The Rotterdam Fuel Approach

Final draft

From
Stratelligence

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Foreword

The Municipality of Rotterdam plans to develop the national fuel vision, including the action programme, into a specific approach for Rotterdam. This wish has been identified in the Rotterdam mobility agenda and is the result of experiences gained with electric vehicles, rapid developments in that field and the government's new fuel vision. This approach has also been translated into an action programme for Rotterdam.

The fuel approach creates a benchmark against which developments can be compared. Based on this approach, an assessment framework will be formed and energy and budget can be generated by stakeholders, including the municipality itself. The action programme will reflect the agreements to be made in a process with the intensive involvement of various organisations and after broad consultation.

The fuel approach and action programme are intended as a joint initiative of the municipality and industry, both in terms of development and financing.

MT RCI has therefore indicated and confirmed its commitment to a complete and widely supported fuel approach, including the support and involvement of the seaport. This gives substance to the agreements between Deltalinqs and the municipality for the sustainable development programme (LoC7).

The fuel approach with the action programme is set out in two separate documents:

- This report contains the fuel approach and translates the national vision into a Rotterdam approach;
- The action programme for track 1: sustainable passenger transport and track 2: making industry more sustainable is a separate document prepared together with industry and other stakeholders on the basis of this fuel approach.

The Municipality of Rotterdam and the RCI (Rotterdam Climate Initiative) are striving to ensure that track 3: making the transport sector more sustainable and track 4 opportunities for seaport and industry, are taken up by the Port Authority.

This document is a final draft. The comments of various RCI parties and Natuur & Milieu and the participants in the work meetings have been incorporated as much as possible (see below). The fuel approach and the action programme for tracks 1 and 2 will now be presented to the alderman.

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At MT RCI 4 March 2016, RCI meeting on 24 October 2016.
Rotterdam is a key player in making transport and transport fuels more sustainable

Rotterdam is an enterprising city with many opportunities and also many challenges. Mobility and transport are important to the city's well-being and prosperity. At the same time, some aspects of the mobility system are harmful to the economy, people and the environment. Examples include daily traffic jams, particulate matter emissions, NO\textsubscript{x}, SO\textsubscript{2}, and CO\textsubscript{2}, increasing noise pollution, not to mention the effects of greenhouse gases on climate change.

Based on the need to reduce the impact on the health of Rotterdam residents and the urgency to reduce climate change and CO\textsubscript{2} emissions, a transition to sustainable mobility has been initiated internationally, nationally and also in Rotterdam. Businesses, governments and other organisations and institutions have already taken many initiatives to promote innovation in the sector. Both nationally in the fuel vision with LEF resulting from the SER Energy Agreement for sustainable growth signed in 2013, as in Rotterdam with the Municipality's Sustainability Programme, concrete ambitions and measures have been identified that will contribute to this transition. These measures may not be sufficient to meet all the objectives and preconditions. Last year, the global urgency to combat climate change was confirmed and reinforced by the results of the Paris Climate Summit. The impact of the Paris climate agreements is therefore being examined by various parties, including Rotterdam. It is possible that international, national and municipal legislation and guidelines will have to be tightened up to make them future-proof. And although no agreements were made in Paris regarding international shipping and aviation, the requirements imposed on the fuels used, such as the sulphur content, are also becoming stricter in this area.

These climate and emission agreements, together with the low price of oil, are placing the fossil fuels industry under pressure. There is a political momentum to de-invest in fossil fuels. However, due to the strong position of the chemical, transport and oil processing industries, Rotterdam and the Netherlands are very much linked to this sector. Rotterdam's sustainable competitive position calls for active commitment to sustainable fuels and a transition or transformation of the seaport. The vision on the sustainable fuel mix is therefore not nice to have, but essential for the preservation of Dutch prosperity and for Rotterdam as the engine of the economy.
The City of Rotterdam is therefore actively pursuing its own ambitious fuel approach. The national vision and action agenda will be developed, updated and linked to the Sustainability Programme of the Municipal Executive. The Rotterdam mobility agenda, the Port Vision and the urban agenda for the seaport, the Koersnota Lucht (air quality policy document) and recent international developments together form the starting point for the Rotterdam fuel approach with its action programme (see Figure 1).

**Mobility and accessibility**

Rotterdam is a hub for various modes of transport, with Europe's largest seaport, important rail connections (Betuwe line), the starting point for inland shipping routes to Belgium, France and Germany, junction of A4, A13, A15, A16, A20 and A29 and is the engine of the Dutch economy (see Figure 2). Rotterdam has a major interest in clean accessibility to make it a pleasant place to live, work and enjoy recreation. Its location at the Maas estuary makes the delta city of Rotterdam vulnerable to climate change and to the consequences of CO$_2$ due, among other things, to increased goods transport. In the Netherlands, the various modes of transport contribute approximately 25% of greenhouse gas emissions. A large proportion of these transport volumes is produced in and around Rotterdam. This percentage does not include emissions from fuels for international shipping and aviation, which are produced and bunkered in Rotterdam. These fuels, too, should be made renewable and future-proof. The national fuel vision therefore affects Rotterdam both positively and negatively. Rotterdam benefits from the reduction in emissions, both in its living environment and in combating climate change, but faces a major challenge in the extent of the transition. Sustainable transport kilometres need to be made more attractive and competitive. Without this transition, mobility could be placed under threat, as could Rotterdam's attractiveness as a place to live and settle.

*Figure 2 Rotterdam: A hub for various modalities.*
For future-proofing, it is important that the transition is arranged in good time in order to avoid stranded assets\(^2\) and to gain a solid position in the new fuel economy.

**Economics and employment**

Rotterdam is also a city of doers, and a city that is involved more than average in the fossil fuel industry for its employment. This is due to the presence of refineries, chemicals and energy-intensive industries and the trade and storage of fossil raw materials.

Much of the prosperity that comes from the fossil fuel industry or from the industry that is heavily dependent on it is earned in Rotterdam and the surrounding area. Rotterdam provides more energy and fuel than the city itself needs, partly because the seaport is the largest bunker port for seagoing vessels in Europe. Fuel production for the northwest European transport sector also takes place in Rotterdam. Rotterdam is therefore a key player in the national vision and when it comes to tackling energy and climate policy. The results of the climate conference in Paris and agreements on limiting global warming to a maximum of 2 and a target of 1.5 degrees will certainly have an impact on the demand for oil, coal and gas and the need for transhipment and refining capacity in Rotterdam. Increased dynamism in the energy market is severely affecting the refining sector and threatening the competitive position of the Rotterdam chemical cluster. At the same time, this dynamic offers opportunities for entrepreneurs in the Port of Rotterdam. Rotterdam, for example, now has the largest bio-based cluster in Europe. CO\(_2\) emissions per ton/km are among the lowest in Europe due to economies of scale and efficient chain cooperation.

![Employment (2013)](image)

**Figure 3 Importance of the seaport for employment in Rotterdam Rijnmond (sources: CBS, Havenvisie, Erasmus University)**

The seaport is not only experiencing the effects of varying economic growth forecasts, global trade and increasing competition between seaports, but also of fundamental changes in the energy market. The emergence of shale gas from the United States and the low oil prices that weaken the competitiveness of the European petrochemical industry, the German Energy Review and the rapid growth of non-fossil and decentralised generation are examples of developments that indicate that the energy market is changing significantly. This energy transition is a major challenge with new

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\(^2\) Stranded assets are assets that run the risk of falling rapidly in value.
possibilities, which calls for effective answers and which offers opportunities for the port of Rotterdam.

But the energy transition is also economically important for the municipality. The seaport is responsible for approximately one-third of employment in Rotterdam-Rijnmond (see Figure 3). An appropriate response by the seaport to the changes that are occurring as a result of making transport more sustainable is essential if Rotterdam is to remain an attractive place to live and work.

Livability

The presence of heavy industry and the transport volumes generated by Rotterdam as a transport hub cause a lower air quality than desirable. Commuting in Rotterdam consists to a greater extent of car transport in comparison with other major cities (see Figure 4). In recent years, a lot of work has been put into improving the inner city air quality in Rotterdam, but the result is still insufficient in some of the city's busy spots.

![Modal split of commuting within 4 large cities](image)

*Figure 4 Modal split of commuting within 4 large cities, averages over the years 2010-2014. Source: KIM mobility image 2015*

Continuing to improve air quality is urgent for a number of reasons. The most important reason is the ambition of the Municipal Executive to improve the health of Rotterdam residents. On average, the presence of air pollution in the Netherlands reduces life expectancy by 13 months, but the impact is greater in large cities. The health damage also manifests itself in the reduction of the quality of life through more health disorders, poorer lung function and more use of care facilities and sickness absence.

