for Ports Intermodality: Network, Opportunities, Development) challenges traditional practices of freight distribution and offers a more sustainable alternative. Through improvements to short-sea routes, multi-modal connectivity between regional ports and their hinterland, and diversified port land use and operational models, LO-PINOD will help deliver social and economic benefits to communities and businesses across the North Sea Region (NSR).

LO-PINOD concerns regional ports and works to improve multimodal transport. The aim of the project is to make regional ports more accessible, sustainable and competitive. The 'Low carbon harbour plan Meppel' is an elaboration of various possible sustainable applications which could be used in both Meppel and other industrial ports. This plan introduces the reader to a number of sustainability principles and provides the reader with insight into possible sustainable applications on the basis of different sustainability themes. The possible applications lead to a number of actions and research questions which can be undertaken in subsequent procedures.

This report is part of LO-PINOD, a North Sea Region Interreg programme project, which is funded by the European Regional Development Fund. For more information visit www.lopinod.eu

Transition and ambition

The municipality of Meppel has expressed the ambition to become carbon neutral in the coming years. In this way, it is shouldering its responsibility and minimising its contribution towards an increased greenhouse effect. In order to achieve this, the municipality drew up the report 'From climate sensitive to climate conscious'. The report describes the steps which could ultimately lead to a carbon-neutral Meppel and environs in 2040. This will take a lot of work. Several results from the report can be applied directly with the realisation of a sustainable industrial harbour.

The province of Drenthe is striving to develop a sustainable freight transport network in which freight transport by water plays a prominent role. The reason behind this is the expected growth in freight transport by water and the importance of good multimodal access. Both the national government and the province of Drenthe therefore want to encourage transport by water and strengthen the network of inland ports. In April 2012, the 'Port Vision Zwolle-Kampen-Meppel' was published. The harbours in Zwolle, Kampen and Meppel fulfil an important function in the economic growth of the region. The harbours enjoy favourable locations and have good access by road to the hinterland.

Principles of sustainability

When it comes to sustainability, various principles can be applied. The principles which play a role with the development of sustainable local ports are the definition of 'sustainable development', the 3 Ps People Planet Profit, the Trias Energetica (for energy efficient design) and the waste management hierarchy. When choices have to be made, it is important to always set these four sustainability principles alongside the choice in order to reach a decision worthy of the future.

Sustainable applications

Sustainability is not only about energy. Water, social and environmental quality, mobility, waste material and corporate social responsibility are also themes which must be considered with the development of sustainable industrial ports. However, there do appear to be a lot more possible applications under the theme energy and that this can lead to great strides in terms of sustainability. Via joint project commissioning, companies operating from the harbour can purchase **solar boilers** and **solar panels**. This produces a direct advantage for the companies, in terms of both the purchase and energy saving. They could also consider erecting a small **wind turbine** (mast height maximum 15 metres) together on the industrial park. Policy allows no scope to permit large wind turbines until 2020. The use of a **heat pump** by firms is mainly of interest to new companies setting up business on the industrial park, with a combination involving **low temperature heating** being an obvious one. For generating heat, the use of small-scale biomass power plants is interesting. The municipality will have to carry our further research for large-scale application.

Hydrogen and **ammonia** are (future) sustainable fuels for ships. The industrial harbours of Meppel, however, are not immediately suited to the production of these fuels. Another fuel that is very interesting for both ships and freight traffic is **LNG**. The role the industrial harbour could play in the storage and marketing of LNG will have to be looked into.

Other energy sources such as **tidal energy** and **wave energy** are not interesting for the harbours in Meppel. Coastal ports are perhaps interested in these energy sources. Generating **energy from surface water** could prove interesting in the future.
With the arrival of decentralised energy production, every user can be producer and consumer at the same time. Port areas lend themselves very well to the decentralised production of energy whereby the established companies are also purchasers of this energy. With the use of a **Smart Grid,** there is optimum coordination between production and purchase. A number of established companies in the harbour area can begin with a **smart cell** and gradually expand this into a smart grid. In this way, dependence on the energy grid above decreases all the time and self-generated sustainable energy within the harbour area can be used and traded as efficiently as possible.

With further collaboration with the harbours in Zwolle and Kampen, it is worth considering setting up a **virtual power plant**. In a virtual power plant, decentralised energy management and communication with the generating installations play a special role. With the virtual power plant, the decentralised generating installations can not only be linked with each other in an intelligent way, but also be used economically and in an environmentally friendly manner. Other local generating installations and systems in the vicinity of Meppel can also be looked at. Close cooperation with MeppelEnergie could lead to success here.

When it comes to the theme water, the most sustainable benefit can be obtained with the **recycling of rainwater and ballast water**. Possibilities for connecting ships' **wastewater systems** to the municipal sewers will have to be looked at in more detail.
A sustainable social and environmental quality can be achieved through **raising awareness**. By drawing up a sustainable communication plan, sustainable behaviour can be encouraged among both employees and visitors to the harbours. In addition, a **well cared-for space** adds to the quality. This has a direct positive effect on the perception value and thus on the 'value' of the company.

LNG is a possible sustainable application when it comes to **sustainable mobility**. The great advantage of LNG is that it emits much less harmful substances and the engines which run on LNG produce approximately 50% less noise than diesel engines. As an alternative to freight traffic, the possibility of transporting containers from the harbour to the national road network via an **underground rail system** can be investigated. For companies, a **mobility and action plan** can be drawn up in connection with sustainable mobility, with a focus on reducing demand, making passenger kilometres more sustainable and choosing more efficient and cleaner possibilities (technology and behaviour) for the remaining kilometres. Finally, the industrial harbour can play a role in **sustainable urban distribution**.

With the implementation of sustainable applications, ICC-PMM can play an important role as park management organisation. Quick gains can also be made here in the field of **waste management**. It is possible to reduce costs for businesses and, at the same time, reduce the impact on the environment by introducing collective waste collection. **Corporate social responsibility (CSR)** has become increasingly important in recent years in how companies present themselves to their clients. ICC-PMM can also play a role in this. For example, in the joint **production and sale of energy**, **sustainable changes in behaviour**, **sustainable supervision in establishing a new business and the introduction of a sustainable entrepreneur quality label**.

LO-PINOD workshop

During a gathering of all participants in the Interreg IVB project LO-PINOD, a workshop was held, during which an inventory of sustainable applications was made during a half-hour 'pressure cooker' session with transnational port partners. For 10 sustainability themes, a TOP 3 sustainable applications was determined for a number of elements, based on partners' experience and knowledge. Elements can be taken from this inventory to further investigate the feasibility. A large proportion of the applications put forward have been incorporated into this report.

