TITLE: THE ZEELAND ISLANDS DISTRICT WATER BOARD IN MIDDELBURG IN RELATION TO SUSTAINABLE BUILDING.

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Summary

The Zeeland Islands District Water Board office building is located in Middelburg (Zeeland, the Netherlands). The office is situated at an prominent place between the canal through Walcheren and the railway line, which separates the historical town centre from the post-war residential areas. The development of the District Water Board office together with the council offices (architect Thomas Rau) is meant to connect the two different parts of the town physically and symbolically. The urban development plan was developed by the Palmboom and van de Bout urban development bureau on the basis of the Station Area Masterplan drawn up by BVR (Rotterdam). The Station Area Masterplan covers a longer stretch along the Canal that still must be developed (2006-2010). The District Water Board office and the Council offices behind it are on top of a parking garage 350 m long. The offices were developed separately but built at the same time by the same contractor (BAM). Both buildings use a common energy storage system in deeper groundwater layers.

1. Attention to high-quality architecture and use of easily maintained materials.

Figure 1 & 2 Aerial views of the station area.

The Zeeland Islands District Water Board office is an innovative and sustainable building on many levels. The building is sustainable for the following reasons:

1. Attention to high-quality architecture and use of easily maintained materials.
2. The flexible office layout with great practical value for different types of organisations.
3. The application of low-energy installations
4. The avoidance of emissive construction metals.

Among the most important conditions for sustainable buildings are architectonic quality and functional utility. Attention to detail and the use of high-quality materials also play an important role. A carefully designed building acquires meaning in the context of urban development. Having meaning increases a building's value and, consequently, it's potential for re-use and adaptation. When their life-cycle is over, buildings with high architectonic quality and wide-ranging functional possibilities are more likely to be considered for renovation and a new lease on life than buildings with lower status. Sustainability is based on preventing demolition and replacement construction.

When the District Water Board office was designed, the location determined the architectonic concept to a great extent. In terms of the urban development plan, the building was meant to be one of the high points in the development of the station area both in mass and form; a sculptural building, orientated in all directions and clearly facing the bus station. In architectural terms, this was achieved through a three-dimensional transformation of a rectangular box. On the canal side, towards the historical city, large folds have been made in the façade surface, as well as deep cut-outs near the entrance and the large meeting hall. On the side of the railway line and the upper façades, the sculptural nature is more subtle and less pronounced, and follows the outlines of the location.

The building's support structure consists of columns and a supporting level of prefab concrete elements to create a free plan. The bricks of the outer structure are glued rather than laid. In glued work, the joint is smaller, requiring a higher quantity of ceramic material per square meter, which contributes to sustainability.

Loam plaster, a natural, easily repaired and, if need be, easily removed plaster was used on the building walls. All rails and fences are of untreated red cedar parts.

Figure 3 & 4 Photos of the interior with solar roof (left) and loam plaster (right).

2. The flexible office layout with great practical value for different types of organisation

Modern organisations change all the time, and an office building must be able to accommodate these changes easily.

The design must be such that these changes can take place without need for major adaptations or building. Further construction should also be unnecessary if another organisation wants to use the building.

This point of departure led to the choice of an open plan office with individual workplaces. The open plan office makes it easy to change the composition of teams and move offices. Working in an open plan office means working in a large space. The negative consequences of this on certain activities are limited by setting up concentrated-activity workplaces in closed-off rooms. These rooms, as well as the large and small meeting places, are set up as loosely closed "huts" which form the transition between movement spaces and open workplaces, reducing hindrance to a minimum. Using a vacant space with a skylight enables workplaces to be established not only on the façade but also in the centre of the building.

