WCS Group

Safe Efficient Compliance

Case Study: Bifipro® At Hospital AZ Oostende

The business case for copper- silver ionisation with the Bifipro® at hospital AZ Oostende.

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Water Safety

Hospital hygiene is a priority for all healthcare facilities, so safe water has precedence. Patient safety is a key issue in the policy documents of every hospital. There are many aspects that must be met in order to provide the patient with the necessary care in a safe environment.

The highest care for drinking water plays a decisive role in patient care. A legionella management plan in combination with a transparent flushing plan seems obvious, but it requires a lot of effort from a health care unit. Passive support in water safety through thermal disinfection is commonly used.

The ever-increasing cost-saving measures, combined with rising comfort requirements and commodity prices, make it increasingly difficult to support the supply of care with the current resources. Investments with a short pay-back are required.

AZ Oostende was the first hospital in Belgium to take the step to provide itself with a proactive measure to control legionella management via the Bifipro® system. The team operates in international markets and has proven its knowledge of the system, both in the field of drinking water and in legionella measures. The system is designed to break down and permanently remove biofilm from the tubing. The functionalities in combination with the recognized biocidal effect keep bacteria from permanent growth and presence.
Objectives

Bifipro® fills the gap to switch to a preventive measure to manage legionella. Not giving

Legionella the chance to enter the 'gate' of the hospital. In addition to a proactive method, it is also an opportunity to 'unburden' the healthcare facilities.
This project offers a 2nd important opportunity. It offers an energetic advantage from the operational hospital costs. This objective ensures that an investment in increase water quality standards is justified in a short-term pay-back.

Qualitative and Technical Recognition

Bifipro® is the market leader in alternative legionella control measures, known for its high-performance operation by efficient product design and technical support. The design construction phase of a hospital requires a lot of (technical) study. Engineering advisors have a great deal of technical knowledge in the construction of healthcare institutions, but given their broad spectrum of techniques, these engineers rely on the water experts of our team.

The specific treatment of water requires knowledge and experience during design and implementation. The knowledge is used to adapt the specification texts and functional requirements to the new norms and safety standards. In addition, the dimensioning of the installations becomes more economical and therefore cheaper in the design phase.

This technical recognition is consolidated by the Flemish government as follows:

VIPA (Flemish Infrastructure Fund for Personal Affairs) has appointed VEB (Flemish Energy Company) to perform energy scans in the healthcare sector. These scans are performed by independent experts and aim to achieve CO_2-emission savings. The result is put in a report in which a capped investment budget is made available for each institution. Each investment from the report meets the conditions and the budget is released immediately after the applicant has registered.

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Bifipro® is recognised by the Belgian government, responsible for the patrimony of the healthcare sector, as a CO_2 saving measure. This means that every healthcare institution that applied or will carry out an energy scan is entitled to a subsidy of 30% for the installation of a HW Bifipro®. This agreement shows that the Flemish government recognizes and uses the HW Bifipro® as a CO_2 reduction measure.

A recent additional qualitative recognition has come from the renewed (6th) edition of the JCI accreditation (Joint Commissioning International). This hospital quality label requires a prevention legionella control measure from the hospitals. Existing thermal
disinfection can only be monitored by active sampling, while Bifipro® proactively breaks down organisms by introducing biocidal action.

This quality label is recognized and included as an implementation for the preventive legionella treatment. The continuous monitoring reinforces control on the water parameters.
Implementation

Installing such a facility involves proper planning and agreements in each process step. The whole project is divided into different phases.

During the initiation phase, agreements were made about the purchase of the Bifipro®

installation. Our team offers a supporting role in this for the correct connection and location in the process via a TO (technical plant visit). Our team also offers all documentation regarding the installation of the system, its operation and official approval for inclusion in the legionella management plan in Belgium.

The preconditions of the system have been verified. The risks surrounding the galvanized main collector have been proposed and addressed; During the installation of the bypass, our team took a section of pipeline and used it for a thorough analysis. The analysis was performed by an independent company. A clause has been inserted that analyzes and provides feedback on the effects of obsolete pipelines.

The next step was the implementation of the system, which required a careful effort from AZ Oostende to ensure that everything runs smoothly. Here too, our team was ready to advise and validate every decision.

The installation required minimal effort, only a power supply and a UTP cable was needed for AZ Oostende. The main water supply was carefully interrupted under the partial supervision of our team and AZ Oostende so that there were no consequences for patient safety or comfort.

After the installation, a contingency plan was drawn up together with Holland Water, in which the various samples were taken by an independent lab for water sampling. These were combined with the temperature reductions on sanitary hot water circuit.

The schedule was maintained for a year in which our team continuously delivers insights into the results of the sampling. Next, there are quarterly service level meetings in which progress is discussed. The Cu-Ag ratio is also monitored to check whether the biofilm comes off. This led to a temporary increased effort by AZ Oostende to clean the water taps. Calamities were mentioned and immediately counteracted
in direct measures.

The professional approach of our team with regard to the total project and implementation indicates a well-founded preparation and extensive know-how.