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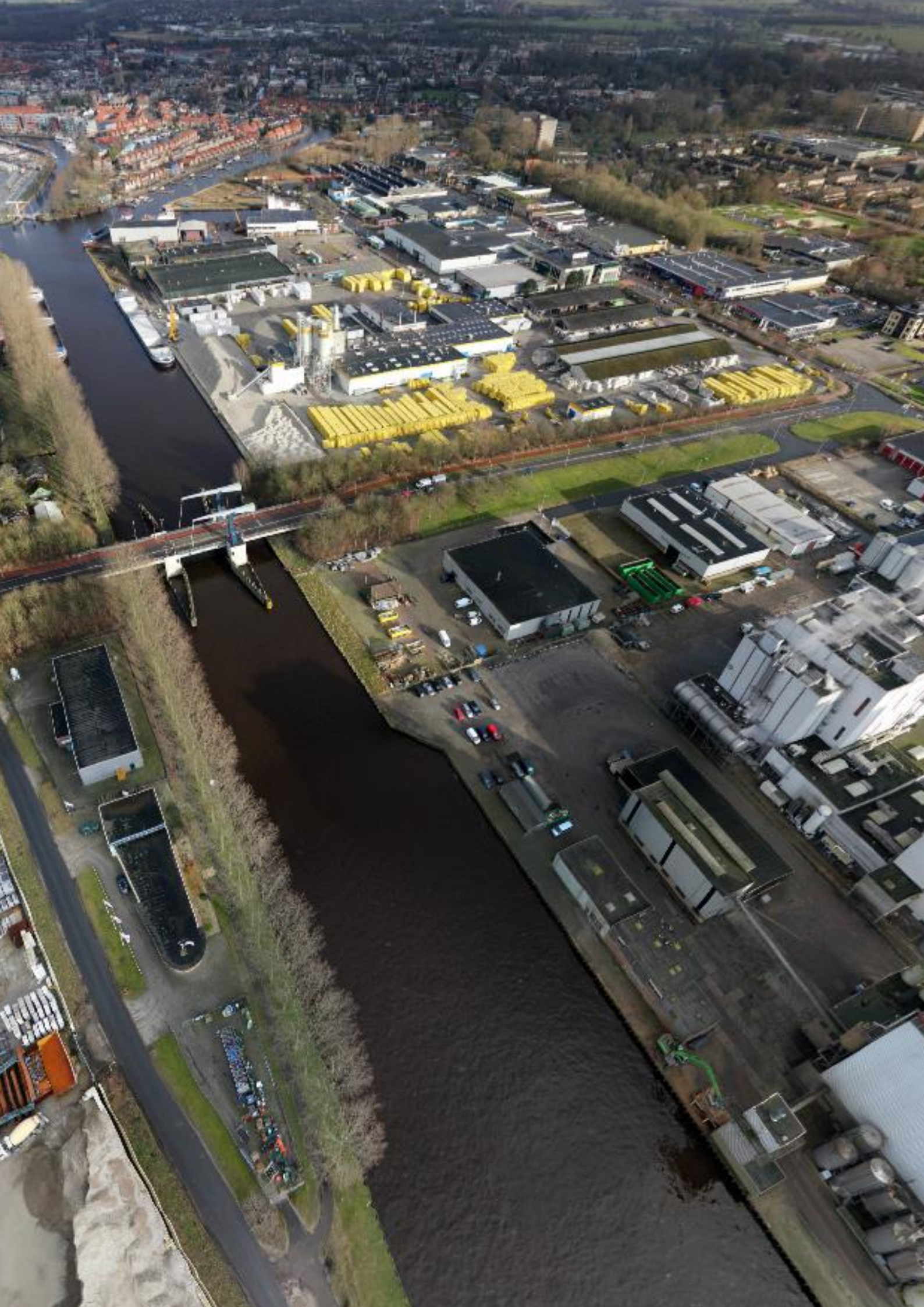


Chapter 1 Introduction

1.1 Background

The national government and the province of Drenthe want to encourage transport by water and strengthen the network of inland ports. This is because freight transport by water is expected to grow in the coming years, partly as a result of the completion of Maasvlakte II. The municipality of Meppel is an important inland port and has the potential for further growth.

LO-PINOD (Logistics Optimisation for Ports Intermodality: Network, Opportunities, Development) challenges traditional practices of freight distribution and offers a more sustainable alternative. Through improvements to short-sea routes, multi-modal connectivity between regional ports and their hinterland, and diversified port land use and operational models, LO-PINOD will help deliver social and economic benefits to communities and businesses across the North Sea Region (NSR).

LO-PINOD concerns regional ports and works to improve multimodal transport. The aim of the project is to make regional ports more accessible, sustainable and competitive. In the Netherlands, Harlingen Seaport and the Municipality of Meppel are taking part in the project.

The municipality of Meppel's contribution to the LO-PINOD project is to provide a 'Low carbon harbour plan'. This plan provides insight into the possible sustainable applications for making local industrial ports more sustainable.

This report is part of LO-PINOD, a North Sea Region Interreg programme project, which is funded by the European Regional Development Fund. For more information visit www.lopinod.eu.

1.2 Objective of the report

The 'Low carbon harbour plan Meppel' is an elaboration of several possible sustainable applications which could be applied in both Meppel and other industrial ports. The objective of this plan is:

- To become acquainted with sustainability principles;
- To gain insight into possible sustainable applications per sustainability theme and sustainability element;
- To gain insight into actions and research questions.

The plan provides an overview of a variety of sustainable possibilities which could be applied and, in this way, forms a basis for making choices and working these out in more detail. In addition, the report will form the basis for talks with the province, the municipalities of Zwolle and Kampen and the businesses operating from the port area.

1.3 Reader's guide

The Low carbon harbour plan Meppel is arranged as follows:

- Chapter 2: A description of the main outlines of a number of relevant policy documents.
- Chapter 3: A description of four sustainability principles which can play a key role in every assessment.
- Chapter 4: An elaboration of sustainable applications per sustainability theme: water, energy, social and environmental quality, mobility, waste material and corporate social responsibility (CSR).
- Chapter 5: Results of the workshop held with participants in the Interreg IVB project LO-PINOD in Edinburgh.

Chapter 2 Transition and ambition

2.1 Freight transport waterways and inland harbours Drenthe

Ambitions and target inland harbours

The province of Drenthe is striving to develop a sustainable freight transport network in which freight transport by water occupies a prominent place. The reason behind this is the expected growth in freight transport by water and the importance of good multimodal access. Both the national government and the province of Drenthe therefore want to encourage transport by water and strengthen the network of inland harbours.
The regional authorities in the province of Drenthe have an ambition to position the Drenthe Zuidas as an industrial and logistics hub between the Randstad and Northeast Europe and as a logistics hotspot in Drenthe by 2020. This aim is very much in keeping with the national and provincial ambition.

In the regional ambition, Meppel is the Blue Port in Drenthe, with the encouragement of more freight transport by water and the offer of space for existing and new water-bound activity. The general 2030 target for the harbours of Meppel is a stronger position as one of the most important multifunctional ports in the Netherlands with large-scale container operations. The port of Meppel will develop into a Blue Port and a multifunctional port with large-scale container operations (2.9 million tonnes of cargo transported by water in 2030).

Action programme municipality of Meppel

In order to achieve the ambitions in Meppel, an action programme has been drawn up containing measures for the inland harbours. Some measures have already been adopted within the municipality's existing policy. Other measures call for an extension of existing policy or new policy.

Measure	Actors involved	Period
Allocate land in Selthehaven	Municipality of Meppel	2010-2015
Increase noise zone of harbours	Municipality of Meppel, Province of Drenthe, businesses	2014
Restructure wet plots "Oevers A" and "B"	Municipality of Meppel, Province of Drenthe, businesses	2015
Improve access by road Meppel harbours	Municipality of Meppel	2015
Draw up Port Vision Meppel	Municipality of Meppel, Province of Drenthe, businesses, Zuidas region, KSV	2011
Expand MSC container terminal and extend quay to 300 m	MCS, Municipality of Meppel, Province of Drenthe	2012
Enhance function of Meppel as Blue Port	Municipality of Meppel, businesses, Zuidas region, Province of Drenthe, KSV	2011-2015
Need for expansion and possibilities harbour of Meppel	Municipality of Meppel, Province of Drenthe, Province of Overijssel, municipal authorities, Zuidas region	2016-2020
Possibilities for restructuring transformation area "Oevers C" -Oude Vaart – Buitenhaven	Municipality of Meppel, businesses, local residents	2016-2020

In order to make the harbours of Meppel easily accessible, the Directorate-General for Public Works and Water Management is carrying out a number of projects, including the replacement of the tide lock in the Meppelerdiep with a navigation lock (class Va shipping) and the deepening of the waterway between IJsselmeer and Meppel. These projects will be completed in 2015.

Source: Policy plan for freight transport on waterways and inland harbours Drenthe, Province of Drenthe, 2010 (http://www.provincie.drenthe.nl/onderwerpen/verkeer-voertuigen/scheepvaart/beleidsplan/).

2.2 Port vision Zwolle-Kampen-Meppel

In April 2012, the 'Port Vision Zwolle-Kampen-Meppel' was published. The harbours in Zwolle, Kampen and Meppel fulfil an important function in the economic growth of the region. The harbours enjoy favourable locations and have good access by road to the hinterland. The harbours of Zwolle, Kampen and Meppel complement each other. This creates opportunities for synergy, such as joint profiling of the region towards the seaports of Rotterdam and Amsterdam. As a result, it is possible to take more advantage of the strategic location of the region between the Randstad and the North Netherlands. In addition, synergy makes it possible to strengthen the region's competitive position. The report provides a detailed overview of recommendations relating to cooperation between the three harbours.

In order to achieve an integrated action programme for the harbours of Zwolle, Kampen and Meppel, a SWOT analysis (Strengths & Weaknesses, Opportunities & Threats) was carried out, among other things.