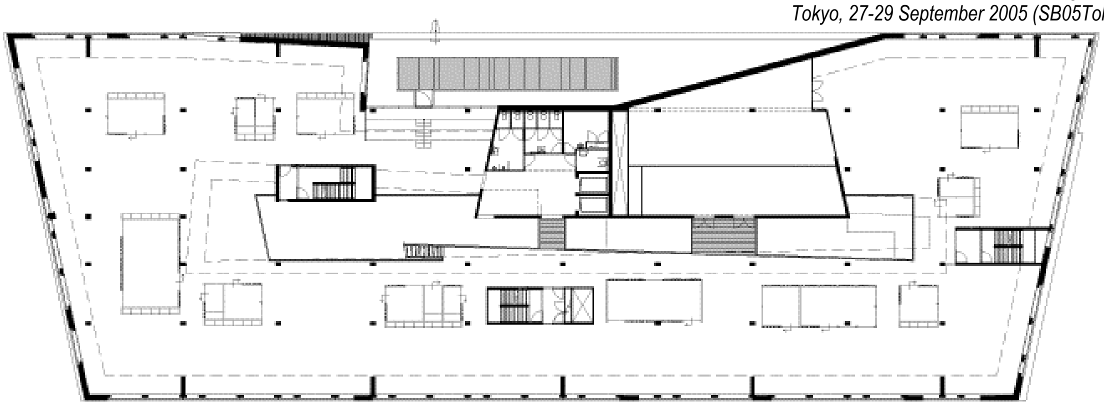


Figure 5 Third floor plan.

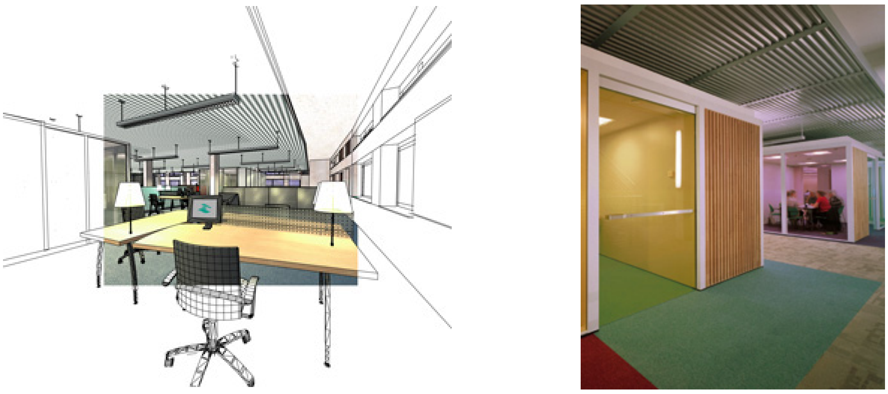


Figure 6 & 7 Impresssion and photo of the open plan office.

3. The use of energy-saving equipment.

A third level of sustainability is reached through the use of intelligent, energy-saving installations.

1. Storm-water, tap water and sanitary fittings

Rain and wastewater are discharged via (H)PE-piping in stead of the environmentally polluting PVC. A collection/filter system for the reuse of storm-water has been installed. All toilets are connected to this system.

Storm-water is buffered in a basin on the 3rd floor of the building without being treated. The filtered water is collected in a tank in the cellar.

The sanitary fittings are provided with water saving cisterns, flow limiters and adjustable temperature limiting. In stead of the environmentally polluting copper piping for tap water installations non-environmentally polluting and decomposable synthetic is used.

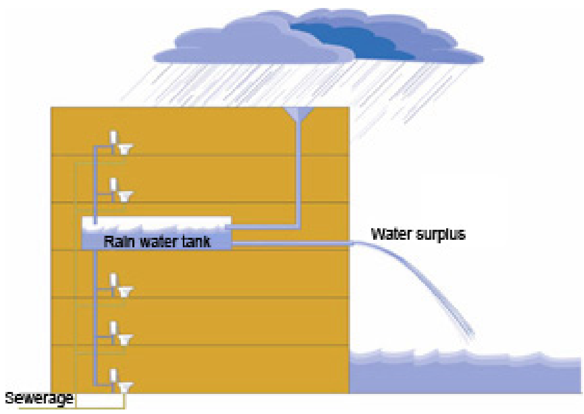


Figure 8 Scheme of the rain and wastewater circuit.