Risk Assessment

The risk assessment shows that the Bifipro® has no direct risk of system failure. In the event of calamities, there is a reaction period of several weeks before bacterial growth will occur.
A second risk is to treat both cold and hot water. The occurence of cold water heating up in the critical zone for bacterial growth in a building is realistic due to diverse techniques. The Bifipro® will mitigate this problem due to the Cu-Ag ionization.
The ionization technique in which the Cu-Ag is used to combat Legionella returns far back in history. For example, its first application can be found in the design of aquaducts by the Romans, copper drinking cups with a silver coin were also taken on the battlefield of the Romans. The strong vikings used cupper en silver painting on the bow of there wooden ships to prevent deterioration due to algae. While astronauts in the late 60's used the ionization method when carrying drinking water with them during space travel. This proves that the technology is mastered by mankind for a long time.

The added value of Holland Water is that they developed Bifipro® to provide a very accurate method to manage continuous monitoring and adjustment in the process. This ensures smooth operation and healthy drinking water.

Change Management

From hospital hygiene point of view, there was no request to adjust the legionella management plan in the first case. There were no problems signed or threats indicating contamination. In addition, there was a certain reluctance to implement an 'automation' in the hospital to serve as a gatekeeper for Legionella prevention. At the start of this project, Bifipro® was not known within the existing health care facilities.
From a technical point of view, the working principle of the installation was transparent and clearly optimized.

This technical validation had to be converted into a hospital-wide validation. The management committee has been approached through an investment proposal
that is collected on a single A3-sheet to provide a decision tool. Of course, the detailed calculations are a bit more complex, but the main goals can be explained. The investment is made clear and the system requirements are integrated along with the planning. The management committee was convinced on terms of agreement with the hospital hygiene committee.

The hospital hygiene committee was not immediately convinced, given our shared interests of both the technical department and patient safety. A second meeting was necessary to clarify the objectives. It was decided to give the new technology an opportunity.

The Hospital Hygiene Committee asked for a clear planning, agreements on screening and adjustment of the legionella management plan. The team counteracted these tasks initiated from the facility department.

The hospital was supported by our team to provide the correct texts and to guarantee a professional project approach. Both matters were monitored thoroughly during the project, the professional approach in combination with a watertight system was one of the crucial factors that made this project a success.

Project deliverables ('hand-shake')

What happened after the installation of the project? A decision meeting was scheduled at the end of the project. The purpose of the meeting was to support the approval in consensus or to reject the project and return to thermal disinfection. Since the entire process was well supported by Holland, the meeting was a formality. All aspects have already been dealt with during the various process steps that
were decided by mutual agreement. Transparent communication and project follow-up were the result of successful preparations for this closing meeting.
Once the project was implemented, the quest was started to justify the savings of the Bifipro®. At first, a detailed calculation was carried out based on the energy consumption that is submitted annually to the board of directors. The As-built plans have been examined more in detail and the distances, diameters of the ring mains have been adjusted according to the measurement.

This detailed calculation showed that 30% more pipes were present than estimated via the retained energy scan. In view of the large margin of error, a second dedicated calculation was carried out through the specifications of the energy consultants. It was eventually established that there were 35% more pipes present for circulation of domestic hot water. The thickness of the insulation around the piping was verified in several places in the hospital and correctly applied according to the calculation.

In addition to the quantity, it is very important to be able to demonstrate the investment effect on the costs from the invoicing. The effect of lowering the temperature will mainly be visible in the natural gas invoices. In the hospital, the water is heated at a low temperature (<45˚C) with GHP (Geothermal field). The domestic hot water is further preheated on the basis of the condensing boilers. In addition, the
condensing boilers are also used to provide hot water for the heating system. During the summer months, the heating system is turned off, so the condensing boilers are only used to generate domestic hot water. The Borehole Energy Thermal Storage (BETS) field provides the hospital with cooling via the ventilation.

In the hospital, gas consumption in the summer months is aproximately 200MWh. This is the amount of gas that was used to generate water up to a temperature of 65˚C on the domestic hot water. After installing Bifipro®, natural gas consumption has decreased to 145MWh. We can extend this to the other months, so that the effect of the investment is 660MWh/year. Given the cost of natural gas at the start, around €30/MWh (a saving of €20.000/year in 2015). The volatility of current commodity prices means that in 2022 this saving will be equivalent to €110/MWh or €66.000/year (!). This means that the payback period today would be less than 1 year.

It is extremely important to monitor closely the follow-up of an investment after installation. Only the follow-up learns the user how to deal with ‘change’ for sustainable water safety. The implementation of the Bifipro® is a first step in the new way of water management.

It teaches us how to deal with water quality, but also how energy shows us to deal with its vulnerability. Confidence in the functionality
increases in the organization and the next step is finding an energy balance of domestic hot water in the building.