Strengths	Weaknesses
▪ Strategic location in relation to Randstad and national/international hinterland ▪ Good access by road and water ▪ Enough space available for establishment of water-bound businesses ▪ Good labour climate ▪ Adequate supply of varied cargo in immediate vicinity ▪ Pre-existing partnerships (Kampen Zwolle Netwerkstad, Drentse Zuidas)	▪ Inadequate scale and position in national network of seaports and inland ports ▪ No direct rail access ▪ Non-water-bound businesses are active in harbour area ▪ Limited availability of more highly trained staff

Opportunities	Threats
▪ More cooperation in distribution and consolidation of cargo flows for whole of Northern Netherlands ▪ Further expansion and improvement of access by road and water ▪ Growth in container transport by inland shipping due to Maasvlakte II ▪ Innovation (ro/ro transport, plant shuttle)	▪ Insufficient profiling as region towards seaports ▪ Environmental/noise legislation limits room for growth ▪ Possible postponement of measures to improve accessibility of IJsselmeer – Meppel waterway

The elements of the action programme which are geared specifically to the harbours in Meppel also form part of the action programme as described in the section 2.1.
Source: Port Vision Zwolle-Kampen-Meppel, Ecorys, 6 April 2012

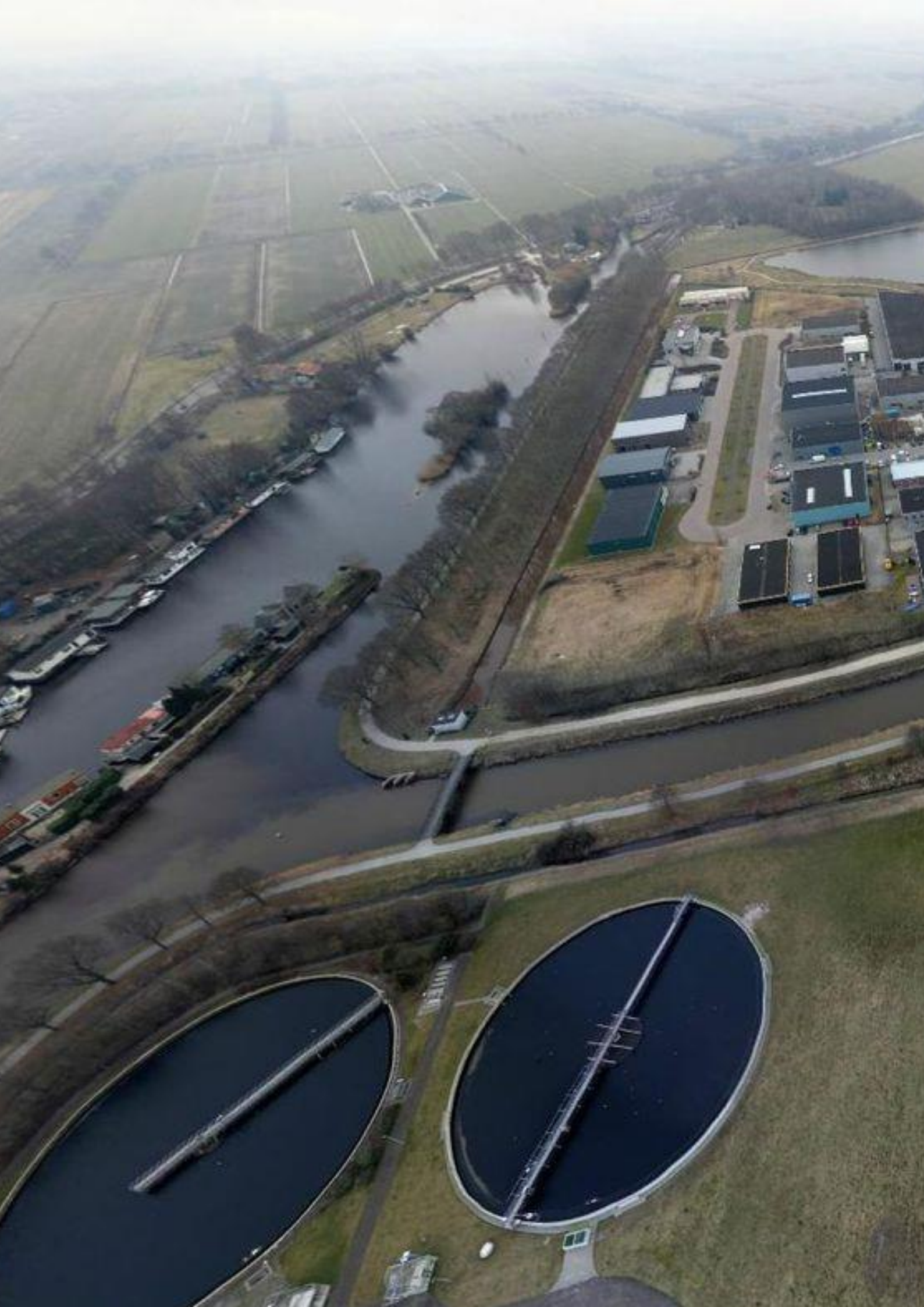
2.3 From climate sensitive to climate conscious

The municipality of Meppel has expressed the ambition to become carbon neutral in the coming years. In this way, it is shouldering its responsibility and minimising its contribution towards an increased greenhouse effect. In order to achieve this, the municipality drew up the report 'From climate sensitive to climate conscious'.
The report describes the steps which could ultimately lead to a carbon-neutral Meppel and environs in 2040. This will take a lot of work.

The starting situation is Meppel's consumption in, among other things, the municipal buildings, the existing housing and newbuild, transport, public lighting and the business community. The main users are the businesses (56% of energy consumption) and housing (42%). In total, this produces 176,000 tonnes of CO_2. That is 0.1% of all carbon emissions in the Netherlands.

Several results from the report can be applied directly with the realisation of a sustainable industrial harbour. It is recommended that you look at the following chapters of the report.

- Chapter 6, Businesses: This looks at energy savings, policy and cooperation with the park management organisation ICC-PMM.
- Chapter 8, Municipal transport: The sections 8.2 Encouraging Sustainable Mobility and 8.3 Sustainable Regional and Urban Distribution in particular are related to the Low carbon harbour plan.
- Chapters 9-14, Energy: These chapters are related directly to section 4.2 'Energy' of the Low carbon harbour plan.



Chapter 3 Principles of sustainability

3.1 Sustainable development

When it comes to sustainability, the 1987 definition that was formulated by the Brundtland Commission (officially: World Commission on Environment and Development) for sustainable development is used.

"Sustainable development is development which meets the needs of current generations without compromising the ability of future generations to meet their own needs."

SenterNovem formulated the following definition for sustainable building.

"Building in such a way that it meets current needs without diminishing the possibilities for other nations and future generations."

3.2 People, Planet, Profit

'People, Planet, Profit' are the three pillars of sustainable development. 'Profit' is often replaced nowadays with the word 'prosperity'. Whilst 'profit' is associated with monetary gain, 'prosperity' stands for 'growth in a good, healthy way'. This principle is applied by many firms in connection with Corporate Social Responsibility (CSR). By viewing every proposed activity of both the government and established businesses from the perspective of the 3 Ps, the mindset changes, resulting in a better balance between people, planet and profit in the proposed activity. Any business concerned with CSR can make use of the 3 Ps.

People
What does the business do for people? Do we meet people's needs? How do we take care of their interests? Think of both staff and consumers here, and look at it from an even broader perspective: Society. With 'People', we often encounter the following terms:

- Human rights
- Employment rights and working conditions
- Safety
- Social commitment
- Discrimination

Planet
With Planet we look at how the organisation treats the environment. What impact do the company's products/services and processes have on the planet? And, most importantly, how can we make sure that this impact can be minimised? Common terms with 'Planet' are:

- Cradle to Cradle
- Carbon compensation
- Recycling
- Waste and reuse
- Sustainable products and services

Profit
The 3rd P, Profit, is just as important as the other Ps. Profit is often seen as something negative, but profit is necessary if a company is to grow sustainably. Profit need not only be expressed in monetary terms. It can also be about improving knowledge or quality for instance. Or the reputation and market position have changed. If the profit is for the more long term, you can call it sustainable. Terms you often hear in relation to 'Profit' are:

- Profit
- Innovation
- Quality
- Reputation
- Transparency
- Partnerships

3.3 Trias Energetica

To achieve the most sustainable possible energy supply, Delft University of Technology (TU Delft) developed a strategy that is also known as the 'Trias Energetica'. The concept, known at the time as 'Trias Energica', was introduced in 1996 by Novem (E. Lysen). As a strategy, this was elaborated by TU Delft (C. Duijvestein), with the emphasis switching to the sequence of the consecutive steps.

The steps are taken in succession in such a way that as many measures as possible from step 1 are taken first; when this can no longer be done responsibly, then as many measures as possible from step 2 and, finally, any residual demand with step 3.