In addition, as the second major reason for improving air quality, there is European air quality legislation. European legislation includes standards for nitrogen oxide (NO\(_x\)) and particulate matter (PM\(_{10}\)). Since there is a direct link in the Netherlands between decision-making on city planning and European standards, this previously resulted in the 'construction stop'. The Netherlands has been granted a postponement for the time when the standards have to be met and the construction stop has been lifted. But for NO\(_x\) there remain numerous bottlenecks.

The new reason for this is nature conservation legislation, which requires that the depositing of nitrogen in protected nature areas must be significantly reduced if the European conservation objectives for biodiversity are to be achieved. A reduction in nitrogen deposits as a result of shipping, traffic and transport also contributes to this.

For this reason, a package of measures was introduced in January 2016 aimed at a rapid improvement of air quality in the (inner) city.
The challenge for Rotterdam: to take decisive action on the local sustainability challenge and translate the national vision

The Rotterdam challenge is not only determined by the national fuel vision, but above all by the urgency created by poor air quality, the seaport’s growth ambitions and the international agreements on reducing greenhouse gas emissions. The objectives are also in line with the ambitions of the municipality’s Sustainability Programme.

International agreements and EU standards

On 14 December 2015, 195 countries and the European Union as a whole signed a treaty in Paris stating that global warming should be limited to less than 2 degrees, with a target of 1.5 degrees. In addition, countries must periodically indicate the extent to which they are implementing this objective in concrete terms. The Paris Climate Summit has thus tightened up the 2-degree standard adopted by the Intergovernmental Panel on Climate Change (IPCC) since 2009. Based on this standard, the EU has formulated objectives and policy and the Dutch SER targets, the national fuel vision and the Sustainability Programme have also been derived from it.

Many forecasts indicate that the 2 degrees will be exceeded worldwide with the current policy. To remain within the 2-degree limit and to meet the 1.5-degree target, new targets and additional measures are needed, which have not yet been included. Compared to the previous targets and packages of measures, it can be expected in the short term that the reduction of CO₂ emissions will become more important for Rotterdam as a result of the implementation of more stringent international and national targets than has now been assumed in the various vision documents. Research conducted by the Netherlands Environmental Assessment Agency indicates that to meet the 1.5-degree target, CO₂ emissions must be halved by 2030 compared to 1990.

International shipping

In Paris, it did not prove possible to make agreements for international shipping and aviation. Internationally, there are no hard CO₂ standards. However, the national fuel vision does contain or confirm agreements in which the Dutch shipping sector has set itself the target of achieving a 50% CO₂ reduction in 2050 compared to 2020. This is in line with the SER energy sector targets.

For the shipping industry, the increasingly stringent sulphur standards are now important for the fuel mix. As of 1 January 2015, the Baltic Sea, North Sea and English Channel have become Sulphur Emission Control Areas (SECA). The emission standard for the sulphur content of marine fuel for seagoing vessels sailing in this region is limited from 1% to a maximum of 0.1%. Worldwide, a standard of 3.5% applies outside SECAs (since 2012). This standard will become 0.5% by 2020, unless the evaluation in 2018 is negative.

The North Sea and the Baltic Sea, already Sulphur Emission Control Areas, are to be designated as Nitrogen oxides Emission Control Areas. From the beginning of this year, vessels such as those passing through a NOₓ Emission Control Area (ECA) will have to comply with stricter nitrogen

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3 PBL What does the Paris Accord mean for long-term Dutch climate policy? (2016)
4 A request to this effect was presented and accepted at the 70th meeting of the Marine Environment Protection Committee in October 2016. The North Sea and Baltic Sea will become NOₓ Emission Control Areas by 2021.
emission requirements (tightening of the standard by 80%\textsuperscript{5}). These standards are currently in force in the 200-mile zone around North America and the U.S. Caribbean.

**Inland and European transport**

Transport within Europe by road, rail and water is mainly subject to European legislation:

- The EU *Renewable Energy Directive* (RED): This is the biofuel blending obligation that will increase to 10% in 2020;\textsuperscript{6}

- The EU *Fuel Quality Directive* (FQD): By 2020, life cycle greenhouse gas emissions from delivered motor fuels (fossil and non-fossil) should be reduced by 6% compared to 2010;

- The EU Directive *Clean Power for Transport* (CPT): this is aimed at reducing Europe's dependence on oil imports, reducing CO\textsubscript{2} emissions and improving air quality by promoting alternative fuels through a network for all alternative transport fuels, setting common technical specifications for the charging and refuelling points and ensuring that consumers are well informed about the use of these fuels. According to this Directive, by the end of 2016, EU Member States will have to publish their targets for available charging stations for electric vehicles, hydrogen filling stations and natural gas filling stations for road and maritime and inland waterway transport. At a minimum:
  o Implementation of LNG refuelling points (fixed or mobile) in the main seaports and inland waterway ports: 2025 for seaports and 2030 for inland ports;
  o Implementation of shore-side electricity facilities in most seaports and inland ports by 2025;
  o Sufficient public charging stations and CNG filling stations in urban and densely populated areas by 2020. Hydrogen fuelling stations for those countries that want to invest in hydrogen by 2025;
  o Sufficient CNG and LNG filling stations along the TEN-T network by 2025.

- The EU *Sustainable urban mobility package* (2013): This builds on the 2009 *Action Plan on Urban Mobility* and includes the promotion of sustainable urban mobility action plans by local authorities and knowledge building and exchange on them;

- EU legislation on CO\textsubscript{2} emissions: average CO\textsubscript{2} emissions from newly sold passenger cars must not exceed 130 g/km on average by 2015. A standard of 95 g/km has been set for 2021. In addition, a standard of around 70 g/km for 2030 is under discussion. For vans, the CO\textsubscript{2} standards are 175 g/km for 2017 and 147 g/km for 2020;

- European emission standards for CO, NO\textsubscript{x}, hydrocarbons and particulate matter: the emission standard is constantly being tightened up and vehicles are allowed to emit fewer and fewer harmful substances into the environment. The Euro VI standard has been in force since the beginning of 2014;

- The *European Energy Efficiency Directive* obliges companies to indicate how they use energy. Under this directive, medium-sized to large companies are required to carry out an energy audit every four years. The results, with its focus on energy consumption and CO\textsubscript{2} emissions, must be reported by the companies to the competent authority. Companies must also indicate what measures they are taking (now or in the near future) to limit energy consumption as much as possible. Business-related transport to and from the business premises also forms part of this audit. As a result of this, within the framework of the

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\textsuperscript{5} MARPOL Annex VI, Regulation 13 for Tier III emission standards for ships built after 1 January 2016 and operating in the IMO Emission Control Areas (ECAs).

\textsuperscript{6} No EU target for the use of renewable energy in transport has been set yet for the period after 2020. It is not yet clear when there will be a general idea about this.
Environmental Management Act and the Activities (Environmental Management) Decree, it is a requirement that energy-saving measures can be recouped within five years are actually implemented. This could also apply to vehicles and mobile machinery;

- For inland shipping, mobile machinery and rail, European requirements have been set for the emission of NO\textsubscript{x}, CO and particulate matter on account of air quality (Directive 97/68/EC). Stricter requirements will apply as of 1 January 2017. No targets or standards have been included for energy efficiency and CO\textsubscript{2} emissions.

- European inland navigation is also subject to a sulphur limit of 10 ppm (0.001%). This tightening up often forces a switch to alternative, more sustainable fuels such as GTL, EN590, biofuels or (bio)LNG or the installation of exhaust gas after-treatment systems (scrubbers) and fuel additives, hybrid systems (diesel electric and dual-fuel marine engines);

- The Environmental Management Act and the Activities Decree include a duty of care on the part of companies. Pursuant to this duty of care, companies must take measures to limit as far as possible the adverse effects on the environment of the transport of goods and persons to and from the facility. The focus is on reducing emissions, NO\textsubscript{x}, particulate matter, CO\textsubscript{2} and traffic noise. For this purpose, transport-relevant companies are required to draw up a Transport Savings Plan when applying for a permit or on the basis of a regulation in which measures included in the national Transport Management Guide, substantiated on the basis of feasibility in their own specific situation, are considered. Wherever possible, companies are put on the track of incentive programmes (such as Ecostars, Beterbenutten/De Verkeersonderneming, etc.). This is also relevant to terminal equipment within the facility. Vehicles must comply with the 'best available technology' requirement. If the technology is outdated, the permit can be rejected;

- In the context of the construction and commissioning of Maasvlakte 2, measures have also been taken and planned locally to improve air quality. For inland navigation, it is important that an additional speed limit is introduced in urban areas and that in 2025, Maasvlakte 2 will only be open to vessels that meet the CCNR 2 guidelines. Freight traffic wishing to visit Maasvlakte 2 is subject to an environmental zone, the first environmental zone in an industrial area in Europe, which essentially means that freight traffic must comply with the EURO VI standard.

