

# RESOURCE TRANSITION CIRCULAR BY 2050



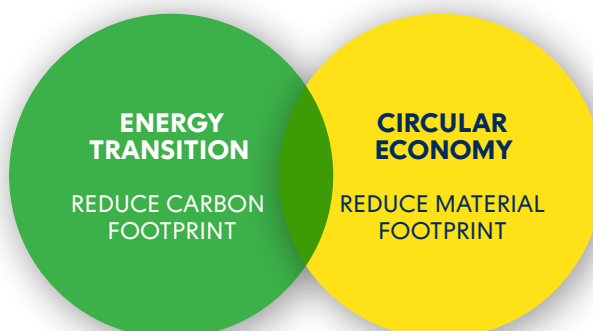
**The Netherlands has expressed its ambition to realise a carbon-neutral energy system and a fully circular industry in the next 30 years. Oil, natural gas, and coal will no longer be used. The Port of Rotterdam Authority endorses this ambition and fully focuses on the resource transition.**

The reasons are clear: the availability of resources is limited and extracting them causes damage to the environment and biodiversity world-wide. What is more, a large part of fossil fuels will sooner or later end up as CO<sub>2</sub> in the atmosphere or in the form of microplastics in the ocean, with all its consequences.

There are alternatives. Crude oil and natural gas are currently the sources of hydrocarbons - combinations of carbon (C) and hydrogen atoms (H) - which we process into products that are used on a daily basis, from light-weight plastics to medicines and from paint to clothing. We can extract carbon and hydrogen also from CO<sub>2</sub>, green hydrogen, 'waste' and biomass. In a fully circular industry, we only use these sustainable resources.

consists of crude oil, oil products, liquified natural gas (LNG), and coal. A large part of this is immediately transported to destinations in the hinterland, whereas part of it is processed in Rotterdam refineries and petrochemical plants. In the next few decades, this stable source of jobs and income will largely dry up.

The ports of Rotterdam and Moerdijk currently account for 565,000 jobs and 8.2% of GDP in the Netherlands. To safeguard employment and the earning capability of the port in the future, it is essential that we develop new, circular production processes. By making the transition to more sustainable and circular production methods in a timely manner, we can ensure that the industry cluster remains modern, vigorous and competitive.



## IMPACT ON THE CURRENT EARNING CAPABILITY

Discontinuing the use of oil, natural gas, and coal has a huge impact on the current cargo flows and on the industry by which the cargo is processed. About half of the cargo transhipped in Rotterdam today

## INDUSTRY ATTRACTS CARGO AND INVESTMENTS

To create added value and to be less dependent on import, housing production capacity is preferred. Industry generates added value and employment, but it also yields cargo. Take the Rotterdam refining cluster, which processes about 50 million tons of crude oil into more than 40 million tons of fuels and raw materials for the chemical sector. Due to this cluster, Rotterdam has grown into the largest energy port in Europe, with raw materials and semimanufactures coming in and products going out. The presence of industry leads to transshipment activities, jobs and high added value to the region and the Netherlands. Besides, new industry will lead to follow-up investments for many years to come, for instance in maintenance, modernisation and extension of the capacity, which

in the course of several decades are often a multiple of the initial investments. As a rule of thumb it can be stated that during a major maintenance stop, which takes place once every five years, about ten percent of the value of a plant is reinvested. Companies ceasing production is rare. The number of shut-downs in the refinery and petrochemical sector since the fifties and sixties can be counted on one hand.

### CURRENT INDUSTRY AS A BASIS

Thanks to the current cluster, Rotterdam has a firm basis for the necessary resource transition.

The refineries of the future producing sustainable fuels and raw materials for the chemical industry will look more or less the same. They still make the same or comparable products. The difference is that they use renewable rather than fossil-based feedstocks. With the present-day infrastructure and utilities, combined with the knowledge and skills available in Rotterdam nowadays, a flying start is possible.

### TRANSITION STRATEGY BASED ON FOUR PILLARS

The strategy of the Port of Rotterdam Authority concerning a carbon-neutral, circular economy is based on four pillars.

- Pillar 1: increasing the efficiency of the existing industry, building (extra) infrastructure for heat, CO<sub>2</sub>, electricity and hydrogen.
- Pillar 2: modernising the energy system by making the transition from fossil energy carriers to green power and hydrogen.
- Pillar 3: moving towards a new fuel and raw material system.
- Pillar 4: making transport more sustainable.