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Energy buildingscan (ROI)

In addition to the primordial requirements for patient safety, there are also the financial benefits that are proposed when initiating a water treatment project. The energy scan performs an energetic balance calculation of the effect of a possible temperature drop. This is divided into 2 subjects, namely a ‘static’ and a dynamic calculation. The ‘static calculation’ determines the effect that the temperature drop initiates due to lower heat losses over the ring main, collectors and buffer tanks spread over the building. At the start, a calculation is made of the number of km of hot water pipes. This pragmatic approach determines the number of running meters of pipes, in combination with the heights of the floors and the necessary branching to decentralized substations.

In addition, it is examined which room temperature can be determined without loss of comfort for the patient. From that point of view, a departure temperature of 45˚C is realistic. From a retained calculation, a flow temperature of 50˚C is always set as the target temperature. In the

AS IS situation, the objective is to maintain the return temperature > 63˚ which means that the system setting is set to 65˚C.

Static calculation of heat losses		
Number of floors	5	
Number of buildings	3	
Height of each floor	4 m	
Length of the building	100 m	
Number of taps	1800	
Diameter of circulation piping	0,075 m	
Outerdiameter piping	0,127 m	
Thickness of tubes	0,004 m	
Thickness of insulation	0,022 m	
Type of insulation	0,044 W/mK	
Temperature of circulation piping [°C] départ AS IS	65 °C	
Temperature of circulation piping [°C] future state TO BE	48 °C	
Ambient temperture [°C] average	20 °C	
Heatloss through tubes		
Insulation losses in building	95%	
Continuous heating by circulation domestic hot water (1 year)	8760 u	
Gasprice ENDEX [€/MWh]	30 €/MWh	
Amount of energy required to compensate heat losses		**528 MWh**
Yearly savings on heat losses domestic hot water		**€16.907**

Table 1. Static calculation of heat losses

The second part of the calculation concerns the reduction on the production of heat to provide domestic hot water. This part is based on the hot water consumption of the building, for the hospital the DHW was not separately monitored whereas we set a ratio of 30% of the total consumption (45.000m3/year).
Next to the water consumption the heat source efficiency play a major role in the calculation.

Depending on the source (heat combustion, heat pump of GSC,...) and his age the efficiency to produce heat is defined. The effect results in energy savings on single heating cost of cold city water to domestic hot water.

Reduction on heat production costs		
Domestic hot water consumption (DHW) a 65 °C	15000 m³	
Efficiency on heat source	90%	
Average temperature incoming city water	10 °C	
Required annual consumption for continuous heating of DHW	437 MWh	
Yearly constprice for heating of DHW	€13997	
Domestic hot water consumption (DHW) a 48 °C (+15% waterconsumption)	17250 m³	
Required annual consumption for continuous heating of DHW	302 MWh	
Yearly constprice for heating of DHW	€9671	
Energy savings on heating costs		**135 MWh**
Yearly savings on heating costs by temperature reduction		**€4.326**
Total annual energy savings		**€21.233**
Investment		
Purchase value HW Bifipro®	€50.000	
Yearly maintenance cost	€4.000	
Payback	2,4 year	

Table 2. Reduction on heat production costs

Implementation of energy reduction

Each process step for temperature reduction is set up at 4˚C. Every reduction in temperature is preceded by a water sample from an external lab. For a sample with no comments, the flow temperature was lowered by 4˚C. The sampling gives the signal that no bacterial growth occurs at lower temperatures. This removes the risk and represents a milestone in the project that removes breeding ground for discussion. The process step is also adopted as a fixation at which temperature plays no longer a role in legionella management control.

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A second reason to gradually lower the temperature is to thoroughly analyze possible problems with flow or comfort requirements. The effect of lower temperature on the buffer vessels was profoundly analyzed. Within the hospital's technical standards, a return temperature of 41˚ degrees was also assumed as the lowest feasible temperature for domestic hot water.

In addition to comfort, there are also a number of applications that are fed with hot water. More specific, the CSI (Central Sterilization Instrumentation) was provided with hot water, the lower limit for incoming water was set at 56˚C. At the 2nd reduction we got error messages at the sterilizers. Building in the steps also gave us a high-performance view of our own installation and built-in alarms. This was of course accompanied by the necessary inconveniences, but by switching the temperature back to the previous step (4˚C) higher, the problem was solved within the hour. Then we were given the time to come up with a structural solution.

At the end of the trajectory, the flow temperature is set to 48˚C, which was initially set as the final target. An energy optimization has been carried out to lower the temperature to 46˚C. There was 1 place, on the 5th floor, during the peak moment of domestic hot water consumption, where a comfort problem was identified. It was decided to raise the temperature to 47˚C to counteract this item. Because recording the flow temperature is not an exact science, there is now a margin of 1˚C to ensure that the flow temperature never drops below 47˚C.

Sustainability

Initially, it was decided to have the water supply directly from the low temperature generation from the GHP. After reflection towards the complexity and the interference of different heat sources, this track has been abandoned. Although the possibilities are there to provide domestic hot water at a low temperature directly by a heat pump in new building constructions or boiler room renovation.

This ensures that every building manager can provide its patrimony with safe domestic hot water without CO_2- emissions.