Rotterdam and Erasmus Bridge at Night

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Climate Change Adaptation in Smart Delta City Rotterdam

PIET DIRCKE, PETER WIJSMAN, AND ARNOUD MOLENAAR

The majority of the world's population will soon live in delta cities that face the challenge of climate change. Rotterdam, situated in the heart of the Dutch delta and one of the biggest ports in the world, is dealing with climate change in a proactive way, turning these challenges into opportunities. The city lies largely below sea level (up to 6 meters), and the city is protected from the sea by a complex system of dikes, closure dams, and storm surge barriers. Rotterdam wants to protect its citizens against the future impacts climate change, like sea level rise and intensified rainfall, by making Rotterdam "climate proof" by 2025. Rotterdam is the perfect showcase for climate change adaptation in the Netherlands and an inspiring example for delta cities worldwide. Rotterdam will prove that dealing with climate change in a proactive way creates opportunities for an attractive, economically strong, and technologically smart delta city.

Introduction

More and more people live in delta cities. By 2025, the majority of the world's population will live in cities in or near deltas, estuaries, or coastal zones. All of these cities will face more or less the same challenges. Hurricane Katrina, and later Al Gore, were wake-up calls, creating a growing awareness of the impact and consequences of climate change, in particular the increased risk of flooding due to sea level rise. Floods are already the natural disaster with the most casualties and the biggest economic impact. The impact of climate change in Rotterdam is not limited to just sea level rise, increased peak river discharges and more severe storm events will affect the city as well. At the same time, land is subsiding, and the city's population and economic activity continue to grow.

Present Situation

Rotterdam is situated in the heart of the Dutch delta and is one of the biggest ports in the world. The city lies largely below sea level (up to 6 meters), and the city is protected from the sea by a complex system of dikes, closure dams, and storm surge barriers, part of the famous Dutch Delta Plan. The Delta Works were established after the disastrous 1953 floods, when more than 1,800 Dutch citizens died, and the Dutch said: "Never again!" One of the main aspects of the Delta Plan was to improve the protection of the Port and the City of Rotterdam with the famous Maeslant Storm Surge Barrier (Figure 1). This barrier protects the city during a storm event, but remains open under normal conditions to allow navigation to the port areas and inland shipping canals behind the barrier. Today, Rotterdam is a safe city with a flood protection level of 1 in 10,000 years, 100 times safer than the US national flood safety standard of 1 in 100.

Rotterdam's urban water system has its own challenges, since it is an internal drainage system below sea level. This is a well-designed system of canals, lakes, drainage basins, and pumps. The Rotterdam Urban Water Plan focuses on both the challenges and the opportunities of living near the water. In this location, water challenges and urban spatial planning are fully integrated.

Climate Change and Flood Risk

Rotterdam has a climate influenced by the North Sea, with moderate temperatures and precipitation occurring in all four seasons. More intense rain events and longer dry spells are some of the expected impacts of climate change, in addition to sea level rise. Therefore, Rotterdam has established the RCP, the Rotterdam Climate Proof program. The objective of the RCP is to make sure that Rotterdam will be "climate proof" by 2025. The first priority for the RCP is the safety of the city. The Dutch protection standards are currently the highest in the world, and the 1 in 10,000 year protection level was established as a result of both the number of inhabitants and the economic value of assets to be protected. The existing urban levees, some of which cross through the heart of the city, will be strengthened and raised with innovative and multifunctional levees to incorporate them in the city landscape. The existing storm surge barrier system will be re-evaluated, extended, and improved, in close cooperation with the Dutch Federal Government and the water boards.

Rotterdam deals with the challenges of climate change in many other ways, for instance with an extensive green roofs program, the development of urban water plazas, climate robust buildings, and amphibian or even floating home communities.

Rotterdam City Ports

Rotterdam is looking for opportunities that enhance flood protection and at the same time, add value to the attractiveness of the city, for instance with the redevelopment of 4,000 acres of former city port areas (Figure 2). Attractive new climate proof waterfronts with sustainable and climate proof areas for living, working, education, and recreation will be developed in the centre of the city: the Rotterdam City Ports Project. The City Ports Project is currently one of Europe's largest urban redevelopments. One of the major drivers for redevelopment of the 4,000-acre old port areas will be knowledge and business development in the fields of water, climate change, and sustainability. This development is necessary in order to learn how to deal with climate change in the best way possible, to develop best practices, and to educate future generations of water and climate managers. One example is the development of new ways of creating buildings that allow flood water to move through the neighborhood without causing casualties or severe damage.