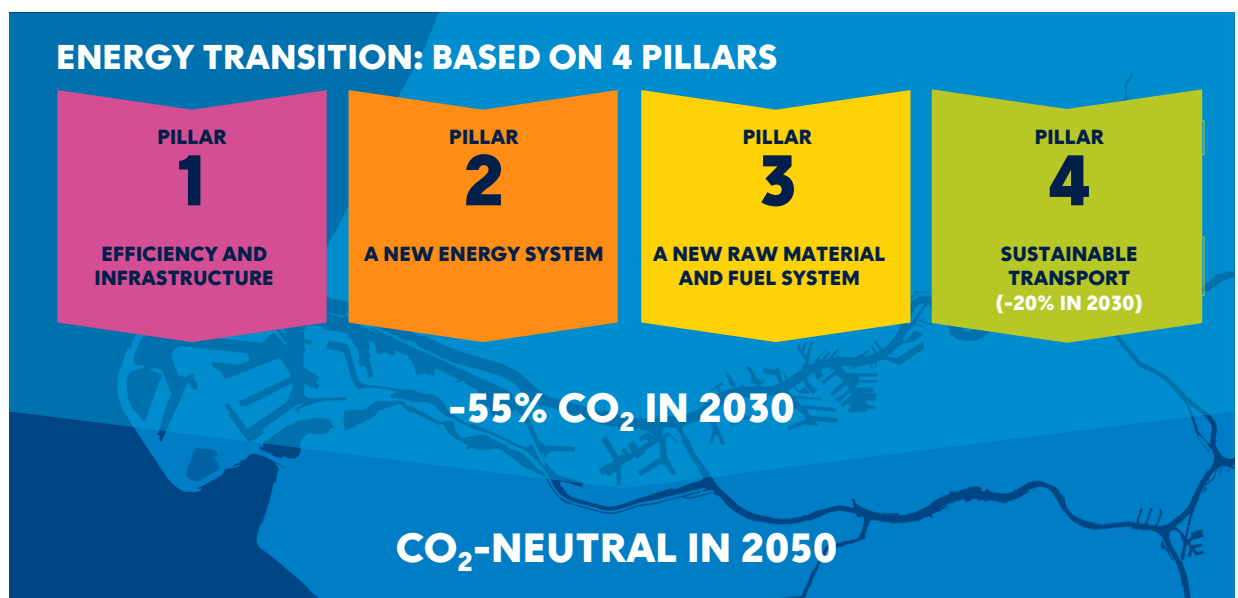
These pillars are interconnected to a great extent. Hydrogen, for instance, is not only used as a fuel (pillars 2 and 4) but also as feedstock for the industry (pillar 3). With the production of green hydrogen (by means of using green electricity to split water into hydrogen and oxygen) much heat is released, which can be used in a heat grid (pillar 1).

An example of a pillar-3 project is the production of sustainable jet fuel from waste or biomass. Other examples include battery recycling or the conversion of waste plastic via pyrolysis into a raw material for cracker units in the chemical industry.

### TAKE CARE OF THE PENNIES...

Rotterdam is a port of high volumes and figures (pillar 3) requires a mix of CO<sub>2</sub>, green hydrogen, biomass and 'waste'. These are the raw materials for chemical products, such as the plastics, coatings, packing materials, clothing and insulation materials we use every day. Transport (pillar 4) will primarily use electricity, hydrogen and synthetic fuels, depending on modality, distance and weight.

The pace of the resource transition is hard to predict and depends on technical and especially political and economic factors. At this moment, it is expected that the fossil production volume will not diminish substantially in the years until 2030. The aim is that in the same period the share of non-fossil fuels and chemicals grows to 20% of the total of fuels and chemicals produced in 2021.



## COMPETING WITH FOSSIL?

The resource transition requires perseverance. We do not need to create an ideal world overnight. The new technologies will gradually become better and better, their efficiency will increase, and their emissions will decrease. Consequently, these new technologies will become more competitive, and some technologies will prove to be more successful than others. Be that as it may, support is needed in the beginning. Financial support as well as other forms of support. After all, the transition is not primarily driven by market developments but by the wish (or necessity) in society to render energy management carbon-neutral and the industry circular.