- Step 1. Limit energy consumption by restricting demand (build well-insulated, airtight buildings)
- Step 2. Use renewable energy sources (ground heat, solar energy, wind, etc.)
- Step 3. Use finite energy sources efficiently (high yield).

The principle behind this trias is that step 1 is the most sustainable and step 3 the least sustainable, relatively speaking.

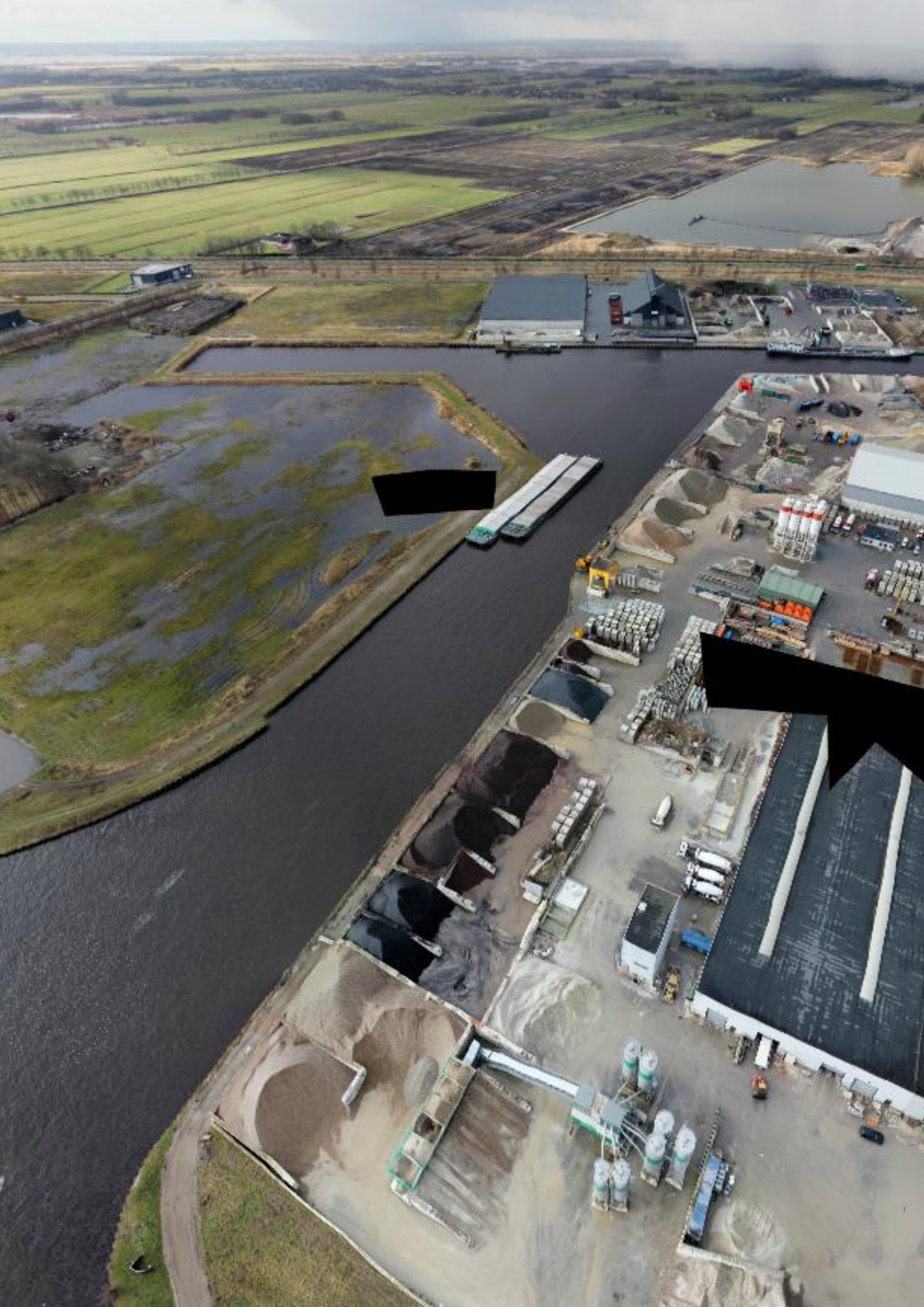
3.4 Waste management hierarchy

For processing waste, the European Union and the various Member States apply a certain hierarchy. Although basically the same – the best thing is to prevent waste, the least desirable is to dump waste – there are differences in the intervening steps or rungs.

The five steps as applied by the European Union are:

1. Prevention
2. Reuse
3. Recycling
4. Other forms of recovery
5. Disposal.

By 2020, 50% of household waste and 70% of building waste must be recycled. Waste combustion could also be used to generate energy. Waste is therefore being approached increasingly as a resource rather than a burden.



Chapter 4 Sustainable applications

The transition from a local industrial harbour to a sustainable local industrial harbour will be achieved in phases. Not all sustainable applications need to be implemented; a choice can be made from various solutions. Some solutions can be realized quickly. Others will require further research, for example into their feasibility.

Sustainability is not just about energy. There are several themes which contribute towards sustainability. In turn, there are several elements per theme which offer obvious sustainable solutions. The following themes are described in turn:

- Water
- Energy
- Social and environmental quality
- Mobility
- Waste material

4.1 Water

Here, water refers to wastewater, rainwater and surface water.

The water-related ambition for the harbours

Wastewater and rainwater are reused as much as possible. The quality of the surface water complies with all the directives. Use of potable water is reduced as much as possible.

4.1.1 Practical sustainable applications for water

Wastewater

For freight transport by inland shipping, there are currently no regulations in place to put an end to the discharge of wastewater and to cover the facilities on board. The possibility of linking the wastewater system of ships moored in the harbour to the municipal sewers will have to be investigated. This will also have to involve looking at possibilities for collecting bilge water. Bilge water is water contaminated with oil that collects in the bilge of a ship. Inland shippers have to dispose of the bilge water with an approved collector.

Another form of wastewater is ballast water that is used by ships. This water may contain oil or chemicals and come from a contaminated ballast tank that is used to improve the draught and/or stability of an empty or partially loaded vessel. This contaminated water can be treated in a purification plant. A sustainable application could be the provision of facilities for treating ballast water in the harbour. The ballast water could then be cleaned in a sustainable way in the harbour, after which it could be offered again as ballast water.

Rainwater

Generally speaking, industrial parks have a lot of metalled surfaces and areas of roof. Rainwater falling on them is usually drained away directly into the surface water. Wherever there is a possibility of this rainwater being contaminated, mainly with

metalled roads, it is possible that this water cannot be drained away directly into the surface water.

The rainwater that falls on roofs can also be reused. There are rainwater systems whereby the toilets, washing machine and outside tap can be supplied with rainwater on a structural basis. The water is filtered, stored in a tank in the ground or in a bag under the floor and travels via a pump to the point of use. In theory, this can save up to 50% a year of the total water consumption. To design such a system, a water balance sheet has to be drawn up. This is a calculation that shows how much rainwater the company needs every day. Depending on the environmental conditions – roof (terrace), leaf debris, type of roof covering – the water will need to be filtered to a greater or lesser degree. When full, a buffer tank must be able to "last" about a month. A pump usually carries the water to the toilets, etc. via pipes.

Rainwater that is not reused can be collected by means of drainage systems and discharged slowly into the subsoil (infiltration) or into the surface water.

4.1.2 Research questions – water

In order to make the industrial harbours in the municipality of Meppel more sustainable, on the basis of the applications described above, the following research questions are relevant.

1. Study: In collaboration with ICC-PMM, look into the feasibility of linking the wastewater system of ships with the municipal sewer.
2. Study: In collaboration with ICC-PMM, look into the feasibility of a joint rainwater system for the reuse of rainwater.
3. Study: In collaboration with ICC-PMM, look into the feasibility of a joint ballast water system.

4.2 Energy

Sustainable energy is an interesting element in local industrial ports, in terms of both use and generation. It also improves air quality in port areas.

The energy-related ambition for the harbours

In 2040, 80% of the energy needed in the harbours and the region will be generated in a sustainable manner. In addition, the ships can use sustainable energy on shore and there is an LNG filling station in the region. Energy demand and supply are linked in an efficient and effective manner.

4.2.1 Sustainable energy applications in ports

Sustainable energy generation

Solar boiler (solar water heating) for port buildings
By using a solar boiler to heat tap water, it is possible to save 50% of energy costs for hot water. A solar water heating system means that it takes less energy to produce hot tap water. There is a solar thermal collector on the roof that absorbs sunlight. The fluid

that flows through the collector is heated by the sunlight. The fluid then heats the mains water in a storage tank in the attic, after which this water is heated to the right temperature (usually by means of a central heating boiler).

