Updating the future

The next steps in becoming the sustainable global port, using scenarios from Limits to Growth

Public summary of ‘Updating the future – The next step in becoming the sustainable global port, using scenarios from Limits to Growth’ – A report for the Port of Rotterdam Authority by the Club of Rome Climate Programme.

The report is also available for download at http://tinyurl.com/UpdatingTheFuture
Introduction

The vision contained in the Port Vision 2030 is that by 2030 Rotterdam will be Europe’s principal port and industrial complex, a solid combination of Global Hub and Europe’s Industrial Cluster, both leading in efficiency and sustainability. Adaptability is the trademark. This will make the complex an important cornerstone for the welfare of the region, the Netherlands and Europe by 2030. Sustainability therefore is an essential component of this vision.

But what does being a sustainable port really mean? Becoming sustainable is a process, but what is it meant to achieve? There are legislated standards, scientific insights, as well as investment opportunities and technological developments. That requires careful navigation. However, is there a beacon that you can aim for?

The Port Authority took the unusual step of asking the Club of Rome to formulate a response to the above-mentioned questions. The Port Authority also did so in order to get a picture of the potential trends for the second half of this century. There are few if any models, other than those of the Club of Rome, that look as far ahead into the future and that consider various trends in context. Scenarios were developed on the basis of the models contained in the Limits to Growth report. These scenarios portray potential futures for the port and identify the challenges that must be overcome in order to achieve robust, sustainable development. As such, the report ‘Updating the Future’ responds to the question: ‘What do we need to do now, so that we do not miss the boat later on?’

The model underlying the Limits to Growth

Finished as well as other goods that find their way to millions of consumers and producers within and outside of Europe converge on Rotterdam. Trends in global markets have a direct impact on the port. However, this dependence on global trends goes beyond the mechanism of supply and demand. In a world that is becoming increasingly connected in all areas, environmental and social trends have a global character. As such they also largely determine the port’s future.

These global dependencies create system risks. This was first recognised by the Club of Rome in 1972. The Limits to Growth report was updated in 2004. The strength of the analysis lies in its approach. The World3 model provides

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insight into the interaction between global trends in the area of population, food production, industrial production, pollution and the use of non-renewable resources. The model provides insight into the ultimate consequences of globally holding on to existing growth concepts. In contrast to many economic models the analysis makes it clear that the extraction of resources may be finite and that pollution has adverse effects on human existence, for example by affecting the food supply. The conclusions of the Limits to Growth report are far-reaching: continuation of existing trends will ultimately lead to a collapse of the population and prosperity, because it is impossible to sustain infinite material growth on a finite planet.

The World3 model that forms the basis of this analysis is specifically not meant as a tool for making precise forecasts. It is a coarse model that can be used to analyse the consequences of consuming finite resources at an increasingly faster pace. On the other hand, we can use the insights provided by the model to develop and assess alternative scenarios that lead to more desirable results.

### The three scenarios

For the present report we selected three scenarios to explore different potential futures. We then applied the World3 model in order to express the global scenarios in terms of the throughput of goods in Rotterdam. The two decisive factors for the calculated throughput are the global industrial production and Europe’s population. We named the three scenarios Standard+, Technology and Integral.

The Standard+ scenario describes a world in which there are no revolutionary breaks in trends and which has an ample reserve of resources. According to the model, the extraction of non-renewable resources will become increasingly more difficult and therefore will increasingly withdraw more capital from other sectors, such as the food supply. Due to the exponentially growing population, the increased use of resources leads to persistent pollution that affects the health of the population, as well as the food supply. This ultimately results in a collapse of the world population and a decline in the global production of goods. The impact on the port of Rotterdam in this scenario is that, after initial growth, starting in roughly 2040 throughput will decline to far below current levels by the end of this century.
The other two scenarios incorporate the effects of possible interventions that go beyond the current trends. In the Technology scenario these include technological measures designed to use resources more efficiently, increase agricultural production and constrain pollution. The demand for goods and services remains unchanged, however. This scenario results in a more stable population, however because the development of the required technology is at the expense of investments in the production of goods, average prosperity declines. A decrease in industrial output in the model is linked to the throughput in Rotterdam and therefore in this scenario the throughput of goods, after growing until approximately 2040, also declines, although the decline is not as pronounced as it is in the Standard+ scenario.

The Integral scenario continues to build onto the Technology scenario. In addition to the technological measures, this scenario also incorporates the effects of a different way of life that leads to a reduced demand for goods. This scenario therefore requires fewer natural resources. Because less capital is required to counteract pollution, extracting resources and increasing food production, the population, as well as the level of prosperity stabilises. Under the Integral scenario, the throughput of goods in Rotterdam until approximately 2040 does not grow as much as in the other scenarios, but then remains constant.

All three scenarios demonstrate that long-term economic growth based on an increase in volumes is improbable. Sustainable economic growth demands a shift from growth based on linear production and transport to a model that provides added value with fewer resources.

