New locks in Albertkanaal in Flanders, Belgium [1]

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, and so 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 back to the upper canal 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 create hydroelectricity.

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. In the eastern part of Flanders one of Belgium's biggest canals is situated: the Albert canal. This canal connects the industrial zone's 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, avoiding 6000 trucks daily on the highways.

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 events. 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 damage 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 ecosystems was another important objective.

Solutions:

In the end different problems, possibilities and advantages were merged into one remarkable solution. Big Archimedes screws were built at the locks in the canal in Ham, the first of 6 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. 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 low water levels occur 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 4.3m diameter and weighing 85 tons. The screws can pump up to 5 cubic meters per second. One lock operation moves 48,000 cubic meters of water. The four screws need 50 minutes on full power to pump back the water. In 2013, three similar screws were installed in Olen. In the coming years (from spring 2017), similar screws will be installed in the locks of respectively Hasselt, Genk, Diepenbeek and Wijnegem.

Importance and relevance of the adaptation:
Case developed and implemented and partially funded as a CCA measure.

Additional Details
Stakeholder engagement:
The organization “NV de Scheepvaart” resorting under the policy area “Mobility and Public Works” has searched for solutions together with its partners. Two major preparatory projects 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 was made of different water uses, consulting water users about their ideas to reduce water use. In a second phase, different possible solutions were proposed, inviting feedback from all relevant stakeholders. In the 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, in a series of workshops preferred strategies were discussed with a broad range of stakeholders using water from the canal system for economic, ecological or societal reasons, including industries, shipping representatives, drinking water supply companies, power companies, nature protection organizations, municipalities and others.

The second project was an environmental impact assessment, on the basis of which the preferred option was chosen from the proposed solutions, taking into account various environmental dimensions, notably fish stock interests and noise.

Success and limiting factors:
Important success factors included the acknowledgement of ecological values 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 natural values 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 of developing of the measures has shown that in order to arrive at broad support research is needed, but also sufficient time for the 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 also enabling of fish migration, and the generation of electricity. Green electricity (hydropower) for an equivalent of 1000 families will be produced by each set of screw pumps. On the basis of hydrological analysis, including climate change, it is expected that the installation will function as power generator for about 10 months per year and pump up water for about one month, with one month stand-still in situations of just sufficient run-off for shipping but insufficient for power generation. On an annual basis much more energy will be generated than used, the precise annual power generated depending on the amount and spread of precipitation over the year, the evolution of shipping intensity and the withdrawals of other water users. There are also biodiversity benefits. Because of the relatively high water quality rich fish stocks exist in the Canal. Advanced technologies used for the pumping installations and power generation minimizes 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; 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 were installed in 2012 in Ham and are fully operational. The second set of screws are implemented in Olen and are operational in 2015. Four more sets of screws will be installed in different lock systems.

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Sources:
Flemish government and NV De Scheepvaart

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What is climate change?

What is the adaptation to CC?

What I can do?

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Infographics

Divulgative resources search engine

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Viewer of Climate Change Scenarios

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[1] https://adaptecca.es/en/new-locks-albertkanaal-flanders-belgium
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