A solar boiler can also be connected to the central heating system.

Solar boilers are excellent for use by businesses. Depending on the demand for heat, a small or large installation is fitted.

- Action by industrial harbours Meppel: The businesses present can receive joint discounts, possibly via joint project commissioning, when purchasing solar boilers. The park management organisation ICC-PMM can play an important role here.

Solar panels (PV: Solar Photovoltaics)
PV (Photovoltaic) cells or solar panels can generate electricity from (sun)light: solar energy. A solar panel works from both direct light and diffuse light. In contrast to solar thermal collectors (which convert sunlight into heat), shadow has a great effect on the yield. If a cell receives less light, electricity production decreases considerably. If solar panels are well ventilated (kept cool), this promotes a good energy yield.

The solar cells in a monocrystalline panel consist of a single crystal. The surface of this is uniform black, with a grid of electrodes. About 15% of the light that falls on a solar panel is converted into power. The most efficient solar panels score a maximum of 20%. This is also referred to as the solar panel efficiency. Monocrystalline gets the highest score here. These panels have the highest yield, but are more expensive than the other types. They also have a higher yield per surface area, so you can install fewer m2.

Within ports, large areas of roof are often available for the installation of solar panels. This means that it is possible to generate a large proportion or perhaps even all of the necessary energy oneself.

- Action by industrial harbours Meppel: The businesses present can be offered joint discounts, possibly via joint project commissioning, when purchasing solar panels. The park management organisation ICC-PMM can play an important role here.

Heat pump (Ground source heat pump)
A ground source heat pump is a system that provides a company with heating and hot water, just like a central heating system or solar boiler. A heat pump can also be used for cooling. Ground source heat pump systems are sustainable: the yield for heating can be as high as 140%. Moreover, the source of heat is unlimited and free: groundwater and surface water, fresh air and ventilation air. Using a heat exchanger, heat pumps extract heat from the inexhaustible sources air, ground or groundwater; and they have a very high yield. That is why ground source heat pump systems use little or no fossil fuel and cause little harm to the environment.

The system is particularly interesting with newbuild because there is a direct relationship with low temperature heating (under-floor heating). The building will also have to be well insulated so that there is virtually no heat loss. With existing buildings, there is a good chance that additional measures will be needed before a heat pump can be used.

- Action: Municipality will draw the attention of companies wishing to set up business to the sustainable possibilities, including the use of a ground source heat pump in combination with low temperature heating.

Wind energy (Wind turbines)
The use of wind turbines to generate energy can be very interesting. Wind turbines with a capacity of 3MW tend to have a 45-metre rotor blade and a shaft height of 105 metres. This means that the total height is approximately 150 metres. It would take 25 wind turbines to make the whole municipality carbon neutral for its electricity supplies. The province of Drenthe aims to have between 66 and 93 3MW wind turbines in operation in 2020. The wind turbines will be concentrated in wind farms in the municipalities of Emmen and Coevorden. No large wind turbines will be erected in the municipality of Meppel before 2020.

- Action: Municipality will continue to monitor developments closely.

The use of small wind turbines with a mast height of maximum 15 metres will remain possible, although the yield is considerably lower. It can be good for the green image of an industrial park to erect a number of wind turbines.

- Action: Municipality will encourage the erection of small wind turbines by easing the regulations.

Biomass fermentation and biomass combustion
Biogas, which is produced with the aid of a fermenter, is often used to power a biogas engine. The energy from the biogas is converted in this way into electricity and heat. The electric yield of such cogeneration is 40-45%. The remaining 55-60% is heat.
In the early days, every fermenter was fitted with a cogenerator, particularly for the production of electricity, because the initial subsidies were geared towards the production of green power. With the introduction of a heat bonus in the SDE+, from 2012, attempts are being made to use this energy in a sustainable way.

With fermentation, waste flows can be utilised to generate gas. Residual flows from agriculture can also be used when, by means of a partnership with the farming community, energy crops can be grown, superfluous manure can be used and green waste from the municipality can be fermented.

The feasibility of fermentation depends on the amount of biogas (or green gas) needed and the investment required to make the system operational. In addition, the willingness to invest forms a basis for further development. In order to implement large-scale fermentation within the municipality, a number of steps will have to be taken.

Small-scale **biomass combustion** is an ideal sustainable opportunity for businesses. Due to the relatively fast payback period of this type of system (less than five years), this option is not only sustainable but also attractive economically. Small-scale biomass combustion (up to 500kW) is relatively simple to achieve. Even with larger systems of up to a few megawatts, the investment can be recouped relatively quickly. Due to current technology, this involves boilers which are fuelled by pellets or wood chips. Boilers are available between 5kW and 50MW in any required capacity and in any required model. They can be applied in any situation where a boiler fuelled by natural gas is used, as long as there is enough room. These systems are not suitable for the primary generation of

electricity, but for generating heat. The use of biomass-fuelled boilers requires an environmental permit, otherwise a change in the environmental permit.

In order to implement large-scale biomass combustion within the municipality, a number of steps will have to be taken:

- Action: Make an inventory of possible locations for the construction of a power plant. Preferably in the harbour, in the vicinity of large heat consumers. This could be, for example, the Oevers industrial park.

- Action: Approach large heat consumers: they might be interested if there is an advantage in it for them. That could be in the price of heat: in the short term, but more importantly in the long term too. Security of delivery and possible independence could also play a role.

- Action: Chart what investments are involved here. This not only concerns the installation itself, but also a city heating network to provide businesses with heat, and the connection costs.

- Action: The purchase of biomass and the storage and transport of fuel also play a role when it comes to generating energy by means of biomass combustion. It is advisable to enter into multi-year contracts with large suppliers. Due to the large quantity of biomass required, it is possible to conclude keenly-priced contracts. It is also advisable to look into the possibility of obtaining green waste from neighbouring municipalities. This can be done on the basis of the philosophy that local energy needs are preferably met by local fuel.

Hydrogen (H2) on demand

The 'Innovation Shed' set up by the Expertise and Innovation Centre for Inland Shipping (EICB), a think tank for making barge engines cleaner in an economically responsible way, considers it to be a highly promising technology. There is one problem, however. Hydrogen may not be used as fuel in inland shipping. Hydrogen is known to be highly volatile and flammable and is therefore dangerous. Also, the energetic value of hydrogen in gas form is low at atmospheric pressure. For efficient storage on board ships, very high quality, expensive tanks are needed.

The European Union has announced a large-scale initiative to stimulate the hydrogen economy. In the coming six years, €1 billion will be set aside for the joint initiative. Sixty companies and an equal number of research institutes and universities will be working on the Joint Technology Initiative. They have been charged with speeding up the development of fuel cells and hydrogen technology and converting this into commercial successes between 2010 and 2020.

Fortunately, there is an alternative for hydrogen as a fuel: H2 on demand. The addition of a small amount of hydrogen gas produced on the spot to the inlet air of older diesel engines in particular can improve combustion. It reduces emissions of fine dust, carbon monoxide and hydrocarbon, and fuel consumption falls.

H2 on demand

By connecting a (relatively) small unit to the electricity network on board (batteries), it is

possible to generate enough hydrogen from water to substantially improve the combustion in the diesel engine. The hydrogen produced enters the combustion chamber via the air inlet. As diesel combusts at a relatively low pressure compared to hydrogen, the hydrogen combusts along with the diesel. All safety aspects relating to the storage and transport of hydrogen on board become irrelevant in this way. The (theoretical) advantages of combining hydrogen with diesel combustion via the engine's air inlet are:

- The costs are low.
- The technology can be applied with pre-existing engines.
- The combustion is faster and more complete, thereby reducing emissions into the air.
- The effective pressure in the combustion chamber increases, resulting in a higher torque.

- Action: Developments for the use of hydrogen are geared mainly towards applications in ships. Hydrogen production is not an option for the sustainable development of the harbours in Meppel.

Ammonia
Burning ammonia only produces water and nitrogen, making it a sustainable fuel. As a fuel, ammonia is highly suitable for ferries and generators. It is fairly simple to modify the engines and another added advantage is that ammonia can be produced locally. You need electricity, water and air. In port areas, all of these 'ingredients' are in adequate supply. The disadvantage of ammonia is the penetrating odour, which causes a nuisance in the surrounding area.

- Considering the location of the industrial harbours in Meppel in the immediate vicinity of homes, the production and use of ammonia is not thought to be feasible.

