PORT OF ROTTERDAM

CO₂ NEUTRAL.

RIGHT HERE RIGHT NOW.
MAKE IT HAPPEN.
As global hub and European industrial cluster, the Port of Rotterdam and industrial area is the gateway to Europe. A global intersection of freight, services, logistics and energy. Via the port and the hinterland, we reach 500 million consumers.

2017 figures
CO₂ EMISSIONS
BY INDUSTRY BASED IN THE PORT

33.1 MT
IN 2017

8.5 MT
REFINERIES

10.7 MT
COAL-POWERED PLANTS

3.9 MT
GAS-POWERED PLANTS

1.6 MT
WASTE PROCESSING

0.4 MT
OTHER INDUSTRY

3.0 MT
PRODUCERS OF INDUSTRIAL GASES

5.0 MT
CHEMICAL COMPANIES

17%

FIGURES FOR ROTTERDAM/MOERDIJK COMBINATION

467.4 MILLION TONNES
OF FREIGHT THROUGHPUT

13.7 MILLION
TEU CONTAINERS

€ 23,000,000
ADDED VALUE (APPROX. 3.3% GDP)

180,000
JOBS

3,000
BUSINESSES

105,000
INLAND VESSELS PER YEAR

30,000
SEA-GOING VESSELS PER YEAR

3,000
BUSINESSES

13.7 MILLION
TEU CONTAINERS

180,000
JOBS

2017 figures
SHORT-TERM MEASURES AND RADICAL INNOVATIONS ARE NEEDED TO REALISE OUR AMBITION.
WHAT WE STAND FOR

Global warming is a huge challenge for the world. The emission of greenhouse gases such as CO₂ and methane needs to be reduced significantly. It was agreed in the Paris Climate Agreement to reduce global warming to a maximum of 2 °C, and preferably 1.5 °C. Some 200 countries support this agreement.

The Netherlands also signed this agreement. To meet the agreement in practice, the cabinet aims to reduce greenhouse gases by 49% by 2030 compared with 1990, and preferably by 55%.

Emissions must be reduced by 95% by 2050. The Port of Rotterdam Authority is adhering to the same objectives as the national task.

Industry emissions in this area were almost twenty per cent of our country’s total emissions. This means that Rotterdam has a lot to offer for the climate. In partnerships with companies, we are working towards a CO₂ neutral port. With this we mean that we have a port with an industrial landscape that has no net negative consequences for our climate.

THE TASK

Our task is crystal clear: we aim to bring the Port of Rotterdam in line with the Paris Climate Agreement objectives. In partnerships with companies, we are working towards a CO₂ neutral port. With this we mean that we have a port with an industrial landscape that has no net negative consequences for our climate.

This demands radical innovation and new technologies. These will be developed and tested in pilot projects. In the meantime, we are already taking measures to reduce emissions as far as possible in the short term, such as the plan to store CO₂ below the sea bed in the coming years. This will give industrial sectors sufficient time to implement more structural changes in business processes and will prevent any unnecessary value destruction.

The Port of Rotterdam Authority is pleased to take a steering role in two important tasks:

1 WHAT WE STAND FOR

2 OPPORTUNITIES FOR A STRONG COMPETITIVE POSITION

The challenges of the energy transition offer opportunities to make the Port of Rotterdam an excellent example at global level. We will succeed in this if we do not see the energy transition as the end of an industrial age, but as the start of a new and sustainable economy. It is exactly here, in the Port of Rotterdam, that we can realise the energy transition. The available industry and knowledge means that all the ingredients for leadership in this sector are readily available.

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The energy transition is achievable with a common, area-focused approached. The energy transition is too big for one company or organisation. Cooperation is the keyword and scale is a condition. That is why we are building coalitions to help existing industries to innovate and to welcome new, sustainable companies.

If we succeed in this, the business climate will also improve. And that, in turn, will attract new industries, jobs and innovation.
WE CAN MAKE IT HAPPEN!

SCENARIOS FOR A CO₂ NEUTRAL PORT

The German Wuppertal Institut researched in 2017 whether a CO₂ neutral port is feasible in line with the Paris Climate Agreement.

INDUSTRIAL CLUSTER

The task for the Rotterdam industrial cluster is considerable and complex. From 2030, the industry for energy consumption and production processes needs to switch from fossil fuels to an entirely new system. A radical transition is needed for this, for which we already need to take the necessary steps. For example, by handling energy more efficiently in combination with the capture and underground storage of CO₂.