2. Central energy supply

The District Water Board's energy supply needs called for a sustainable solution for both energy and material. The solution was to develop a common installation for both the District Water Board and the nearby Council offices. The expansion meant that the most complete form of sustainable energy generation was an installation with heat pump and long-term energy storage (LTES) in the soil.

Using ground water to cool and warm the building also fits in well with the Zeeland Islands District Water Board's business process.

This LTES installation consists of four wells (two doublets), each approximately 80 metres deep and with approximately 35 m3/h draw-off, combined with an extra-high-efficiency heat pump (capacity approximately 454 KW) and two high-efficiency boilers (approximately 600 kW each).

The heat pump and high-efficiency boilers are required for specific building functions (the laboratory, among others) as well as for business security. The heat pump is selected in such a way that it can be used practically non-stop.

In the winter, groundwater is pumped from the warm well. The heat pump or high-efficiency boiler is used to bring the heat to the temperature level required by its various users. The cooled water is then injected into the cold well. The heat pump has a heating capacity of 475 KW

In the summer, the process (and the groundwater's flow direction) reverses. Water from the cold well is then used for cooling. If necessary, the heat pump is used to lower the water temperature. After the users have drawn off the cooling energy, the warmed up water is injected into the warm well. The heat pump has a cooling capacity of 440 KW

After approximately a year of use, the process is in equilibrium and capable of delivering at maximum capacity. A necessary condition for the use of the LTES installation is that the energy flows are balanced and therefore no heat is structurally added to the ground water.

To get the best use out of the LTES installation, a "low temperature" heating installation (55-40°C) and a "high temperature" cooling installation (12-18°C) are added.

The applied heating and cooling elements need to have 50% more heating surface.

Practically every pump is fitted with a rotation frequency control system. As a result, the right amount of water needed is pumped at the correct pressure at all times, saving electricity.

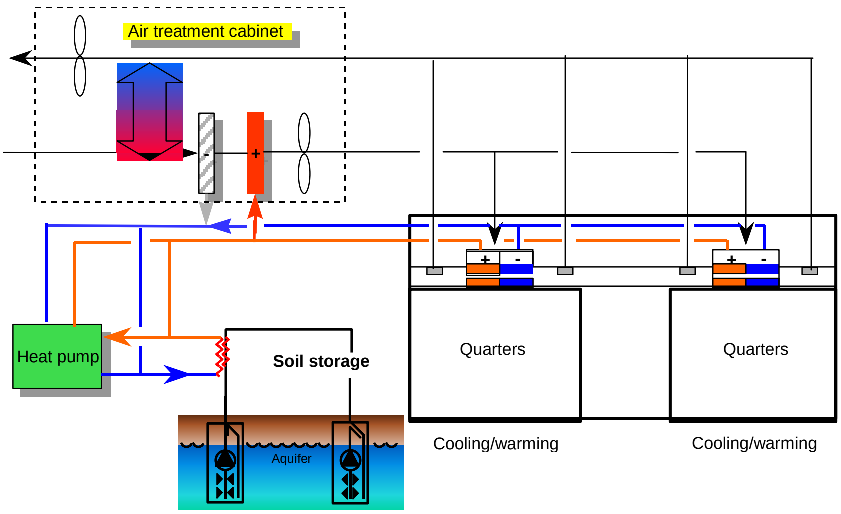


Figure 8 Diagram of the central energy supply.

3. Air treatment

The air treatment, needed for a healthy and pleasant internal climate, is provided by means of heat recovery with a heat wheel. This enables both tangible and latent (moist) heat recovery.

In addition, air treatment allows ventilation in summer if the enthalpy of the air inside is higher than the enthalpy of the air outside. In this way, a substantial amount of the heat accumulated in the building throughout the day can be drained away. This is also called free cooling. At the beginning of the working day, the building mass has a low temperature, allowing it to accumulate heat during the day.