Air quality objectives

Short-term air quality objectives are set out in the Air Quality Policy Document. The city council assesses new measures, not only in terms of the legal standards for particulate matter (PM10) or nitrogen oxide (NO\textsubscript{x}), but above all in terms of the emission of soot (EC = elemental carbon). This smallest fraction of particulate matter is the best indicator of negative effects on health; these particles can penetrate deeply into the lungs and blood vessels. Urban traffic is responsible for 50% of the concentration of soot, mainly due to emissions from diesel engines.
Objectives to improve air quality have been identified for this municipal executive’s term (2014-2018):

- Urban traffic emits 40% less soot than urban traffic compared to 2014, in addition to meeting European standards for NO\textsubscript{x} and particulate matter. In 2014, the average contribution of traffic was 0.75 μg/m\textsuperscript{3};
- In 2018, the municipal vehicle fleet will be 25% 'cleaner';
- The use of bicycles at the measuring points around the city centre is increasing by 10%.

Improvements in engine technology and the replacement of old cars are making the municipal vehicle fleet increasingly cleaner. In addition to this autonomously occurring decrease in elementary carbon until 2018, an additional reduction of approximately 20% with new measures is required to achieve the target.

Seaport objectives

In the Port Vision 2030, the Port of Rotterdam Authority, the port industry, the Municipality of Rotterdam, the Province of Zuid-Holland and the national government indicated that they aspire to be the most important European port and industrial complex by 2030. In view of all the changes in the competitive field and energy market, this is not possible through improved efficiency and price competition alone. The existing cluster must be strengthened and, at the same time, the energy transition must continue. Together with partners, they will focus on bio-based chemistry, the circular economy and sustainable energy. This can be achieved, among other things, by investing in the overall energy and other infrastructure. Additional opportunities are seen in the field of e-storage or the storage of electricity in transport and energy systems.

The objectives related to the fuel approach are as follows:

- Rotterdam intends to be the **global hub** for containers, **fuels** and energy by 2030;
- Rotterdam is the **frontrunner** in the field of sustainable and efficient chains. The sustainability of the chains is measured in **terms of the CO\textsubscript{2} emissions per ton kilometre**;
- In 2030 a total of no more than **35% of containers are transported by road**. In 2014, the figure for the Maasvlakte was 45.6%;
The Seaport and Region's CO₂ emission must be reduced. As a result of the climate agreements in Paris, the Urgenda ruling and the delayed and changing use of the carbon capture & storage capacity, the previous objective of 50% less emission in 2025 than in 1990² is being adjusted. The consequences of this are now being investigated;

The annual average concentration of particulate matter and NOₓ-emissions must remain below the legal standard of 40 micrograms/m³. According to the annual Port Status 2030 linked to the Port Vision, the port and the region as a whole meet this requirement.

Mobility agenda objectives

Mission, vision and port authority

Mission
The Port of Rotterdam Authority creates economic and social value by working together with customers and stakeholders to achieve sustainable growth in the world-class seaport.

Vision
"We are continuously improving the Port of Rotterdam to make it the safest, most efficient and most sustainable in the world. We create value for our customers by developing chains, networks and clusters, both in Europe and in growth markets worldwide. As an enterprising seaport developer, the Port Authority is the best possible partner for world-class customers. This also enables us to strengthen the competitiveness of the Netherlands."

In the Rotterdam mobility agenda, the Municipal Executive outlines the objectives for the current college period in the field of mobility. Two basic principles are assumed here: making better use of the existing network and ensuring a sustainable network in the longer term. In working towards a healthy balance between the quality of (car) accessibility and the quality of the living environment, stronger emphasis is placed on improving the air quality and quality of the public space. The effort consists of:

- **More greenery.** Rotterdam is laying green walking routes through the city. The motorist is a guest once again in the city and parks his car in a car park;
- **Rotterdam is creating a more car-free city centre.** This will benefit air quality, road safety and quality of life;
- **Bikes first.** Cycling is encouraged. There will be more and better cycling paths and it will be easier and safer to park your bike;
- **Innovation first!** Rotterdam actively encourages innovative entrepreneurs to invest in sustainable mobility, with the focus on car use instead of car ownership;
- **The construction of the A4, A13-16 and Blankenburg tunnel will provide better and faster access to Rotterdam;**
- **Public transport will be given an extra boost** by improving the connection between pre- and post-transport and existing networks.

² RCI
The shift from polluting to cleaner modes of transport is important for the fuel approach. The car is deterred and the modalities with fewer emissions per passenger kilometre (public transport, cycling, walking) are stimulated. Another traffic circulation and capacity expansion of the surrounding national roads will reduce car traffic in the city centre and stimulate car traffic to opt for the motorways around the city centre (‘The Ring’).

**Goals from national vision**

The national vision elaborates the agreements in the SER energy agreement into ambitions for each fuel track and mode. Although the international shipping and aviation sectors are not covered by the SER energy agreement or the climate agreement, the national fuel vision also includes ambitions for shipping and aviation.

Shipping in particular is a relevant sector for Rotterdam as a port city. The majority of marine fuels are transhipped and/or produced in Rotterdam and Rotterdam is the most important port in the Netherlands and Europe.

In the national vision, ambitions have been formulated for each fuel track for the years 2020 and 2030. In addition, by 2035, all new passenger cars sold must be able to drive with zero emissions. Ambitions for 2020 and 2030 that are linked to the number of vehicles have been translated in proportion to the number of vehicles registered in the Municipality of Rotterdam compared to the national registrations. The production figures per fuel type are determined on the basis of the ratio of market shares in Amsterdam and Rotterdam or a specific allocation. For example, the ambitions for canal cruise boats are entirely for the account of Amsterdam and Rotterdam is the designated port for bunkering bio-kerosene for Rotterdam-The Hague Airport and Schiphol. Loading points and filling stations are determined for large numbers, in proportion to the number of registered vehicles. For small numbers such as LNG and hydrogen stations, stations were first divided nationally into (pilot) areas.

The results are provided in the Annex. Rotterdam’s contribution to heavy transport is expected to be greater than the proportional translation, as the transport movements of goods traffic in the Rotterdam region in particular are larger than the share in the Dutch vehicle records. In addition, a large percentage of carrier vehicles are registered abroad.

Ambitions in numbers that have been specifically formulated for Rotterdam are ambitions for charging stations, zero-emission buses and water taxis.

**Water taxis**: Watertaxi is currently experimenting with a hybrid boat that sails 70% on shore power and is also charged using a single generator. A second boat is being converted to electric. As it is more difficult to sail electrically than to drive due to the power required, no major steps are expected towards 2020. The ambition for 2030 is to sail with zero emissions if this is technically and economically feasible.

**Buses**: The intention of RET is to switch to zero-emission buses as soon as technically, financially and in terms of operation/infrastructure feasible. By 2030 at the latest, the approximately 250 buses will be fully zero-emission. From 2025 onwards, only zero-emission buses will be purchased. The first series of buses will be put into service in 2019. This will then be expanded step by step. To ensure a smooth transition, it is also expected that a further purchase will be made of a series of up to 100 diesel or diesel hybrid buses. Depending on the subsidy possibilities, buses with a range extender in the form of a fuel cell can be used.
Charging stations: The municipality is building a basic network of electric charging stations (on the street and in car parks) and anyone with an electric car can apply for the subsidy scheme for charging stations. More than 2,000 public charging stations have already been installed. The ambition is to have around 4,000 public charging stations by 2020.

**Sustainability Programme**

In the Sustainability Programme, the field of tension touched on above between economy and quality of life is clearly expressed in three ambitions (see Figure 5). The fuel approach fits in seamlessly with this programme and this specific position: an above-average commitment to cleaner transport in the city itself and cleaner energy and fuel. The fuel approach also takes into account the existing market positions and revenue potential in Rotterdam.