The energy transition and resource transition are facing many challenges. In over one hundred years, the current industry that is based on fossil commodities has developed into a sector in which technology, market (demand for and supply of products) and earning models respond to each other well. For new production processes this is true to a lesser extent. This means that calculations of earning models hardly add up without government support and that investments in infrastructure – not utilised optimally right from the start (the so-called loading risk) – take long to be recovered. The development of demand for circular and bio-based products is crucial. The blending obligation for fuels, for instance, has led to a healthy business

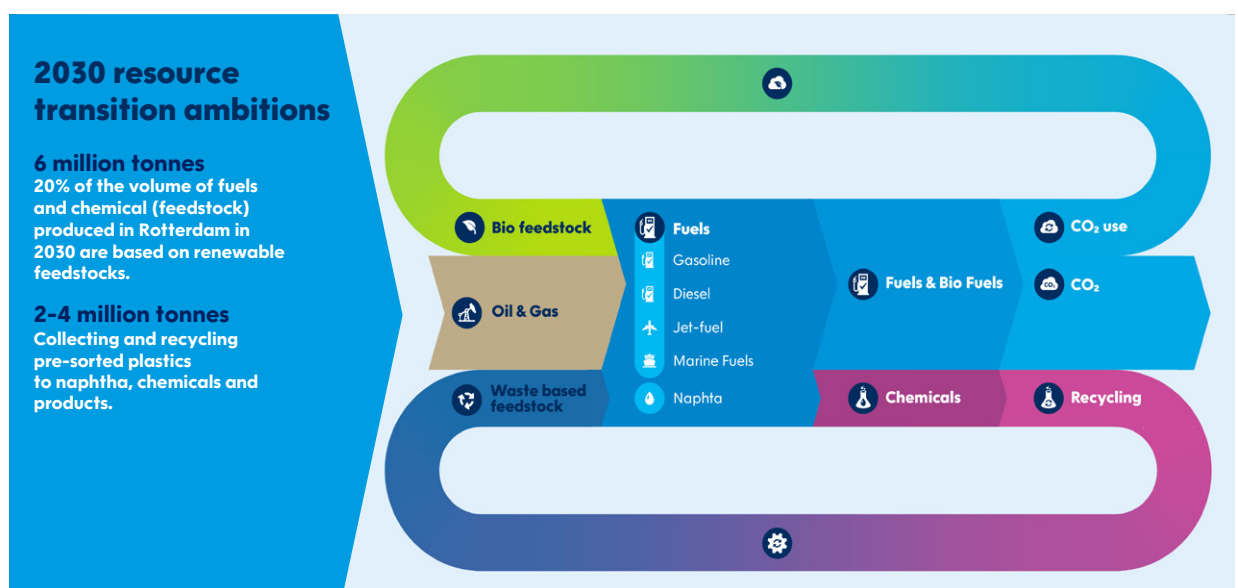
## NO HOLY GRAIL

Studies indicate there is not a single holy grail. Various technologies will have to be developed parallel and be used in various combinations. Green power and green hydrogen are crucial for making the energy system sustainable (pillar 2). A circular industry (pillar 3) requires a mix of CO<sub>2</sub>, green hydrogen, biomass and 'waste'. These are the raw materials for chemical products, such as the plastics, coatings, packing materials, clothing and insulation materials we use every day. Transport (pillar 4) will primarily use electricity, hydrogen and synthetic fuels, depending on modality, distance and weight.

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## WHAT IS NEEDED

This calls for decisions for the long term. This does not only apply to decisions made by the Port Authority but also to those made by governments and businesses. It could involve opting for projects that may not have the most favourable business case right now -



case for biofuel production. In a similar way, we need policies for developing circular plastics, synthetic fuels, etc. The production of sustainable kerosene will only be feasible if there is sufficient certainty about demand for the product.

projects with more uncertainties than the standard projects in logistics or petrochemistry but which are very important in bringing about a vigorous, carbon-neutral and circular industry cluster by 2050.



This is why the Port of Rotterdam Authority is doing its utmost to realise specific infrastructure projects as well as company establishments and expansions that fit in with the transition strategy. These activities lead to improved sustainable technologies, causing the cost price of products to drop. This will lead to more favourable earning models and renders the port of Rotterdam an attractive location for establishing industry, which contributes to retaining economic activity and employment.

Giving companies peace of mind by making utilities available to them, in addition to providing physical space, is a major means to attract companies. It allows them to concentrate on their core processes and reduce investments.

### **ACTION REQUIRED NOW**

If Europe and the Netherlands want to continue to create added value with a vigorous chemical sector and production of sustainable fuels, we do not want to depend on imports of these essential products. If the Netherlands and Rotterdam want to retain a healthy, clean industry with jobs and added value that go with it, we should not sit back and wait, but we should start the intended development toward a carbon-neutral and circular industry actively.

On the basis of details about investments, employment, use of space and current opportunities and projects, an estimate has been made of everything that is necessary to produce 20% of the petrol, naphtha, diesel and kerosene made in Rotterdam from renewable feedstocks by 2030. The total amount of sustainable fuels involved is approximately 6 million tons, based on a ratio of 40% waste as raw material and 60% bio-based resources. The fuels for shipping are not considered here, because there are not enough reference projects.

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