WHAT CAN WE DO?

Wuppertal indicates that industry can achieve a total of 98% CO₂ reduction. Various transition routes have been defined for this. A combination of various routes is needed to achieve the objective.

1. CLOSED CARBON CYCLE

98% CO₂ REDUCTION 2050 vs. 2015

- Water electrolysis (H₂ production)
- Synthetic fuel & bio-based production
- Heat grid extension
- Power to heat & geothermal heat
- Large scale availability of sustainable biomass
- Widescale implementation of Paris Agreement
- Increased share of renewable electricity (wind/solar)

2. BIOMASS AND CCS

98% CO₂ REDUCTION 2050 vs. 2015

- Power to heat
- Water electrolysis (H₂ production)
- 100% biomass/waste-fired power plants (+ CCS)
- Heat grid extension
- Large scale availability of sustainable biomass
- Reinvestments in refineries and petrochemical plants

3. TECHNOLOGICAL PROGRESS

75% CO₂ REDUCTION 2050 vs. 2015

- Power to heat
- Water electrolysis (H₂ production)
- Large scale CCS (for power plants and refineries)

4. BUSINESS AS USUAL

30% CO₂ REDUCTION 2050 vs. 2015

- Power to heat (small scale)
- Water electrolysis (H₂ production)
- Reinvestments in refineries and petrochemical plants
- Rapid adoption of best available technologies (energy efficiency)
- Carbon capture and storage

WE CAN MAKE IT HAPPEN!
TRANSPORT- AND LOGISTICS SECTOR

Wuppertal Institut was commissioned by the Port Authority to conduct further research in 2018, this time into transport and logistics sector CO₂ emissions. In other words: all shipping by sea and towards the hinterland with the Port of Rotterdam as departure or end destination. This concerns an annual 25 million tonnes of CO₂. With routes between, for example, China and Rotterdam, the majority (21.5 million tonnes) can be attributed to marine transport. If we do nothing, it is expected that CO₂ emissions from shipping will increase by between 50% and 250% by 2050.

Wuppertal has identified two important tasks for both maritime and hinterland transport on the route to climate-friendly shipping.

1 DECARBONISATION OF MARITIME TRANSPORT

In the short term, technical and operational measures can reduce CO₂ emissions for the maritime industry. Efficiency measures in fuel consumption can result in a 20% to 50% reduction. In the medium term, we need to switch to electric propulsion, hydrogen and synthetic fuels such as methanol. LNG and biofuels can be used as transition fuel between 2020 and 2050.

2 DECARBONISATION OF HINTERLAND TRANSPORT

The same measures apply here regarding efficiency and the switch to alternative fuels. What can deliver an additional contribution is the switch from road transport to inland shipping.

1 Closed Carbon Cycle
This route focuses largely on closing cycles. Fossil fuels will still be used, but only for products, and these will almost all be fully recycled.

2 Biomass and CCS
Biomass and Carbon Capture & Storage (CCS) relies heavily on capturing, storing and reusing CO₂, combined with biomass as raw material for the chemical industry.

3 Technological Progress
This latter route offers a reduction of 75%. The most important elements in this are the large-scale capture, use and storage of CO₂, and further technological development.

4 Business as Usual
This scenario will not result in any sharp reversal in trends. The ‘best available technology’ will make industry more efficient and will result in lower CO₂ emissions. The expectation is that production will also be reduced in line with the reduced demand for fuels. The result will be 30% lower CO₂ emissions by 2050.

25 MT CO₂ EMISSIONS PER YEAR IN THE PORT OF ROTTERDAM
The energy transition comprises many steps by many parties over a long period, through which we can work step by step towards a CO₂ neutral industrial complex. Waiting is not an option! That is why we have initiated 7 programmes in which we develop projects together with partners. Over forty projects have now started. Our strategy is and-and: we help the existing industry to make drastic reductions in their CO₂ emissions while also attracting new, sustainable industry.

**ECONOMY WITH BIOMASS AS RAW MATERIAL**

We aim to move from an economy that runs on fossil fuels to an economy that uses biomass as raw material. Biomass originates from vegetable or animal material as well as from waste streams from agriculture and production processes. It is a good replacement for fossil fuels in industry in applications such as liquid fuels and chemicals. The Port of Rotterdam already houses the world’s largest industrial cluster that uses biomass as raw material.