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<td>Ambition 1: <strong>Healthy living environment and sustainable mobility</strong></td>
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<td>Ambition 2: <strong>Cleaner energy at lower costs</strong></td>
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<td>Ambition 3: <strong>Strong and innovative economy</strong></td>
<td>Ambition 3: <strong>Future-proof engine of the economy</strong></td>
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*Figure 5 Translating ambitions from the Sustainability Programme into the Rotterdam Fuel Approach*

Cleaner transport, while the engine of the Dutch economy loses competitiveness, will not result in green growth. On the contrary, technology, the use of IT and innovation in the transport sector must ensure that a strong and innovative economy is created. In addition, Rotterdam is setting out to make at least a proportionate contribution to the national vision and action agenda and, where necessary, strengthen these in line with the climate agreements and Urgenda.
A joint strategy of the city and port based on four tracks

Various tracks are needed to achieve the Rotterdam local targets set out in the Policy Document on Air Quality (Koersnota Lucht), the Port Vision and to contribute to the national targets. The parties involved in each track differ greatly and the tasks and sub-targets for each track vary as well. As in the Sustainability Programme, there is cooperation between the municipality and the port authority.

**City (Municipality)**

1. Sustainable passenger transport
2. Greening the business activity

**Port (Port Authority)**

3. Greening the transport sector
4. Opportunities for port and industry

Focus on livestability through electrification and efficiency

Focus on greening Rotterdam's economy

*Figure 6 Distribution of strategy focus areas between the municipality and port authority*

**Municipal focus**

The municipality focuses on transport and business activities in the city to improve the city's quality of life while maintaining good accessibility. This involves changing and improving the sustainability of light transport, especially with a small action radius. Criteria used in the assessment are the contributions of measures to local objectives:

- Reduction of EC, particulate matter and NOx emissions to meet air quality targets;
- Increase in bicycle, walking and public transport kilometres, decrease in car kilometres;

In addition, national and international targets play a role:

- CO2 reduction;
- Energy saving or efficiency gains in transport;

Preconditions and possible by-catches include:

- Traffic noise impact should meet national standards at a minimum, but more improvement is appreciated. The stakeholders would like to see a more stringent standard;
- Costs per transport kilometre and additional investments must fit within budgets.
In view of the above objectives, transport-relevant companies will also be referred by the competent authority to their duty of care in the context of the Environmental Management Act. The competent authority is the Municipal Executive of Rotterdam or the Province of Zuid-Holland.

In the city, the air quality objectives are more urgent than the national CO₂ objectives. The use of electric transport and hydrogen is the most effective way to make the air in Rotterdam cleaner without restricting mobility. Hydrogen and electric are the only two energy carriers that enable completely emissions-free transport (see Figure 7 and Figure 8). There is also the potential to reduce noise pollution. LNG, CNG and biofuels can contribute to the reduction of CO₂ emissions and the reduction of noise pollution, but do not bring about a major improvement in the emission of particulates and NOₓ. Fine particulates from brakes and tyres are not shown, but they do not differ much, depending on the fuel used. The well-to-tank CO₂ emissions of hydrogen and electricity are estimated in the national fuel vision to be higher than the well-to-tank emissions of fossil fuels. The total well-to-wheel emissions are lower, however. But in Rotterdam, the charging stations use green electricity, which means that the ratio is also favourable for well-to-tank.

Figure 7 Comparison of light transport emissions in g per km as established in the national fuel vision (source figures: TNO reference values from costs and effects of fuel vision) For transport in the city, Rotterdam is therefore focusing more on electrification of the vehicle fleet and a shift to zero-emission public transport ('electric unless...'). Electrical alternatives to passenger transport are available, but often at a higher cost. The currently still limited range of electric transport is less of a problem in the city and does not force people to drive on petrol or diesel in a PHEV version. Hydrogen alternatives are still at the beginning of the market launch, but have no action radius limit and are more suitable for heavy duty applications. The municipality will therefore be

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8 with a lot of transport to and from the city.
9 Research carried out by TNO in October 2016 shows that the differences can be considerable with a cold start.
10 Many different opinions and figures are circulating on the exact emissions of different alternatives. In the fuel approach, the decision was made to operate the latest nationally accepted figures until new generally accepted figures become available. Some of the differences can be explained by differences in starting points. The figures shown depict a fleet forecast for 2020. This results in differences other than a test of the latest models at this time.
11 Many different opinions and figures are circulating on the exact emissions of different alternatives. In the fuel approach, the decision was made to operate the latest nationally accepted figures until new generally accepted figures become available. Some of the differences can be explained by differences in starting points. The figures shown depict a fleet forecast for 2020. This results in differences other than a test of the latest models at this time.
gaining experience in this area. In 2016, RET will take part in a national pilot and, with the help of the Ministry of Infrastructure and Water Management, will purchase two hydrogen buses for this purpose.

The focus on electric/zero-emission also applies to commercial and goods transport in and around the city. However, this is not always possible; either the alternatives are not yet available or they do not have an attractive business case. This is currently the case for non-residential transport and for tractor and semi-trailer combinations used, for example, to supply supermarkets. As long as this is the case, other alternatives to diesel are also possible, such as GTL (lower emissions of particulate matter and NOx, and slightly more CO2 emission) or CNG/LNG (less CO2, NOx and noise). These options do not contribute or contribute to a lesser extent than electric to the longer-term climate objectives. Electric therefore remains the main objective and, because of the air quality, even more so than in the national vision. Sustainability is urgent not only because of air quality but also because increasing parcel transport is leading to more and more polluting movements.

![Graph showing CO2 emissions and NOx emissions for lorries in 2020](image)

**Figure 8: Comparison of emissions for heavy transport in g per km as established in the national fuel vision (source figures: TNO reference values from costs and effects of fuel vision)**

In addition to the goals from the national vision, we will be looking at mobile equipment in Rotterdam, such as forklift trucks and road construction machines, as well as cranes with combustion engines. Nationally, they also make a major contribution to NOx and particulate matter emissions, even more so than to CO2 emissions (see Figure 9). They are also well-represented in Rotterdam, due to the presence of the port and construction activities.

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12 Many different opinions and figures are circulating on the exact emissions of different alternatives. In the fuel approach, the decision was made to operate the latest nationally accepted figures until new generally accepted figures become available. Some of the differences can be explained by differences in starting points. The figures shown depict a fleet forecast for 2020. This results in differences other than a test of the latest models at this time.
The use of electric transport only to achieve air quality targets becomes too expensive or has insufficient effect. That is why, in addition to changing the energy carrier, a strong focus is being placed on behavioural measures, smart solutions for the last mile and deterring the most polluting and least economical vehicles. The necessary measures have already been taken and plans drawn up, such as the scrapping scheme, zero emission urban distribution (5 years earlier in Rotterdam than nationally) and the established environmental zone. With a view to the statutory duty of care of companies, the Environmental Management Act and the Activities Decree are aimed at implementing improvement measures, as referred to in the National Transport Management Guide ('Handreiking Vervoermanagement'). Under a new concession, buses will also have to operate either electrically or with hydrogen (and preferably sooner rather than later).

In the municipal focus, a distinction is made between passenger transport (track 1) and mobility linked to activities, such as urban distribution (last mile) and mobile machinery (track 2).

**Port authority’s focus**

The port authority focuses on two areas of activity. The first focal area concerns the green growth opportunities for the seaport. The second focus area is the long distance and heavy transport that has Rotterdam as its point of departure or destination. The transition to a sustainable energy supply calls for a change in order for Rotterdam to remain the engine of the Dutch economy, but making transport fuels more sustainable also presents opportunities.

Criteria used in the assessment are the contributions of measures to national targets and making the economy future-proof. The air quality objectives are currently less urgent, but determine the amount of space the port has to grow. It should be noted that nature conservation objectives as set out in the Programmatic Approach to Nitrogen largely determine the environmental area of use, particularly for NOx.

The importance of a good transition is vital to employment and the added value of Rotterdam:

- Added value and employment, new fuels and energy carriers (bio LNG, biofuels and hydrogen, modal shift to rail and shipping);

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13 See: [http://www.infomil.nl/onderwerpen/duurzame/vervoermanagement/](http://www.infomil.nl/onderwerpen/duurzame/vervoermanagement/)
Growth in electric vehicles and infrastructure and innovation potential in the long term (bioLNG, biofuels and hydrogen);

Accelerated electrification of non-road equipment, such as automatic guided vehicles (AGVs) at terminals. Stimulation of hybrid systems for, for example, generating shore-based electricity from an LNG-barge.

