New locks in the Albert canal in Flanders, Belgium [1]

Image not found or type unknown
Image from Climate Adapt about this case study [2]

Autor: Â© De Vlaamse Waterweg

The Albert canal in the eastern part of Flanders connects the industrial zones around Liege with the harbour of Antwerp. Ships can continue their way at both ends of the canal: via the river Scheldt to the Netherlands and via the river Meuse to France. In the future, the Meuse basin, from which the Albert canal receives its water, is projected to experience more and longer periods of low river discharge, as a consequence of climate change. Thus, less water is expected to be available for sluicing ships. This would limit inland navigation. The solution to use less Meuse water for navigation are large (fish friendly) Archimedes screws at locks along the Albert canal. In the low discharges on the Meuse, the screws can pump water back to the upper canal to reach the water lost due to the passage of a ship through the lock. In the case of more than enough discharge at the Meuse, the screws are used as a bypass and to generate hydroelectricity. The combination of pump installation and hydropower station is unique in the world.

Case Study Description

Challenges:

Because of climate change, Belgium is experiencing more and longer periods of drought. In the future this is projected to be aggravated. According to the climate projections developed within the Cordex.be [3] project, (2015?2017), changes in precipitation and evapotranspiration in the period 2000?2100 indicate in summer months deepening of negative water balance, causing an increasing risk of the occurrence of droughts and their higher severity. While winter precipitation is expected to increase slightly, summer precipitation will significantly decrease. The expected decrease in precipitation simulated by the models for August varies between -10% for the emission scenario RCP2.6 up to approximately -40% for the emission scenario RCP8.5 by the year 2100 in comparison with the year 2000.

In the eastern part of Flanders one of Belgium?s biggest canals is situated: the Albert canal. This canal connects the industrial zones from the (French-speaking) Walloon part of Belgium with Antwerp, Belgium?s largest harbour. Ships can continue at both ends of the canal, to the Netherlands (e.g., Rhine, Rotterdam) and to France (Meuse). Because of the building of the canal also some important industrial areas were developed along it, making it an economically extremely important waterway for Belgium, with a total traffic of 40 million tons per year.

The canal gets its water from the river Maas (Meuse), a river only fed by rain. The Maas is also feeding other canals, with the Juliana canal to the Netherlands being the most important. So agreements had to be established with the Netherlands to address situations of extreme weather events, including low water discharges resulted from droughts. In some (rare) cases, the discharge of the river Meuse is not enough for feeding all canals in Flanders and the Netherlands, and for maintaining a minimum discharge in the Meuse itself. During these periods, the water level of the Albert canal can drop, so that the allowed draft for ships has to be reduced, making inland navigation less attractive as transport mode. Up to now, these problems were addressed by a number of measures, such as lift-locking of professional shipping with less water and limiting water withdrawals for agricultural and nature management purposes, but these measures implied accepting associated economic and ecological damages.

Objectives:

The main objective of the measures described in this case study was to avoid economic losses due to reduced traffic possibilities on the canal (due to very low water discharge from the Meuse river), which are expected to be aggravated in the future because of climate change. Protecting the Meuse river ecosystem and biodiversity was another secondary objective.

Solutions:

Big Archimedes screws were built at the locks in the canal in Ham, the first of six lock systems. In case of drought these enormous screw pumps, the biggest in Europe, are pumping up water lost by the passing from the ship through the lock. In case of an excess of water, mainly in winter, the screws are used as a bypass to get rid of the excessive amount of water. In that case, the pumps work as an electricity generator, with hydropower as renewable energy reducing GHG emissions. The net effect on GHG emissions over time depends on the balance between low and high water levels, but since until now low water levels have been occurring only rarely, the net effect is generally positive. The canal is also a possible waterway for migrating fish. Therefore the screws are designed to allow fish migration, protecting biodiversity.

The installation in Ham (2012) consists of four enormous screw pumps with 4.3 m diameter and weighing 85 tons. The screws can pump up to 5 m3 per second. One lock operation moves 48,000 m3 of water. The four screws need 50 minutes on full power to pump the water back. In 2013, three similar screws were installed in Olen. Having proved their functionality and effectiveness, installation of screw pumps on the Albert canal?s locks continued in 2018, when three Archimedes? screws were built in Hasselt. The colossal screws ? 22 metre long, 4.30 metre diameter, weighing 100 tons - can pump 5 m3 water per second to the top of the lock, and with enough water they can produce green electricity for 1,500 households. The pumping installations in combination with hydropower plants are being built also on the other locks of the Albert canal of Genk, Diepenbeek and Wijnegem. These are expected to be put in operation after 2021.