Scenarios provide a simplistic view of the world and furthermore are limited by our own imagination. As a consequence, in scenario analyses system changes are often proposed as gradual changes, while in reality this is seldom the case: system changes are often characterised by periods of acceleration in which a system changes by fits and starts, a tipping point. In addition, a number of risks are not included in this study, such as the increasing probability of a pandemic due to the increasing transport of people and goods.
Interpreting the scenarios

The scenarios based on the adjusted World3 model provide a rough view of the long-term trends. To be able to translate these into potential actions for the Port Authority, the scenarios were further refined in terms of three themes: energy, food and resources. This was done on the basis of literature that details global scenarios. The available energy, food and resources scenarios indicate that the world is currently developing in accordance with the Standard+ scenario. Safe limits as to what the earth is able to cope with have already been exceeded in areas such as climate change and the loss of biodiversity. Other planetary limits have reached a critical stage. The alternative scenarios that identify the route to a more sustainable future were subsequently analysed for each theme. These were reviewed on the basis of the Technology and Integral scenarios. Next, where possible, the analysis further zoomed in on the European context of these themes, since Europe is Rotterdam’s hinterland.

Scenario results for throughput of the Port of Rotterdam, including historical data (mln tonnes)

The asterisk indicates an additional autonomous growth that was added between 2014 and 2035 to take the pull effect due to Maasvlakte 2 into account.

Data sources: CBS (historical throughput Rotterdam)
The energy crisis

The energy scenarios most clearly reflect that the world is on a Standard+ track. There would appear to be sufficient reserves of coal, oil and gas to be able to meet the 21st century’s demand for energy. However, the fossil fuel-based energy system releases such quantities of greenhouse gases that their continued use will cause the earth to heat up to dangerous levels. This trend can only be reversed by replacing the use of carbon-intensive energy with carbon-free energy. All possible technological options will have to be explored in the Technology scenario for this purpose. Indeed, the demand for energy will continue to grow unrelentingly in this scenario and in addition to renewable energy, nuclear energy and Carbon Capture and Storage (CCS) systems will be essential as well. In addition, the cost of extracting fossil fuels will continue to increase. This money consequently cannot be used for other purposes. In one energy scenario that stays closer to the Integral scenario, there is a strong focus on reducing the demand for energy. This makes it possible to achieve the objective of staying within the planet’s limits with various mixes of carbon-free energy technologies. This is technologically as well as economically feasible, but requires unprecedented effort and political will.

The food crisis

Our food supply is increasingly coming under pressure. While the population is increasing, the effects of the green revolution have spent their force in many areas, as a result of which agricultural production is growing at a reduced rate. In the meantime, agriculture is demanding more and more chemical fertilisers, fertile soil and water, while the energy sector also wants to use biomass. The quantity of land that is suitable for agriculture is finite. The best agricultural lands are already in use and expanding the available acreage is at the expense of nature. In addition, pollution, depletion and erosion have a negative effect on the yield per hectare. Meat production requires a relatively large area, as a result of which a scenario in which the global population pursues the western meat-rich diet is not possible. A Technology scenario presupposes that people, for example through means of meat substitutes and artificial meat, on average will eat somewhat less meat. Cultivation problems are solved through means of a wide range of technological solutions. This scenario is feasible, provided that the available agricultural acreage is expanded. The Integral scenario presupposes drastically reduced meat consumption. This scenario is feasible, while requiring very little nature to be sacrificed and furthermore, is still feasible with a switch to less efficient, but entirely organic agriculture.
The resources crisis

Our treatment of non-renewable resources focuses on critical materials: materials that are not renewable, such as rare earth metals and phosphates. The risks related to the scarcity of these materials are multi-dimensional. The extraction of these materials will become increasingly more difficult and consequently cause more pollution. At the same time, these materials often are only present in a limited number of countries, which can result in geopolitical and economic problems. The probability of interruptions in the supply chain increases, and that can endanger the development of the essential technology required for a renewable energy supply or efficient agriculture, for example. Through means of efficiency, reuse and recycling, the use of resources can be uncoupled from economic growth. That is the route in the Technology scenario. For the Integral scenario it is also necessary to reduce the demand for materials. This requires new economic models and an entirely new way of dealing with goods: a circular economy.

Implications for the port of Rotterdam

Our interpretation of the models from the Limits to Growth report demonstrates that the world currently is developing in accordance with the Standard+ scenario. The delays in the feedback mechanisms mean that the effects of human actions are only visible after many years. This is why it is necessary to quickly initiate the changes that lead to a sustainable scenario. The urgency and scope of this challenge mean that it is essential for the Port Authority to jointly tackle this job with its partners.