General national and international targets also play a role:

- CO₂ reduction and cost savings;
- Energy savings and efficiency gains in transport;

Preconditions and possible by-catches include:

- Reduction of EC, particulate matter and NOₓ emissions;
- Costs per transport kilometre and additional investments.

Rotterdam produces more energy and fuel than is necessary for its own city and, as a major producer, has a responsibility to green this energy. This means making an effort to improve the efficiency of transport and changing the energy required for this. Residual products from industry can make energy both cheaper and greener. There are already hydrogen plants in Rotterdam with unused capacity that could be used for transport, possibly after additional purification. In addition, a number of industries produce hydrogen as a residual product. The hydrogen pipeline from Rotterdam to Antwerp offers an opportunity for further distribution.

For the position of the seaport, a smooth transition to an economy that is less based on fossil fuels is more important than the national CO₂ targets. This national vision cannot be rolled out without measures aimed at strengthening or building up a comparable position in the green economy. Rotterdam also sees the transition as a condition for maintaining its position as a world seaport. That is why the port authority, with the Port Vision and port partners, is putting a great deal of effort into facilitating and stimulating the transition by producing and supplying cleaner energy carriers. The municipality supports this in the Urban agenda for the seaport. This affects all modes of transport, such as shipping, heavy transport, green electricity for electric transport and also aviation through the bio kerosene pilot. Measures such as electrification result in savings for terminal operators, for example. Adequate facilities (e-infrastructure and smart grids) thus strengthen the seaport’s competitive position.

For Rotterdam, connection to the production, distribution and transport of hydrogen is an obvious choice, as are production, distribution and storage for biofuels, LNG for ships and heavy transport. The Port of Rotterdam has been working on its position as a European biofuel hub for many years, is carrying out pilots and Rotterdam is home to the world’s largest industrial cluster with biomass as a raw material. Biofuels can be relatively easily blended into the petroleum chain or used as a raw material in the chemical industry. The fact that Rotterdam plays an important role in the fuel trade, refining and distribution, gives it a head start in developing the same position for biofuels. Rotterdam is a frontrunner in Europe for the introduction of LNG as a fuel. The port plays a leading role in adapting the regulations and building the necessary infrastructure. To ensure the future resilience of both biofuels and LNG, it is important that the market for sustainably produced and advanced biofuels and bio-LNG be further developed in the years to come.

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14 Samen werken aan een cluster in transitie, actieplan versteviging industriecluster Rotterdam/Moerdijk (Working together on a cluster in transition, action plan for strengthening the Rotterdam/Moerdijk industrial cluster), R. Willems March 2016.
15 Such as trials with sailing on HVO, exploration of ‘drop in’ biofuels for inland shipping (e.g. B30).
The port authority is seeking cooperation with market parties for *smart grids* (heat and electricity) and shore-based electricity for shipping.

A distinction is made between supporting distribution and use (track 3) and efficiently producing and trading the new renewable fuels (track 4).

This total of 4 tracks of the municipality and port in the Rotterdam fuel approach covers the interface between quality of life, mobility and the economy (see Figure 10). These tracks are detailed one by one in the following chapters.

**Rotterdam Sustainability Programme**

*Figure 10 Positioning of fuel approach tracks*

A distinction is made between supporting distribution and use (track 3) and efficiently producing and trading the new renewable fuels (track 4).
Track 1: Sustainable passenger transport

Track 1 is about clean passenger transport in the city for commuting and private and business visits. The modes of transport are various. This concerns public transport (bus, train, tram, metro) and taxi, but also individual transport by bicycle, on foot, by car or by powered two-wheelers. Ideally, a further shift to full zero-emission transport would be desirable: 100% electric or hydrogen, bicycle use or walking. Measures that respond to this are described in the Sustainability Programme and in the Air Quality Policy Document. The action programme sets out a hard target for zero emissions:

What is the challenge?
- Improve air quality in Rotterdam (urgent): -40% soot compared to 2014;
- Contribute proportionally to national and international CO₂ targets.

What is the commitment for the short and long term?
- Zero-emission passenger transport (individual and collective), stronger deployment than national;
- Improvement in efficiency (short term);
- Shift from individual transport by car to collective transport (public transport) and cycling;
- Gases and biofuels in accordance with national and international policy, no specific incentive policy for passenger transport;
- Public transport concessions, zero-emission;
- Hard target for zero-emission;

Why?
- Nationally, the longer-term focus is on zero-emission urban public transport, hydrogen and E-passenger transport and cycling. By 2035, all new passenger cars sold must be able to drive at zero emissions;
- Due to the air quality in Rotterdam, emissions in the city are more urgent than on the national level;
- Electric transport and hydrogen transport are the only two zero-emission energy carriers (tank-to-wheel). Electricity generation and production of hydrogen, the well-to-tank part, still produce emissions at present;
- Biofuels can lead to a reduction in the calculated CO₂ footprint, but they can also lead to an increase in case unsustainable biofuels are used. They have no impact on emissions in the city (CO₂, NOₓ, particulate matter/EC). Potential implications for land use require attention;
- Gaseous fuels (GTL and LPG, CNG) do not yield (GTL) or only yield a limited reduction in urban emissions compared to diesel (CO₂, NOₓ, particulate matter/EC), other than for a cold start. For passenger transport, there are more effective alternatives, such as electric and hydrogen, which are therefore being stimulated;
- The costs of fully electric vehicles (hydrogen and battery) are still high, but for regional transport the action radius is now generally no longer an obstacle. The action radius is increasing rapidly as a result of developments in battery technology.

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16 For synthetic GTL, there is no CO₂ gain, but an increase.
17 Different studies have come to different conclusions. For the time being, we will start from the latest generally accepted figures until new fact sheets from TNO are available (presumably early 2017).
Objectives for air quality and CO\textsubscript{2} are difficult and expensive to achieve by only stimulating electric driving or driving on hydrogen; It is therefore also necessary to promote cleaner and more efficient engines and to change behaviour to use fuel efficiently.

**What is already happening or planned in Rotterdam?**
- (Extension) environmental zoning;
- Scrapping scheme;
- Facilitating and encouraging electric transport for private individuals (e.g. through the Test Drivers ('Testrijders-programma') programme of Natuur en Milieu);
- Zero-emission buses in 2025;
- Improving public transport and public transport connections (park and ride);
- Improving the bicycle network, policy on two-wheelers/bicycles and encouraging e-bikes to get people out of cars (see bicycle plan 2016-2018: bicycles have priority);
- Adapting traffic circulation (city lounge);
- Improving the provision of information (within municipality and external);
- Training courses for economical driving style;
- Fewer municipal cars;
- Maasvlakte bus transferium;
- Stimulating innovation and behavioural change;
- Returning braking energy of the metro;
- Network charging stations and fast charging stations on green electricity and combined with smart charging;
- Sustainable municipal fleet (electric unless...);
- Pilot with hydrogen buses RET in 2016;
- Pilot with hydrogen cars in the city (in planning);
- Purchase up to 120 electric cars for the municipality;
- Pilot with a hydrogen-powered truck for the port authority;
- Pilot with a very fast 100% electric water bus (BB Green, Aquabus).

**What else is needed in the short term?**
- Policy aimed at changing mopeds and scooters;
- Contract transport policy (target group transport, workers);
- Commuting agreements with employers and removing obstacles, including encouraging and facilitating the use of bicycles for commuting;
- Electrification of water taxis, ferries and canal-cruise boats;
- Encouraging E-Taxis;
- Incorporating zero-emission in public transport concessions;
- Car sharing in the city, zero-emission;
- Additional advantages EV/hydrogen, e.g. shared use of bus/taxi lanes, parking policy, private lease arrangements?
- Limiting business-related transport emissions, based on the EED and statutory duty of care of companies, drawn up in the Environmental Management Act and the Activities (Environmental Management) Decree;
- Developing recognised and cost-effective improvement measures to limit the use of fossil fuels and transport emissions;
- Lobbying central government and the EU to remove legal barriers, such as BPM (private motor vehicle tax) on E-taxis and vans.
- To stimulate the purchase of cleaner mobility and equipment, as well as to encourage zero emissions in the case of civil engineering works, the police, etc. This can be done through the municipal's procurement policy and by making agreements with other authorities, such as Rijkswaterstaat, the province, water boards, regional police and so on.