4. Digital control systems

Control system optimisation enables reduced energy consumption if properly managed. The Zeeland Islands District Water Board has a digital control system and a building management system (BMS) in place.

People can use their own PCs to indicate their presence in each workplace. In this way, the installation switches to a comfortable temperature. The user can also use a PC to adjust the temperature by +/- 3K.

5. Lighting

Practically every space is provided with energy-saving TL armatures with screen-friendly high-efficiency mirror optics and high-frequency chokes.

A low basic light level of 150-200 Lux has been chosen for all office spaces. In this way, the installed capacity is brought back to approximately 7 W/m2. The PC-operated office lamp increases the lighting level to approximately 450 Lux.

The lighting armatures on the façade sides are provided with daylight control sensors. The windowsills of the upper windows are equipped with mirrors that reflect light far into space, meaning that the façade side lighting is hardly ever in operation.

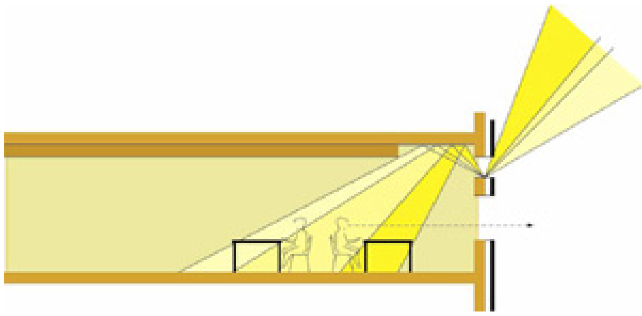
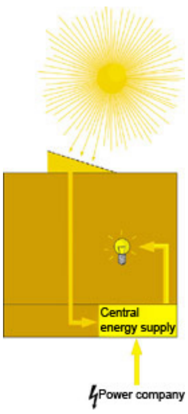


Figure 9 & 10 Impression and lighting principle

Other

The atrium roof is provided with photo-voltaic cells (PV cells) which can generate approximately 40 kWp of electricity. The PV cells also act as sun-screens for the workplaces in the atrium. In this way, a great deal of cooling energy is indirectly saved.



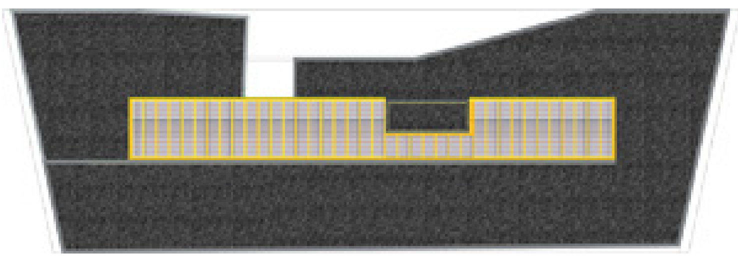


Figure 11 & 12 Photo-voltaic cells

4. The avoidance of emissive construction metals.

One core business function is the control and decontamination of surface water in the Zeeland province.

The Zeeland District Water Board's policy is not only water decontamination but precisely the prevention of contamination, in order to avoid the need for decontamination. An important part of surface water contamination is caused by heavy metals: lead, copper and zinc.

Lead is frequently used in Dutch construction for water-proofing under window frames or as stepped flashing abutting brickwork rising above a roof.

Copper is used for roofing and façade material, water pipes and sometimes for storm-water discharge.

Zinc is used in steel preservation and for gutters and rainwater discharge.

It was forbidden to use these materials in combination with water anywhere in the District Water Board office building in order to prevent canal and wastewater pollution.

DPC foil is used everywhere as an alternative to lead. Instead of copper water pipes, synthetic PE piping is used and zinc is replaced with stainless steel where necessary.

Figure 13 Exterior photo

Figure 14 Exterior photo by night