Figure 1. Maeslant Barrier

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Figure 2. Rotterdam City Ports

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These new technologies are being developed at knowledge centers like the RDM (Research, Design, and Manufacturing) Campus, an initiative of Rotterdam University of Applied Sciences, the Rotterdam Port Authority, and several other public and private partners. At the RDM Campus, previously the old RDM Shipping wharf, now education, knowledge development, and innovation go together; students of Rotterdam University work together with small, innovative companies on new sustainable research projects.

Rotterdam National Water Centre

Rotterdam will become an innovative center for water management and climate change, a truly smart delta city. International collaboration with other delta cities will be intensified. The leading role of Rotterdam as the Netherlands' international showcase for water management and climate change was underlined by the decision of the Dutch water sector, which established a national Water Centre in Rotterdam, also reflecting the desire on a national level to connect deltas. Rotterdam will be ready to host guests from all over the world who will visit the opening event in 2012. The Rotterdam Floating Pavilion (Figure 3), a visible icon for climate change adaptation, a resilient building, and a landmark for the City, will serve as the exposition space of the National Water Centre.

Connecting Delta Cities

Rotterdam, as an affiliate member of the C40 initiative, is also heading the "Connecting Delta Cities" initiative. The objective is to establish a network of delta cities that are active in the field of climate change adaptation, to exchange knowledge, and share best practices. Under this initiative, the delta cities Rotterdam, New York, Jakarta, London, New Orleans, Ho Chi Minh City, Hong Kong, and Tokyo have decided to join forces and exchange knowledge on climate change adaptation, starting with an overview of best practices in these cities, documented in a book that was presented by Major Ahmed Aboutaleb of Rotterdam to His Royal Highness the Prince of Orange at the recent "Deltas in Times of Climate Change" conference in Rotterdam in 2010. Other cities, including Melbourne, Shanghai, and Copenhagen, are keen to join this initiative. Also, cooperation with other delta networks like the Delta Alliance and the Estuary Alliance is increasing. This expanding and well operating network of knowledge-driven delta cities is one of the best answers for coping with the challenges by turning them into opportunities for safe and attractive living with water.

Rotterdam: Smart City, Smart Flood Control

Rotterdam is currently developing innovative technologies to become a smart city of the future. The integration of information technology into the most modern and innovative adaptive flood control science and development plans in the world is one of the tools. "Flood Control 2015," a public-private consortium, will research the feasibility of developing a smart flood control system for the city. The aim is to make decisions during an emergency, like a flood, two times better and two times faster than the present rate, using tools like smart gaming, a demonstrator control room, decision support systems, and the application of sensor technology in levees. Students from the Rotterdam University of Applied Sciences are also involved in developing these tools. In this way, future generations are attracted to start a career in water and climate change, making Rotterdam a smarter and safer city in the future.

Figure 3. Floating Exposition Center at Night

PHOTO: ARCADIS

PIET DIRCKE *is a Water Program Director for ARCADIS in the Netherlands and a part-time professor in Urban Water Management at the Rotterdam University of Applied Sciences. In his work for ARCADIS, he leads many strategic growth initiatives in the Netherlands related to climate change adaptation and intelligent flood management techniques. In the US, Mr. Dircke is involved in projects in New Orleans, New York, and San Francisco.*

PETER WIJSMAN *is the Water Resources Program Manager for ARCADIS in California. As a Dutch native currently based in San Francisco, one of his responsibilities is technology transfer of expertise in water management, flood protection, and climate change adaptation between the Netherlands and the US.*

ARNOUD MOLENAAR *has served as Program Manager of the City of Rotterdam's ambitious Rotterdam Climate Proof program since his appointment in 2008. In previous positions, he served as a senior advisor for Environmental Policy at the City of Rotterdam, where he played a crucial role in the Rotterdam Environmental Policy Plan and the Water Plan of Rotterdam. In 2001, he became the Deputy Head of the Water Management Department of the City of Rotterdam.*