What is needed in the longer term?
- Accelerated roll-out of basic hydrogen filling stations infrastructure and hydrogen fleet;
- Pilots for energy transition and distribution of charging capacity;
- Zero-emission contract transport.

Explanation of development paths (Figure 11 to Figure 15)
The various expectations and ambitions are shown for each track (behaviour, fossil, 0 emission, etc.) in a development path. It is not yet clear how many vehicles or how much infrastructure Rotterdam is aiming for and when. However, the desired direction is clear: for example, in the case of behaviour, the aim is to discourage car traffic (downwards arrow) in favour of public transport and bicycles (upwards arrow). We also assume that this ambition will be maintained from now until 2050 (the direction of the arrows remains the same). Measures to achieve this are mentioned under the development path. In this case, this includes improving public transport and public transport connections and improving the bicycle network. The situation is different for biofuels in passenger transport. Rotterdam is acting in line with national and international policy without additional measures in the city. We expect the use of biofuels to increase for the time being as a result of the European blending requirements for biofuels and the use of bio-CNG. After 2030, the use of biofuels in passenger transport will decline as a result of the increase in electric and hydrogen transport. No additional regional incentives or disincentives will be introduced.
Figure 11 Development path for sustainable passenger transport
Track 2: Making industry in Rotterdam more sustainable

Track 2 focuses on clean business operations and goods transport in the city. These include vans and trucks that have to enter the city and mobile equipment that is used by construction companies and industry in the port or city. Freight transport that does not have to be in the city is, where possible, deterred or encouraged to choose another route. Ideally, a further shift to fully zero-emission transport would be desirable: Measures that respond to this are described in the green deal zero emission city distribution and the Air Quality Policy Document. Additional policies are needed for mobile equipment and construction traffic.

What is the challenge?

- Improve air quality in Rotterdam (urgent); this requires additional targets for mobile equipment;
- Contribute proportionally to national and international CO₂ targets.

What is the commitment for the short and long term?

- Zero emission city distribution; stronger commitment than national;
- Reduce emissions from mobile equipment and vehicles by means of smart logistics and behavioural measures (economical operation, bundling of flows for last mile) and fleet change;
- Only if electrification is not possible is a low-emission (in terms of particulate matter, NOₓ and/or CO₂) solution appropriate, such as GTL, (bio)CNG, (bio)LNG;
- Hard target for zero emissions and for alternative fuels.

Why?

- In the longer term, the national focus will be on zero-emission city distribution and delivery vans;
- Due to the air quality in Rotterdam, reducing emissions in the city is more urgent than at the national level;
- Electric transport and hydrogen transport are the only two zero-emission energy carriers (tank-to-wheel). Electricity generation and production of hydrogen, the well-to-tank part, still produce emissions at present;
- Biofuels reduce calculated CO₂ but do not improve quality of life in the city (CO₂, NOₓ, particulate matter/EC). Potential implications for land use require attention;
- Gaseous fuels (GTL and LPG, CNG) produce a limited reduction in emissions compared to diesel (CO₂⁻¹⁸, NOₓ, particulate matter/EC). These fuels could yield an improvement for applications where suitable electrical solutions are not yet available (see Figure 13, track 3). There are also advantages in terms of noise levels;
- The costs for vehicles with a fully electric drive (hydrogen and battery) are still high, but the range for electric driving is often not an obstacle within the city;
- Zero-emission transport costs also call for the promotion of cleaner and more efficient engines and behavioural changes, such as IT applications and logistical cooperation on the last mile.

What is already happening in Rotterdam in the short term?

- (Extension) environmental zoning;
- Scrapping scheme;
- Lorry ban on ‘s Gravendijkwal;
- Green deal 010 ZES: smart logistics: fewer kilometres through combining, among other things;
- Green deal 010 ZES: good behaviour: gaming and training;
- Green deal 010 ZES: clean technology demand aggregation for large EVs (vans, lorries);
- Green deal 010 ZES: well-organised: (custom) privileges for large EV;
- Ecostars;
- Training courses for economical driving style;
- Stimulate transport over ‘The Ring’;
- Petrol stations with GTL;
- Pilots on port site for hydrogen-powered equipment (intention);
- Network of charging stations and fast charging stations;
- Improving sustainability (and reduction) of municipal fleet (electric unless...) with 60 vans and 18 heavier vehicles electric.

What else is needed in the short term?
- Policy on two-wheeled couriers (mopeds and scooters);
- Further roll-out of fossil fuel efficiency through behavioural measures;
- Sustainable logistics vehicles/utility vehicles city (garbage trucks, ambulances, greenery, fire brigade);
- Improving sustainability of vehicles construction/mobile equipment city (cranes, construction equipment, excavators, asphalt pavers);
- Additional advantages EV/hydrogen (shared use of bus lanes, parking permit, loading and unloading times);
- Developing recognised and cost-effective improvement measures to limit the use of fossil fuels and transport emissions; Examples include off-peak distribution;
- Reduce company transport emissions based on the EED and the statutory duty of care of companies laid down in the Environmental Management Act and the Activities (Environmental Management) Decree and make tax regulations such as MIA/Vamil that make investing in clean technologies fiscally attractive.

What is needed in the longer term?
- Roll-out of basic hydrogen filling station infrastructure;
- EMVI requirement for construction projects, sustainable transport and mobile equipment;
- Fast charging infrastructure for electric freight transport.
Figure 12 Development path for making industry in Rotterdam more sustainable
Track 3: Making the transport sector more sustainable

Track 3 will focus on improving the sustainability of the energy supply for heavier traffic that has its destination or point of departure in Rotterdam. This concerns road transport, shipping (maritime, inland waterway) and rail transport. Measures that respond to this are mentioned in the Sustainability Programme and the Port Vision and to a lesser extent also in the national action agenda.

What is the challenge?
- Supporting national targets from the fuel vision;
- Facilitate the seaport’s ambitions by using sustainable energy carriers in heavy transport, long-distance road transport, rail and shipping.

What is the commitment for the short and long term?
- Facilitate national and international shipping targets and Port Vision (maritime and inland shipping, trucks) by installing facilities for new fuels (LNG and biofuels) for refuelling;
- Develop/upgrade infrastructure for use of biofuels by shipping and aviation;
- Encourage the use of new fuels by users (LNG, biofuels and hydrogen);
- Stimulate efficiency improvements and behavioural changes, more rail and inland waterway transport, smart transport concepts;
- Reduce emissions from port area to meet the ambitions of the Sustainability Programme, preserve environmental usage space (air and noise) and long-term tasking for a low-carbon transport chain.

Why?
- For heavy transport, long-distance road transport, shipping and aviation, the sustainable alternatives consist of biofuels, LNG and hydrogen (national vision);
- The large-scale use of electric transport (battery) does not seem to be an option for heavy transport and long-distance road transport for the time being (see Figure 13), shore-based power for inland shipping has become the standard and expansion of the existing possibilities of shore-based power for seagoing navigation is a subject of further research;
- Rotterdam bunkers large volumes of fuel for shipping;
- Rotterdam and the Netherlands can strengthen their leading role in transport, distribution and logistics and the associated added value and employment by leading the way.

![Figure 13 Depiction of transport sector sustainability options;](image-url)
What is already happening or planned in Rotterdam?

- Ecostars;
- Platooning truck pilot;
- Encouraging modal shift to rail or inland waterways;
- Green deal efficient logistics construction;
- Facilitating conversion of ship engines for LNG;
- Implementation of LNG safety programme;
- Construction of LNG bunkering stations on land and ships;
- Construction of refuelling points for LNG cargo;
- Differentiation of port charges for LNG;
- Offering refuelling opportunities for biofuels in shipping;
- Making connections to shore power;
- Encouraging more electric transport on the Betuwe line;
- Limiting business-related transport emissions, based on the EED and the statutory duty of care of companies, drawn up in the Environmental Management Act and the Activities (Environmental Management) Decree;

What else is needed in the short term?

- Hydrogen and biofuel (passenger, freight and shipping) refuelling infrastructure;
- Expanding LNG refuelling opportunities (freight and shipping);
- Stimulating dynamic savings, hybrid vehicles and vessels in combination with shore power connection;
- Measures to make cruise ships more sustainable, particularly the use of energy during visits;
- Stimulating the purification of hydrogen from residues for use in transport;
- Further development of smart transport concepts (such as off-peak distribution) and linking of transport flows via distribution centres;
- Developing recognised and cost-effective improvement measures to limit the use of fossil fuels and transport emissions;
- Sustainable logistics vehicles/utility vehicles port (cargo handling equipment such as reach stackers on LNG, GTL and AGVs electric);
- Reorganising pilotage services, patrol vessels of Port Authority, port service providers (civil engineering, dredgers). Dredging company Boskalis is already piloting B30 biofuel (Goodfuel).