Tidal energy
Generating energy from the tides is fairly predictable. However, enough difference in height is required between high and low water. In the estuary of the Rance near St. Malo in France, between Normandy and Brittany, the tidal difference can be as great as 13 metres. Since 1966, there has been a tidal power station here, which supplies energy for 300,000 households every year. In the river Severn in England, there is also a good chance of generating tidal energy due to the great difference in tidal water levels.

- It would not be logical to set up a tidal power plant in the municipality of Meppel and it is therefore not considered feasible. Tidal energy is perhaps an option for other international ports which are located on a sea or ocean.

Wave energy
Generating energy from waves is only applied on the coast and then preferably on an ocean.

- Action: The use of a wave power plant in the municipality of Meppel is not an option, but perhaps is for other international ports located on a sea or ocean.

Generating energy from differences in temperature using surface water
The potential recoverable energy from bodies of water such as lakes, ponds and the sea consists of the amount of recoverable heat for heating and recoverable cold for cooling

buildings. A lot of research still needs to be done to establish the yield when using a TES installation linked to surface water.

- Action: For the time being, this is not seen as a realistic option for the harbours in the municipality of Meppel.

Energy management

Smart Grid (relationship with NvL)
With the development of sustainable sources of energy, the need for good coordination between demand and supply will increase. Globally, there are various systems which are comparable to Smart Grid approaches such as PowerMatcher, BEMI, Open ADR and suchlike. These systems attempt to offer a solution for the coordination problem. With the arrival of decentralised energy production, every user can be a producer and consumer at the same time. Port areas lend themselves very well to the decentralised production of energy, with the established companies also being customers for this energy. The use of a Smart Grid means that production and purchase are coordinated optimally with each other.

In Meppel, the unique sustainable district of Nieuwveense Landen (NvL) will be developed to the north of the industrial harbours in the coming 20 years. A system of hybrid heating facilities based on biogas will be realized in the district. A biogas cogeneration system will produce heat and electricity. The heat will be used to provide some of the residents with heating and hot tap water, via a heat network. Other residents will be provided with heat and cold with the aid of heat pumps which run on the electricity produced. The heat balance is maintained using residual heat from treated sewage water. In order to administer this whole heat facility as efficiently as possible, a smart grid will be used. Experience gained in Nieuwveense Landen can be used when setting up a smart grid in the harbour area.

A number of established businesses in the harbour area can start with a smart cell and gradually expand that into a smart grid. In this way, they can gradually reduce their dependence on the energy network above and use and trade the sustainable energy they have generated as efficiently as possible within the harbour area. Cooperation between all of the parties in the energy chain (from producer right up to consumer) is crucial when setting up a smart grid. The government also plays an important role in making a smart grid possible.

- Action: Study feasibility

Virtual Power Plant (VPP)
A step further than the realisation of a smart grid is to link different decentralised generating plants by means of a virtual power plant (central control entity). In a virtual power plant, decentralised energy management and communication with the generating plants play a special role. With the virtual power plant, the decentralised generating plants can not only be linked together in an intelligent way, but can also be utilised economically and in an environmentally friendly manner. The virtual power plant opens up sales channels which would otherwise not be available to the operators of the separate plants. Linked, the power plants can be run even more efficiently and thus more economically.

- Action: Municipality of Meppel to study feasibility in collaboration with MeppelEnergie.

LNG

LNG stands for Liquefied Natural Gas and is a fuel that is very well suited to use in shipping and road transport. LNG could replace traditional ship's fuel and diesel. The great advantage of LNG is that it emits much less harmful substances and the engines which run on LNG produce approximately 50% less noise than diesel engines.

Port areas lend themselves very well to an LNG terminal or LNG bunker station. With a bunker station, LNG is brought in from the LNG terminals via bunker vessels or trucks and stored. From 1 January 2015, shipping in the North Sea will have to comply with new regulations governing Sulphur Emission Control Areas (SECA). LNG will then have to be available in sufficient quantities. In time, this will also apply to inland shipping.

The Energy Valley Foundation is a cosignatory to the Green Deal LNG Rhine and Wadden. Energy Valley will strive to identify and remove the obstacles to LNG so that LNG can be introduced successfully as a new fuel.

- Action: In collaboration between the municipality, representatives of industrial harbours and Energy Valley, explore the possibilities for setting up an LNG terminal or LNG bunker station in Meppel and/or in the harbour region Zwolle-Kampen-Meppel

Onshore power supply

Onshore power supply (OPS) is one of the strategies recommended by the World Port Climate Initiative for reducing the environmental impact of seagoing vessels in ports.

OPS replaces auxiliary engines at berth

When berthed, ships require electricity to support activities like loading, unloading, heating and lighting and other onboard activities. Today, this power is generally provided by auxiliary engines that emit carbon dioxide (CO_2) and air pollutants, affecting local air quality and ultimately the health of both port workers and nearby residents. The same holds for noise nuisance.

As an alternative to onboard power generation, vessels can be hooked up to an onshore power supply, i.e. connected to the local electricity grid. In this way ships' operations can proceed uninterrupted, while eliminating negative side-effects.

Implementation of OPS provides an opportunity not only to improve air quality, but also to reduce emissions of carbon dioxide, one of the main contributors to global warming. By switching from fuel oil to gas as an energy source or, better still, to sustainably generated wind power, for example, CO_2emissions can be curbed. According to the IEA, the average CO_2 emission associated with power generation in the EU is 350-380 g/kWh Taking a figure of 220 g/kWh for fuel consumption, the corresponding CO_2 emissions of auxiliary engines are around 680 g/kWh, implying a reduction of around 50% if vessels switch to OPS.

If renewable energy from water or wind is used, CO_2 emissions will be zero or near–zero, thus clearly giving the greatest CO_2 reductions. Most electricity suppliers are able to supply renewably-sourced power. To calculate the effects of OPS on CO_2 emissions the website provides an OPS calculation tool.

Source: http://www.ops.wpci.nl/

- Action: In collaboration between the municipality, representatives of industrial harbours and Energy Valley, explore the possibilities for setting up an OPS in Meppel.

4.2.2 Research questions – energy

In order to make the industrial harbours in the municipality of Meppel more sustainable, on the basis of the energy applications described above, the following research question is relevant.

1. Study: In collaboration between the municipality, representatives of industrial harbours and Energy Valley, explore the possibilities for setting up an LNG terminal or LNG bunker station in Meppel and/or in the harbour region Zwolle-Kampen-Meppel. At the moment, work is going into an initial business case, in collaboration with the municipalities of Zwolle and Kampen.

2. Study: Make an inventory of possible locations for the construction of a biomass power plant. Preferably in the harbour, in the vicinity of large heat consumers. This could be, for example, the Oevers industrial park. Chart what investments are involved here. This not only concerns the installation itself, but also a city heating network to provide businesses with heat, and the connection costs.

3. Study: feasibility Smart Grid (relationship with Nieuwveense Landen)

4. Study: feasibility VPP in collaboration with MeppelEnergie.

5. Study: In collaboration between the municipality, representatives of industrial harbours and Energy Valley, explore the possibilities for setting up an OPS in Meppel.

4.3 Social and environmental quality

Functionality is very important in industrial ports. The social and environmental aspects then often come in second place. The positive impact that a good social and environmental quality has on the people who work there is often highly underestimated.

The social and environment-related ambition for the harbours

The social and environmental quality in the harbours is so good that it contributes towards a healthy working environment. Moreover, employees and visitors themselves also help to make the harbour area more sustainable.

4.3.1 Sustainable applications for social and environmental quality in ports

Conducting a health impact assessment (HIA) can provide a good understanding of the different factors which influence health. By means of the HIA, exposure to air pollution, noise, odour nuisance, external safety and electromagnetic fields can be assessed from the health point of view. Measures can be taken on the basis of the results.

Sustainable social quality depends largely on people becoming more aware of their actions and the effect these have on sustainable quality. Providing people in the harbours with good information about the sustainable role they themselves can play in making the

site more sustainable will make a positive contribution straight away. In order to structure this consciousness-raising process one could consider using, for example, gaming (games for change).

- Action: Draw up a communication plan aimed at encouraging sustainable behaviour among personnel and visitors.

If the area looks well cared-for, this will have added value for the businesses established there, as well as for personnel and visitors. Feeling good about safety and health helps create a positive perception and hence also a positive attitude towards the company. This applies to the public space, the private industrial parks and the buildings (on both the outside and inside).

4.3.2 Research questions – social and environmental quality

In order to make the industrial harbours in the municipality of Meppel more sustainable, on the basis of the applications described above, the following research question is relevant.