**ENERGY EFFICIENCY**

One of the biggest costs for industry in the port is energy consumption. That is why there is a continuous search for measures to reduce consumption. By optimising processes and introducing new technologies such as improved heat integration, insulation and process optimisation, potentially an additional 20% energy savings can be made. This programme is being led by Deltalinqs, the business community representative in the port.

**LARGE-SCALE ELECTRIFICATION**

Industrial companies in the port mainly use energy to generate heat for their production processes. Towards 2050, industry will switch to a new energy system. Electrification based on solar or wind power or produced from hydrogen will then be an important energy carrier. This concerns a gradual transition with hybrid and flexible solutions.

**ALTERNATIVE FUELS**

Modes of transport will change towards 2050. More and more transport will become electric and the requirement for clean, sustainable fuels will increase. The Port of Rotterdam will also promote alternative fuels for transport in the future, with fuels from biomass and waste, or with emission-free propulsion systems based on sustainably-generated electricity.
**ENERGY INFRASTRUCTURE**

Today, the Port of Rotterdam has a unique energy infrastructure, that enables companies to produce efficiently. A new energy infrastructure will result in companies being able to operate efficiently and sustainably in the future. For instance, a central infrastructure is being developed for residual heat, steam and CO₂. The large quantities of heat and steam that are released in the port can thus be reused effectively and CO₂ can be transported to locations for storage or reuse.

**CIRCULAR ECONOMY**

In the circular economy we reuse products and substances as far as possible. The Port of Rotterdam will become a reuse hub. Waste will become a raw material and cycles will be closed as far as possible to minimize the introduction of new raw materials in the production chains. In a circular economy, production and consumption are as clean as possible. Waste is only incinerated to generate electricity if nothing else can be done with the residual product.

**PROJECTS**

There are currently over 40 projects in various stages of development. The Port Authority is applying a project funnel with strict criteria to develop concepts and ideas and to monitor realisation.
PARTNER COALITIONS AND PILOT PROJECTS

Together with companies, knowledge institutes and governments, we started CO\textsubscript{2} reduction projects that will make the Port of Rotterdam a sustainable main port. Partner coalitions are at the foundation of the projects that are currently being developed. Partnerships between sometimes extremely diverse parties that demonstrate ambition, understand the urgency and, together, make the difference. Together, we shape the transition by focusing on initiatives that contribute to economic innovation, we utilise new technologies, we test innovations in practice and we link existing companies to new ones.
FROM WASTE TO METHANOL
A Waste-to-Chemicals installation in Botlek with which waste is processed into syngas and later to clean methanol for the chemical industry and transport sector. First installation of this type in Europe.

Partners: Enerkem, Air Liquide, AkzoNobel and Port of Rotterdam Authority.
Investment: €9 million in initial expenses.
$CO_2$ reduction / year: 0.3 million tonnes.

HEAT NETWORK SOUTH HOLLAND
Residual heat from the port and heat from geothermal sources will heat households, greenhouses and companies in South Holland. With this, natural gas for heating will be a thing of the past.

Partners: Provincie Zuid-Holland, Gasunie, Eneco, WBR, Port of Rotterdam Authority.
$CO_2$ reduction / year: 2 million tonnes (and a reduction of 1.3 billion m³ of natural gas from Groningen per year).

ENERGY ISLAND ON THE NORTH SEA
A sustainable European energy system on the North Sea to connect offshore wind farms and then convert the wind power on the island into green electricity or sustainable hydrogen.

Partners: TenneT, Energinet, Gasunie and Port of Rotterdam Authority (North Sea Wind Power Hub-consortium).

CO2 STORAGE BENEATH THE NORTH SEA
A basic infrastructure throughout the port area for transport, use and underground storage of $CO_2$. This $CO_2$ is partly used by the greenhouse horticulture industry. A large majority will be stored in empty gas fields beneath the North Sea.

Partners: Gasunie, EBN and Port of Rotterdam Authority.
$CO_2$ storage / year: 2–5 million tonnes.
**SOLAR PANELS IN THE PORT**
The Port Authority is installing solar panels on its own property and is stimulating clients to install solar panels on their roofs. Returns: 50-100 MW electricity supplied to 15,000 - 30,000 households.