What is needed in the longer term?

- Transition of fossil infrastructure to partly bio-based infrastructure, supplemented by partly carbon capture and storage and optimal utilisation of residual heat and CO₂ from production processes. Meanwhile, research is being carried out into whether CO₂ can be converted into fuel and there are cooling concepts based on liquid CO₂.
Figure 14 Development path for greening the transport sector
Track 4: Opportunities for the seaport and industry

Track 4 is an anomalous track that focuses not on vehicles but on the opportunities arising from the production of sustainable energy carriers for the various modes of transport. Measures that respond to this are primarily mentioned in the Port Vision and follow from the national vision. This vision cannot be brought to fruition if the new fuels do not become available in the Netherlands at competitive costs. The Port Authority's vision focuses strongly on the necessary energy transition. For fuels, this concerns the production (trade, transhipment, supply) of new biofuels, LNG, hydrogen and possibly also (green) electricity. The Port Vision mentions a number of measures that fit in with this. Furthermore, measures can be derived from the need for energy carriers that follows from the national vision and the demand that follows from tracks 1, 2 and 3.

What is the challenge?

- Transforming dependence on fossil fuels into sustainable energy and raw materials for transport;
- Supporting national targets from the fuel vision by producing sufficient sustainable fuels and energy carriers;
- Fulfilling the ambition to be a frontrunner in the field of fuels, energy and sustainability.

What is the commitment for the short and long term?

- Supply raw materials for new fuels (biomass, LNG);
- Production of new and advanced biofuels (bio-kerosene, biodiesel) and hydrogen at an acceptable cost;
- Optimisation and more sustainable use of biomass through optimisation in bio-refinery, co-firing, use of chemistry;
- Achieving a comparable position in sustainable energy carriers as currently in fossil fuels in order to remain the engine of the economy. This applies to both the production (well-to-tank) and the use of fuels (tank-to-wheel);
- Optimisation of residual heat flows and useful application of CO₂;
- Opportunities for the storage of CO₂;

Why?

- For heavy transport, long-distance road transport, shipping and aviation, the sustainable alternatives consist of biofuels, LNG and hydrogen (national vision);
- For the time being, electric transport (battery) is not an option for heavy transport;
- The current fuels for these segments are mainly supplied via the Port of Rotterdam or produced in Rotterdam (diesel, kerosene);
- Rotterdam delivers kerosene via the pipeline to Schiphol Airport, Rotterdam and Frankfurt and bunkers large volumes of fuels for shipping;
- Rotterdam has a crucial role to play in making the national vision possible. Without the production and supply of sustainable fuels, the roll-out of the fuel vision for heavy transport, shipping and aviation will not be feasible;
- Rotterdam and the Netherlands can lose considerable added value and jobs if the role in supply and production is played by a foreign port in the long term;
- The demand for petrol will decrease and, in the long run, disappear due to electrification; Electricity demand is increasing, but it will also have to be generated in a fully sustainable
way by 2050. This presents opportunities for storage and buffering (e.g. in combination with a landfall point for wind energy).

What is already happening in Rotterdam in the short term?
- GATE terminal transhipment of LNG;
- Breakbulk terminal for distribution with smaller vessels;
- Presenting Rotterdam internationally as a pilot area for bio-based production
- Transhipment of biomass facilities;
- Plug and Play concept biofuels 2nd Maasvlakte;
- Research into biorefinery based on cascading;
- Encouraging production and marketing of bio-kerosene;
- Limiting business-related transport emissions based on the EED and the statutory duty of care of companies drawn up in the Environmental Management Act and the Activities (Environmental Management) Decree;

What else is needed in the short term?
- Facilitating/extending pilot projects and research on bio-based delta/bioport;
- Facilitating/extending pilots and research on biorefinery and hydrogen;
- Detailing of ‘deep decarbonisation pathways’.
- CO₂-aware purchasing strategies of municipal services, the Port of Rotterdam Authority, Rijkswaterstaat, police, fire brigade, etc.;
- Research, policy and investments aimed at buffering and storing electricity;
- Research and policy aimed at reducing the difference in cost price of sustainable alternatives;
- Developing recognised and cost-effective improvement measures to limit the use of fossil fuels and transport emissions;

What is needed in the longer term?
- Additional hydrogen production capacity;
- 100% green electricity/hydrogen;
- Mixing of bio-kerosene in pipeline or alternative transport;
- Continuation of efforts to develop the biofuel port.
Figure 15 Development path opportunities fuel approach for the seaport
Consideration of new initiatives and planned cooperation action programme

Not all measures and objectives can be influenced by Rotterdam itself or fall under the competent authority of Rotterdam. For this reason, we are working together with other stakeholders. Intensive cooperation and broad support are also important for achieving the objectives.

Meetings were therefore organised for tracks one and two under the leadership of the municipality to identify measures and select improvement proposals. The draft approach, which was drawn up in consultation with a limited number of parties, was discussed at that time and developed into an action programme. The Municipality of Rotterdam and RCI aim to have tracks three and four picked up by the port authority as part of planned initiatives such as the Deep decarbonisation pathways project and the Next Economy.

We expect this approach to make a broadly supported action programme possible. This is because the municipality itself is at the helm and can make preliminary commitments with regard to incentive schemes, facilitating participation, the development of business parks, the establishment of environmental zones, the granting of permits, the construction of urban infrastructure and communication to citizens and businesses, etc. Moreover, we are not starting again but are using all the ideas that are already present in Rotterdam and making allowance for a level playing field. In some cases, lobbying for a European or IMO approach will be more effective than developing individual policy. The realisation of non-fossil alternatives along all EU corridors also calls for a European approach and a higher level of scale than Rotterdam.
Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tr>
<td>AGV</td>
<td>Automatic guided vehicles</td>
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<tr>
<td>CNG</td>
<td>Compressed natural gas</td>
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<tr>
<td>CO₂</td>
<td>Carbon dioxide</td>
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<td>CPT</td>
<td>Clean Power for Transport</td>
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<td>EC</td>
<td>Elementary Carbon</td>
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<tr>
<td>ECA</td>
<td>Emission Control Area</td>
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<tr>
<td>EV</td>
<td>Electric Vehicle</td>
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<tr>
<td>GTL</td>
<td>Gas-to-liquid</td>
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<tr>
<td>IPCC</td>
<td>Intergovernmental Panel on Climate Change</td>
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<tr>
<td>I&amp;M</td>
<td>Ministry of Infrastructure and the Environment</td>
</tr>
<tr>
<td>KiM</td>
<td>Knowledge Institute for Mobility Policy</td>
</tr>
<tr>
<td>LEV</td>
<td>Light Electric Vehicle</td>
</tr>
<tr>
<td>LBG</td>
<td>Liquid biogas</td>
</tr>
<tr>
<td>LNG</td>
<td>Liquid natural gas</td>
</tr>
<tr>
<td>NOₓ</td>
<td>Nitrogen oxide</td>
</tr>
<tr>
<td>OV</td>
<td>Public transport</td>
</tr>
<tr>
<td>PHEV</td>
<td>Plug-in Hybrid Electric Vehicle</td>
</tr>
<tr>
<td>PM₁₀</td>
<td>Particulate matter</td>
</tr>
<tr>
<td>PPO</td>
<td>Pure plant oil</td>
</tr>
<tr>
<td>RCI</td>
<td>Rotterdam Climate Initiative</td>
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<tr>
<td>SECA</td>
<td>Sulphur Emission Control Area</td>
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<tr>
<td>SER</td>
<td>Economic and Social Council</td>
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<tr>
<td>SO₂</td>
<td>Sulphur dioxide</td>
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<tr>
<td>SV</td>
<td>Special Vehicles</td>
</tr>
<tr>
<td>TiW</td>
<td>Tank to Wheel</td>
</tr>
<tr>
<td>WtT</td>
<td>Well to Tank</td>
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</table>
## Calculation of volumes required for new energy carriers