Importance and relevance of the adaptation:

PARTFUND_AS_CCA;

Additional Details

Stakeholder engagement:

The organization ?De Vlaamse Waterweg? is responsible for managing and developing inland waterways as a network contributing to the economy and prosperity of Flanders. This company acts as the key coordinating stakeholder for the development of the Archimedes screws at the Albert canal?s locks.

Two major preparatory projects preceding the installation of screws at the locks led to the eventual design of the measures, in which relevant stakeholders were involved. The first was the development of a low water strategy for the canal. In a first problem analysis phase, an inventory of different water uses was made, consulting users about their ideas to reduce water use. In a second phase, possible solutions were proposed, inviting feedback from all relevant stakeholders. In a third phase, the effects of the solutions in terms of effectiveness and costs were analysed quantitatively with a suite of models and other analytical tools. In a fourth and final phase, preferred strategies were discussed with a broad range of stakeholders including: industries, shipping representatives, drinking water supply companies, power companies, nature protection organizations, municipalities and others.

The second project dealt with the environmental impact assessment of different alternatives. The preferred option was chosen taking into account various environmental considerations, in particular related to the preservation of fish migration and the mitigation of noise.

Success and limiting factors:

Important success factors included the acknowledgement of ecological values to be maintained and the attention to the development of a collaborative process in which all stakeholders were seriously engaged.

As to the former, two ecological factors played a key role: the structural possibility to protect some ecosystem services in the Meuse valley by limiting extraction of Meuse water and maintain a sufficiently high run-off level, and the consideration of the fish stocks in the Albert canal.

As to the latter, the process highlighted the importance of allowing sufficient time and resources for stakeholders to cooperate, share knowledge, understand each other and get to know and respect each other?s culture. Imposing solutions or taking insufficient time would have limited success. One of the main factors of success to collaborate was the awareness of the inadequacy of current solutions and projected worsening of the situation in terms of frequency and length of low water levels.

Budget, funding and additional benefits:
The cost of the installation of the screws is about 7M? for each lock system. The benefits include the navigability of the canal under changed climatic conditions, the reliability of the canal for shipping and the generation of electricity. Green electricity (hydropower) for an equivalent of 1,000 families can be produced by each set of screw pumps. In the past years it was observed that the installation functions as power generator for about 10 months per year and pump up water for about one month. Another month usually stands in a situation of just sufficient run-off for shipping but insufficient flow for power generation. On an annual basis much more energy is generated than used. The precise annually generated power depends on the amount and distribution of precipitation over the year, the shipping intensity and the withdrawals from other water users.

There are also biodiversity benefits. Because of the relatively high water quality, rich fish stocks occur in the canal. Advanced technologies used for the pumping installations and power generation minimize the impacts of the installations on the fish stocks.

Legal aspects:
A legal agreement was established between Flanders and The Netherlands about the water availability in the river Meuse. In particular, this agreement addressed the water extractions from the Meuse by the Zuid-Willemsvaart in Maastricht It also covers the reduction of water losses in the Meuse in case of low run-off, collaboration on research and development of the common Meuse, and compensation of fresh water losses of the Kreekraksluizen.

Implementation time:
The first set of screws was installed in 2012 in Ham and is fully operational. The second set of screws is implemented in Olen and is operational since 2013. The installation in Hasselt is operational since 2018, while three more sets of screws are being installed in different lock systems.

Reference Information

Contact:
Griet Verstraeten
Policy Officer Climate Adaptation
Flemish Government
Department of Environment, Nature and Energy
Koning Albert II-laan 20 bus 8, 1000 Brussel
E-mail: griet.verstraeten@lne.vlaanderen.be [4]
Generic e-mail: Beleid@lne.vlaanderen.be [5]

Koen Maeghe
De Vlaamse Waterweg
Tel: +32 11 298400
E-mail: koen.maeghe@vlaamsewaterweg.be [6]

Websites:
https://www.fithydro.eu/ham [7]

https://www.vlaamsewaterweg.be [8]

Sources:
Flemish government and De Vlaamse Waterweg

Source URL: https://www.adaptecca.es/en/new-locks-albert-canal-flanders-belgium
Links
[1] https://www.adaptecca.es/en/new-locks-albert-canal-flanders-belgium
[2] https://www.adaptecca.es/sites/default/files/11292206.jpg
[3] http://cordex.meteo.be/
[4] mailto:griet.verstraeten@lne.vlaanderen.be
[5] mailto:Beleid@lne.vlaanderen.be
[6] mailto:koen.maeghe@vlaamsewaterweg.be
[7] https://www.fithydro.eu/ham
[8] https://www.vlaamsewaterweg.be