1. Study: In collaboration between the municipality and representatives of industrial harbours, commission a health impact assessment (HIA) in order to come up with an action plan. The results can also be applied in other comparable situations.

4.4 Mobility

The mobility-related ambition for the harbours

For transport on the site, vehicles which run on sustainable, preferably locally produced fuel are used wherever possible. For the people who work there, the harbours are easily accessible by public transport. Road haulage to and from the hinterland is by sustainable means of transport wherever possible.

4.4.1 Sustainable applications for mobility in ports

Transport movements

Due to the expected increase in transport by water to the industrial harbours of Meppel, there will also be a rise in transport by road to and from the hinterland. When this transport involves heavy goods traffic, other fuels are being considered to ensure that the burden on the environment does not increase but actually diminishes. In section 4.2.1, the possibilities for LNG are looked at in more detail. The great advantage of LNG is that it emits much less harmful substances and the engines which run on LNG produce approximately 50% less noise than diesel engines.

- Action: In collaboration between the municipality, representatives of industrial harbours and Energy Valley, explore ways of encouraging sustainable goods traffic using LNG.

Mobility policy of companies

Sustainable applications in the field of mobility are aimed primarily at the modes of transport used by existing companies. In order to achieve a substantial reduction in the

environmental impact and mobility costs, a principle like that of the trias energetica can be applied.

1. Reduce demand (prevention)
2. Make passenger kilometres more sustainable (modal shift)
3. Make remaining kilometres more efficient and cleaner (technology & behaviour)

An initial step is to chart the potential for improvement by making an inventory of transport movements, the need for consultation and the corporate structure.

- Action: Draw up a mobility policy and action plan for the harbours.

Sustainable urban distribution from industrial ports

There has been growing interest in sustainable urban distribution in the Netherlands in recent years. About a hundred companies are conducting trials to gain experience. Commercial firms also see market opportunities and are offering services to implement sustainable urban distribution. With sustainable urban distribution, the main benefit is in terms of logistics; instead of 20 diesel trucks transporting goods in the city, the goods are carried and delivered by 1 truck running on CNG (natural gas).

With this system, the goods are delivered to a central depot, from where they are transported into the city. If approached cleverly, this can be financially advantageous for the client. Examples of sustainable urban distribution are Greencity Distribution, Cargohopper, 020 stadsdistributie.nl, Eco2city and Delta Stadsdistributie. Various transport systems are used here.

- Action: The municipality takes the initiative, together with the Meppel trade association and possibly other parties. Bringing parties together and enthusing them about sustainable urban distribution sets the ball rolling, after which the efforts of the municipality can be minimised.

Trimodality in Meppel

Meppel's harbours do not have rail access. This means that goods can only be transported to the hinterland by road. The distance from the industrial harbours to the national road network is about 3.7 km. The expected growth in transport by water will automatically mean growth in the number of transport movements by road. In addition to the deployment of sustainable trucks, the possibility of using less obvious, alternative means of transport can be considered. This could include an underground transport system for containers between the harbours and the national road network.

- Action: In collaboration with the Province, look into the possibilities of linking various modes of transport between harbour and other infrastructure networks.

4.4.2 Research questions – mobility

In order to make the industrial harbours in the municipality of Meppel more sustainable, on the basis of the applications described above, the following research questions are relevant.

1. Study: The Municipality of Meppel, together with parties involved, initiates a feasibility study into the possibilities of sustainable urban distribution from the harbours of Meppel.

2. Study: The Municipality of Meppel, in collaboration with the Province of Drenthe, looks into the possibilities of linking various modes of transport between harbour and other infrastructure networks.

4.5 Waste material

The waste-related ambition for the harbours

In 2020, 50% of the waste material that is removed in 2014 will be reused or recycled .

4.5.1 Sustainable waste material applications in ports

Waste products are produced on every industrial park, so too with industrial ports. Almost every company has its own facility for collecting these waste flows. Due to this fragmentation, it is often not worth the effort to separate waste products prior to disposal. It is possible to reduce the costs for businesses and, at the same time, cause less harm to the environment, by introducing collective waste collection.

This refers to the following:

- Disposing of waste flows jointly with a single waste collector.
- Broader waste separation and hence lower processing costs.
- Project-based approach to waste products resulting in:
  - Prevention of waste products
  - Reduction in disposal of waste products
  - Useful applications of waste products
  - Possibilities for generating energy
  - Using each other's residual flows

- Action: The park management organisation can be responsible for organising a collective waste collection system.

4.5.2 Research questions – waste material

In order to make the industrial harbours in the municipality of Meppel more sustainable, on the basis of the applications described above, the following research question is relevant.

1. Study: The park management organisation, in collaboration with the municipality of Meppel , looks into the feasibility of collective waste collection in the harbours of the municipality of Meppel.

4.6 Corporate Social Responsibility

The CSR-related ambition for the harbours

Every company in the harbour has included its own view of CSR in its annual plan, featuring a personal ambition when it comes to sustainability. The added value of this is achieved jointly and propagated via a Park Management Organisation.

4.6.1 Sustainable applications of CSR in ports

Entrepreneurs are always open to measures which make business operations more cost effective. Recently, there has been an increased focus on energy due to the external concern for energy saving, the annual increase in energy prices and the internal desire, as a company, to go 'green'.

In many cases, entrepreneurs do not have sufficient knowledge and resources to actually maximise energy savings. In addition to this, they are faced with a forest of measures and suppliers so that the companies often can't see the wood for trees. Although it means that there are opportunities and possibilities with respect to energy saving and sustainable energy, businesses will have to be encouraged and helped in this. Companies often do nothing with research reports. It is therefore of vital importance to assist companies in implementing measures.

Motivated entrepreneurs realise that, in the context of CSR (Corporate Social Responsibility), energy and sustainability can make a positive contribution to their company. Measures with a payback period of more than five years can also be attractive to entrepreneurs. And being "green" is increasingly important to a company's image.

In addition to the regulations, the park management of the joint companies (ICC-PMM) plays a role when it comes to energy and sustainability. ICC-PMM is the overarching contact point for the Meppel companies. The association has more than 170 members. In the context of ICC-PMM, the entrepreneurs on the industrial parks work together to improve the quality of the parks and develop them further.

ICC-PMM wants to put energy and sustainability actively on the agenda, but on the basis of a concrete project as an example of the possibilities that exist. The role of the municipality is to facilitate, that is to say stimulate, initiate, enthuse and organise, but not to finance.

Cooperation is the motto

Many companies are currently struggling with the fact that energy costs account for an increasingly large share of production costs. To guarantee good employment levels in Meppel, it is therefore important:

- to make an offer to as many companies as possible:
  - on the basis of 'an offer you can't refuse' particularly for 'low-hanging fruit'
  - to mobilise the local suppliers in a collaboration model so that the realisation of the measures, on the one hand, contributes directly to employment in Meppel (ICC-PMM) and, on the other, the measures have a high price-quality ratio for example with a quality label. This is so that the company wishing to

have the measures implemented can be sure that the solution offered represents a success factor for it in terms of measure(s) and the offering party.

- to achieve the greatest possible carbon reduction:
  - with a number of companies, to zoom in specifically on opportunities for cooperation. For example through residual heat uncoupling, but also by making demand for electricity and natural gas sustainable.
- with the partnerships described above, the ICC-PM alliance occupies a strategic position, for example considering its network within Meppel.

Sustainable supervision when new business is established

The establishment of a new business is the ideal opportunity to pay attention to energy savings and possible sustainability. It is a natural moment at which the entrepreneur is sure to feel positive about a low-energy and sustainable start for his business. This not only applies to newbuild, but also to conversions. In the future, a sustainable energy supply will be an important argument for setting up business.

Supervision can be on the basis of the Collaboration Model for Energy Studies and will preferably be offered to any new company setting up business on the industrial park.

In practical terms, this means that a company wishing to set up business should have a study carried out, based on the view that investments in energy can also be included in the package. There can also be a link via the Integrated Physical Environment Permit, part of the section on energy.

"Sustainable Entrepreneur" quality label

Following the example of other municipalities, create the "Sustainable Entrepreneur" quality label.

The municipal authority can use this quality label to reward sustainable entrepreneurs and encourage other entrepreneurs to make sustainable choices.

A green image encourages entrepreneurs to take more measures and integrate energy savings into their company and processes.