### National Fuel Vision Goals

<table>
<thead>
<tr>
<th>Category</th>
<th>Calculation</th>
<th>Source</th>
</tr>
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<tbody>
<tr>
<td>Bio-kerosene</td>
<td>Volume (kton)</td>
<td>2020 2030</td>
</tr>
<tr>
<td>Bio-marine diesel</td>
<td>Number of vessels</td>
<td>2020 2030</td>
</tr>
<tr>
<td>(FAME, 7% burning)</td>
<td>Consumption per vessel (kton, 7%)</td>
<td>2020 2030</td>
</tr>
<tr>
<td>GTL</td>
<td>Number of vessels</td>
<td>2020 2030</td>
</tr>
<tr>
<td></td>
<td>Consumption per vessel (kton)</td>
<td>2020 2030</td>
</tr>
<tr>
<td></td>
<td>Volume (kton)</td>
<td>2020 2030</td>
</tr>
<tr>
<td>Biodiesel PPO</td>
<td>Number of vessels</td>
<td>2020 2030</td>
</tr>
<tr>
<td></td>
<td>Consumption per vessel (kton)</td>
<td>2020 2030</td>
</tr>
<tr>
<td></td>
<td>Volume (kton)</td>
<td>2020 2030</td>
</tr>
<tr>
<td>Biodiesel HVO</td>
<td>Number of vessels</td>
<td>2020 2030</td>
</tr>
<tr>
<td></td>
<td>Consumption per vessel (kton)</td>
<td>2020 2030</td>
</tr>
<tr>
<td></td>
<td>Volume (kton)</td>
<td>2020 2030</td>
</tr>
<tr>
<td>LNG international shipping</td>
<td>Number of vessels</td>
<td>2020 2030</td>
</tr>
<tr>
<td></td>
<td>Consumption per vessel (kton)</td>
<td>2020 2030</td>
</tr>
<tr>
<td></td>
<td>Volume (kton)</td>
<td>2020 2030</td>
</tr>
<tr>
<td>LNG inland shipping</td>
<td>Number of vessels</td>
<td>2020 2030</td>
</tr>
<tr>
<td></td>
<td>Consumption per vessel (kton)</td>
<td>2020 2030</td>
</tr>
<tr>
<td></td>
<td>Volume (kton)</td>
<td>2020 2030</td>
</tr>
<tr>
<td>LNG lorries</td>
<td>Number of lorries</td>
<td>2020 2030</td>
</tr>
<tr>
<td></td>
<td>Consumption per vehicle (MJ/km)</td>
<td>2020 2030</td>
</tr>
<tr>
<td></td>
<td>Transport performance per year (km)</td>
<td>2020 2030</td>
</tr>
<tr>
<td></td>
<td>Volume (PJ)</td>
<td>2020 2030</td>
</tr>
<tr>
<td></td>
<td>Volume (kton)</td>
<td>2020 2030</td>
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<tr>
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<td>2020 2030</td>
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<td></td>
<td>Transport performance per year (km)</td>
<td>2020 2030</td>
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<tr>
<td></td>
<td>Volume (PJ)</td>
<td>2020 2030</td>
</tr>
<tr>
<td></td>
<td>Volume (kton)</td>
<td>2020 2030</td>
</tr>
<tr>
<td>Hydrogen vans</td>
<td>Number of vans</td>
<td>2020 2030</td>
</tr>
<tr>
<td></td>
<td>Consumption per vehicle (MJ/km)</td>
<td>2020 2030</td>
</tr>
<tr>
<td></td>
<td>Transport performance per year (km)</td>
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<tr>
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<td>Volume (PJ)</td>
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<tr>
<td></td>
<td>Volume (kton)</td>
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</tr>
<tr>
<td>Hydrogen lorries</td>
<td>Number of lorries</td>
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<tr>
<td></td>
<td>Consumption per vehicle (MJ/km)</td>
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<td>Transport performance per year (km)</td>
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<tr>
<td></td>
<td>Volume (PJ)</td>
<td>2020 2030</td>
</tr>
<tr>
<td></td>
<td>Volume (kton)</td>
<td>2020 2030</td>
</tr>
<tr>
<td>Hydrogen buses</td>
<td>Number of buses</td>
<td>2020 2030</td>
</tr>
<tr>
<td></td>
<td>Consumption per vehicle (MJ/km)</td>
<td>2020 2030</td>
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<tr>
<td></td>
<td>Transport performance per year (km)</td>
<td>2020 2030</td>
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<tr>
<td></td>
<td>Volume (PJ)</td>
<td>2020 2030</td>
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<tr>
<td></td>
<td>Volume (kton)</td>
<td>2020 2030</td>
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**Total hydrogen**

<table>
<thead>
<tr>
<th>Calculation</th>
<th>Source</th>
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</thead>
<tbody>
<tr>
<td>Volume (kton)</td>
<td>0.7 25.2</td>
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</table>
The proportional translations for Rotterdam are not ambitions or hard goals that Rotterdam sets itself, but a translation based on the number of registrations, without a correction for the higher share of heavy traffic [NO AMBITIONS LIST FOR ROTTERDAM]

<table>
<thead>
<tr>
<th>National sectoral ambitions</th>
<th>Proportional translation Rotterdam</th>
<th>Quantity</th>
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</thead>
<tbody>
<tr>
<td>Infrastructure road (#)</td>
<td>2020</td>
<td>2030</td>
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<tr>
<td>EV charging stations, public</td>
<td>70,000</td>
<td>720,000</td>
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<tr>
<td>Green gas refuelling stations CNG</td>
<td>250</td>
<td>250?</td>
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<tr>
<td>LNG refuelling stations, trucks</td>
<td>30</td>
<td>115</td>
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<tr>
<td>LNG refuelling stations, ships</td>
<td>7</td>
<td>?</td>
</tr>
<tr>
<td>Hydrogen refuelling stations passenger vehicles, vans, lorries</td>
<td>20</td>
<td>200</td>
</tr>
<tr>
<td>Hydrogen refuelling stations, buses</td>
<td>6</td>
<td>40</td>
</tr>
<tr>
<td>Buses, public transport</td>
<td>2020</td>
<td>2030</td>
</tr>
<tr>
<td>EV</td>
<td>500</td>
<td>3,470</td>
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<tr>
<td>H</td>
<td>75</td>
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<tr>
<td>CNG</td>
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<tr>
<td>Coaches</td>
<td>LNG</td>
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<tr>
<td>LEV’s</td>
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<td>625,000</td>
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<tr>
<td>E-bikes</td>
<td>2,000,000</td>
<td>3,000,000</td>
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<tr>
<td>speed bikes</td>
<td>200,000</td>
<td>500,000</td>
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<tr>
<td>Cars</td>
<td>2020</td>
<td>2030</td>
</tr>
<tr>
<td>EV/PHEV</td>
<td>200,000</td>
<td>2,000,000</td>
</tr>
<tr>
<td>H</td>
<td>2,000</td>
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<tr>
<td>LPG</td>
<td>265,000</td>
<td>705,000</td>
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<tr>
<td>CNG</td>
<td>73,000</td>
<td>700,000</td>
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<tr>
<td>Vans</td>
<td>2020</td>
<td>2030</td>
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<tr>
<td>EV (FEV and PHEV)</td>
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<td>8,400</td>
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<tr>
<td>H</td>
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<tr>
<td>LPG (light cargo)</td>
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<tr>
<td>CNG (light cargo and SV)</td>
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<tr>
<td>LNG (box lorries and tractor-trailers)</td>
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<td>29,400</td>
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<tr>
<td>Ships (#)</td>
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<td>Inland shipping</td>
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<td>STL</td>
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<td>250</td>
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<td>hybrid</td>
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<td>Shipping</td>
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<tr>
<td>Canal cruise boats</td>
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<tr>
<td>Water taxis</td>
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<td>Not determined</td>
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<tr>
<td>Fuel production (in kton)</td>
<td>National sectoral ambitions</td>
<td>Proportional translation Rotterdam</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>----------------------------</td>
<td>------------------------------------</td>
</tr>
<tr>
<td></td>
<td>2020</td>
<td>2030</td>
</tr>
<tr>
<td>Bio-kerosene (aviation)</td>
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<td>1782</td>
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<td>Bio-marine diesel (FAME)</td>
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<tr>
<td>Biodiesel (PPO)</td>
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<td>135</td>
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<tr>
<td>HVO shipping</td>
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<td>LNG shipping</td>
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<td>LNG lorries</td>
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<td>191</td>
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<td>GTL shipping</td>
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<td>22.5</td>
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<tr>
<td>Hydrogen production</td>
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<td>25</td>
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