In the Standard+ and the Technology scenarios, the throughput of goods at a certain point declines sharply. Especially in the Standard+ scenario, the port of Rotterdam, with its dependence on global trade, is heavily hit. Only the Integral scenario prevents a collapse of throughput. This does not mean that the port in the future will not see a growth in added value. In a circular economy, the return flows can offset a portion of the eliminated transport movements. Instead of only once, the port can earn income from resources multiple times. In addition, it is possible to produce higher quality materials and goods from the repeated use of (renewable) resources.

The key to a sustainable future is found in efficiency. Increasing the efficiency of the themes - energy, food, resources - studied here provides the Port Authority and the port’s business sector with increased opportunities for making the transport and industry sectors more sustainable. Uncoupling
Prosperity and non-renewable resources can be achieved with existing technology for the energy system, in agriculture and in industry. This requires the rapid phase out of all activities that are currently significantly contributing to overshooting the planet’s carrying capacity. For Rotterdam this challenge is enormous: the industry as well as its logistics are based on fossil energy.

If Rotterdam wants to remain an engine for Dutch prosperity over the long term, it will have to undertake a fundamental review of the port’s activities. The port is already taking steps in the area of energy, biomass and resources. The resulting impact is however too limited or too late.

The need for sustainability also represents a major opportunity for becoming a front runner in the next economic era. The future belongs to companies that respect the planetary boundaries. This is diametrically opposed to the vested interests of the companies and institutions that stand to lose the most from a transition to a sustainable society. At the present time existing revenue models, regulations, infrastructure and institutions block or impede the transition to a sustainable economy. Involving parties in the change process requires a predictable and gradual transition. At the same time, the process must be flexible enough so that it can be adjusted in line with new scientific insights.

The first step is to develop the indicators that can be used to steer towards a sustainable economy. The economic valuation of the impact of activities on the biosphere is in its infancy. And although there is a broadly supported consensus that the GDP is an inadequate measure for measuring prosperity, GDP growth by far remains the most important target on which most countries focus their economic policy.

**Recommendations**

The Port of Rotterdam Authority demonstrates the courage and the leadership required to deal with the challenges of the 21st century. Many of the ideas and technologies required to achieve the goal of becoming a sustainable port are available. By focusing on efficiency at all levels, the Port Authority increases its options in terms of future technologies. The Port Authority cannot achieve the required acceleration on its own. 'Updating the future' requires a joint effort on the part of all partners in the industry, logistics, government and science.
The Port Authority and its partners will have to take steps on two levels: regional and on the international playing field. In international or European partnerships, the port must argue for the strictest possible measures designed to reduce the impact on the environment. To profit from stricter laws and regulations, measures must be taken on the regional level to promote sustainability. This way sustainability will become Rotterdam’s new competitive advantage.

In an international and European context this involves the following steps:

1. **Ensure that prices reflect the actual costs of resources**
   In a general sense, the price of resources must incorporate actual costs. Today, for example, resources are less expensive than recycled materials, because the environmental damage caused by the extraction of resources generally is not included in the price. The higher prices of the resources caused by including the cost of environmental damage can be compensated by lowering the taxes on labour. Sustainability benefits from replacing the taxes on labour by taxes on resources.

2. **Encourage legislation that reduces negative environmental impacts**
   Insist on the need to reduce the impact of the current energy system by including the harmful external effects in economic considerations. That means arguing for a CO₂ price that is high enough to stimulate efficiency and make investments in renewable energy profitable. In addition, strict requirements must be imposed on the emission (air quality) of the transport sector and industry. Finally, it is important that all relevant sustainability criteria are applied to the use of biomass for energy generation.

3. **Ensure optimal value of resources**
   Ensure that the application of resources meets the highest possible standards. First, by avoiding waste, then through high-quality reuse and recycling, and only as a last possibility, using resources for energy generation. Reduce, reuse, recycle. Apply economic incentives, as well as laws and regulations for this purpose.
In general terms, we recommend the following for the Rotterdam region:

1. **Think in terms of energy systems**
   Retain the climate targets set by the Rotterdam Climate Initiative, but review the ways in which this is to be implemented. Apply sustainable technologies, such as smart grids and the application of new energy carriers, such as hydrogen.

2. **Acquire greater insight into the opportunities offered by sustainable biomass for the Rotterdam region**
   Develop a road map for sustainable biomass in Rotterdam, whereby biomass is only used for generating energy after as many valuable components as possible are used for other applications. Formulate the relationship between the use of biomass and food production.

3. **Be a pioneer for the circular economy**
   Create a platform for the purpose of finding creative solutions for the implementation of a circular economy. As a measure of success, a form of integrated reporting must be developed for enterprises.

In so doing, develop the port and industrial complex into the most sustainable in the world. In this respect the port cannot measure success in terms of volumes, but in terms of added value. This requires new revenue models and performance indicators.
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Design and lay-out:
Smidswater

Date:
November 2013

The report is also available for download at
http://tinyurl.com/UpdatingTheFuture