Companies must be able to register via a website, yet to be set up. Online, they will answer questions about sustainable business practices. If they answer 90% of the questions in the affirmative, they receive a golden quality label, 80-90% a silver quality label and 70-80% a bronze quality label. Nomination will take place within the categories hospitality industry, retail trade, service providers and production companies.

In the experience of other municipalities, lots of entrepreneurs display this quality label in their communication with business relations**.** Backing from the business community (ICC-PMM) for this initiative is essential for generating a support base.

- Action: ICC-PMM must be asked to set up the "Sustainable Entrepreneur" quality label, including the accompanying financing. A specific website must also be built. Joint activities, such as speaking to companies, setting up a jury and awarding prizes, must be organised.

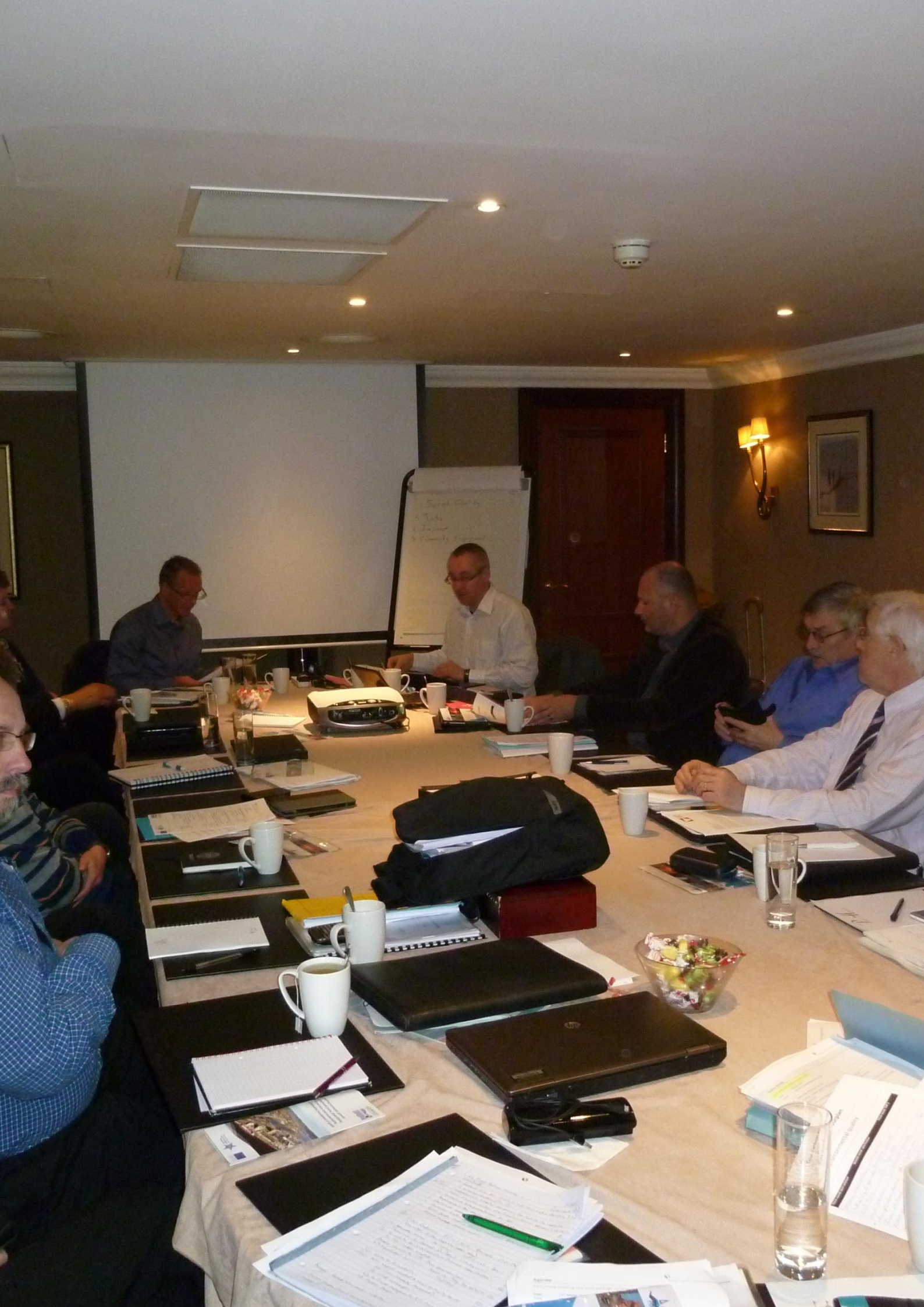
4.6.2 Research questions – CSR

In order to make the industrial harbours in the municipality of Meppel more sustainable, on the basis of the applications described above, the following research questions are relevant.

1. Study into the possibility of setting up an Energy collaboration model, for example in the context of an alliance, to look into and realise energy measures on the industrial park.

2. The design of the Energy studies among companies.

3. Study into the possibility of one or more partnerships among the energy-intensive companies (residual heat exchange, but also making gas and electricity more sustainable).



Chapter 5 Workshop in Edinburgh

"If you have an apple and I have an apple and we exchange these apples then you and I will still each have one apple. But if you have an idea and I have an idea and we exchange these ideas, then each of us will have two ideas."

George Bernard Shaw (1856-1950)

5.1 LO-PINOD meeting & workshop

On 12 and 13 March 2014, all participants in the Interreg project LO-PINOD met together in Edinburgh. They informed each other of developments in the project. During the meeting, the municipality of Meppel held a workshop.
The primary aim of the workshop was to work with the participants to achieve concrete results that would contribute to the 'Low carbon harbour plan'.
The secondary aim was that, by the end of the workshop, the participants would have gained new insights into the possible applications involving sustainable developments in local ports.

5.2 Pressure cooker

In order to pursue as many creative avenues as possible in the search for solutions relating to sustainability themes and the elements relevant to these, it was decided to hold a brainstorming session in the form of a 'pressure cooker'. This pressure cooker, which Roland Klarenbeek organised on behalf of the municipality, consisted of 3 rounds.

Round 1

In the first round, lasting 5 minutes, participants (in groups of about 4) listed possible sustainable solutions individually on forms. As soon as someone named a possible solution, the form was passed on to the person on their right. Two to three elements per group were dealt with and, in total, possible solutions were determined in this way for 10 elements.

Round 2

On the basis of the possible solutions listed, the group spent 20 minutes on defining the possible solution in more detail, so that it was clear to everyone what the solution involved.

Round 3

In the final round, lasting 5 minutes, every participant decided on their TOP 3 applications which made a sustainable contribution to local industrial ports. The totals per group ultimately determined the TOP 3 for the element.

5.3 TOP 3

The results of the 'pressure cooker' are presented per theme in tables.

Water

Theme	Element	TOP	Solution	*
Water	Effluent	**1**	Ballast water tanks in port to supply ships, collect the effluent at the port, reuse ballast water for other ships	*
		2	Clean the water using micro-organisms	
		3	Use effluent as fuel, steam engine	
	Rainwater	**1**	Reuse	*
		2	Collect water in storage	*
		3	Use for flushing toilets	*
	Open water	**1**	Clean containers sustainably	
		2	Collect polluted surface water	

Energy

Theme	Element	TOP	Solution	*
Energy	Fuel	**1**	Facilitate, promote and use LNG	*
		2	Smart Grid	*
		3	Shorter transport more efficient, liner routes, modality issues	
	Electricity	**1**	Use renewable energy like hydroelectricity, wave energy, wind energy, etc.	*
		2	Change behaviour through education	*
		3	Shore-based power for ships	*
	Energy management	**1**	Reduce use	*
		2	Reuse of energy released (for example heat)	
		3	Use green energy	*

Environmental quality

Theme	Element	TOP	Solution	*
Environment	Social quality	**1**	Create new jobs / low carbon training programmes	
		2	Improve transport, reduce crane operations	
		3	Community engagement	*
	Environmental quality	**1**	Smart logistics	
		2	Sustainable energy	*
		3	Noise reduction	

Mobility

Theme	Element	TOP	Solution	*
Mobility	Water-rail-road	**1**	Storage & reuse of traffic calming	
		2	Efficient traffic management & Uniform vehicles to base transfer (common modal shift platforms)	*
		3	Close proximity	

Materials

Theme	Element	TOP	Solution	*
Materials	Residual materials & Waste	**1**	Change the mindset	*
		2	Manage residual materials & waste, collect & sort for reuse or recycle	*
		3	Reuse containers	

The top 3 results from the workshop contributed to the contents of this report. Frequently proposed solutions are described in more detail in the various chapters. These solutions are marked with an * in the table.