**MORE AND MORE WIND POWER**
Approximately 10 per cent of the total wind power capacity in our country, some 200 MW, is located in the Port of Rotterdam. At least 150 MW wind power will be added to this in 2020. Returns: 350 MW wind capacity in 2020.

**OWN FOOTPRINT**
The Port Authority is also reducing its own footprint: A third of the patrol vessels runs 100% on biofuel. We are also stimulating employees to travel by public transport or bicycle. For leased car drivers a CO2 standard of 59 g/km applies. The office uses heat from the port and green electricity. And throughout the port, the Port Authority is replacing lighting with LED. Returns: 20% reduction per year, with 49% reduction by 2030.

**CLEANER SHIPPING**
The Port Authority has an incentive scheme of 5 million euro for climate-friendly shipping; shipping owners and charterers who experiment with low-carbon or zero-carbon fuels that are supplied in Rotterdam can benefit from reductions; for inland shipping a reduction of 100% on inland port dues applies if the platinum Green Award certificate requirements are met (sailing on electric or fuel cells for at least 50% of the time or 3 hours a day) and if the vessel participates in Nextlogic, as soon as this is operational. Nextlogic is a digital planning tool to optimise the handling of inland container shipping in the Port of Rotterdam.

**PRONTO**
Digital applications also contribute to an important efficiency improvement for the approximately 30,000 sea-going vessels that call at the Port of Rotterdam every year. With Pronto, waiting times can be reduced by 20%. Pronto results in improved port terminal occupancy and good coordination and services such as bunkering, maintenance and stocking.

**BLOCKLAB**
Blockchain technology will be an important enabler for the future energy system. Blocklab, the field lab for blockchain in the Port of Rotterdam, has four innovation projects with solutions for the energy market. With these four initial innovation projects, Blocklab wants to contribute to the acceleration of the energy transition.

Four prototypes have now been developed, focusing on the heat market, offshore wind farms, smart meters and consumers wishing to trade self-generated electricity.

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NEW ECONOMY, NEW POLICY

For a new economy we need new rules that offer space to innovation. The Port Authority considers it important that a Northwest European coalition is initiated to introduce a joint, much higher CO₂ price. This stimulates companies to invest in clean technologies and innovation. Such a coalition would guarantee a level playing field for the industry. The Dutch government can help create this coalition by developing an industrial policy under the banner of: international pricing, national incentives. For the greatest acceleration towards the transition, it is important to have an integrated vision on the new economy. This calls for an image of the future industrial landscape and what is needed for R&D.

Conditions that can support the energy transition in the Port of Rotterdam are:

- **REDUCTION IN INVESTMENT RISKS**
  The covering of the unprofitable top section of business cases, stimulating supply, promoting demand, making existing technologies and/or innovation profitable and ensuring immediate results in CO₂ reduction. A port transition fund can contribute to this.

- **LEGISLATION AND REGULATIONS THAT OFFER STABILITY**
  An optimal business climate requires stability in the form of a long-term investment climate and certainty on all administrative levels. A climate act can contribute to this.

- **NOT JUST WORDS BUT DEEDS**
  Facilitating innovation programmes that will play an important role towards 2050. Examples include power to X (gas, heat, chemicals) and CCUS. Agreements about research and investment programmes, financing and risk reduction are required.

“FOR A NEW ECONOMY WE NEED NEW RULES THAT OFFER SPACE TO INNOVATION.”

VIEW ALLARD CASTELEIN’S SPEECH ABOUT THE ENERGY TRANSITION
A NEW ENERGY SYSTEM.

WITH A RADICAL CHANGE TOWARDS 2050

The climate objective for 2050 demands new technologies and radical innovation of our energy and raw material system. Radical innovation takes time. That is why we’re taking as many measures as possible along this route to minimise emissions in the short term. And we are building knowledge with pilot and demonstration projects to realise innovation.
We are focusing on initiatives that can contribute to the transition towards a CO₂ neutral economy and economic innovation; initiatives that can be scaled up.

We will organise the transition case-by-case and test innovations in practice.

We will link existing and new companies.

We will share our knowledge.

We will co-invest and participate in initiatives that make a vital contribution to the big picture.

Do you want to contribute to the energy transition in the Port of Rotterdam? We are always searching for new partnerships with enthusiastic partners who have innovative ideas.

For further information, please contact the Port Authority:

DO YOU HAVE AN IDEA? LET’S BRING IT TO LIFE HERE!

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