Brussels Health Campus Description

The Brussels Health Campus containing the university Hospital (Universitair Ziekenhuis Brussel UZB-VUB) and part of the Vrije Universiteit Brussel (VUB), is a well-advanced energy island owning and running a state-of-the-art microgrid that can work in island mode for 5 consecutive days. It includes a thermal and electricity grid, wastewater recovery, a high-speed glass-fibre telecom network and a total of 33 HV transformers divided over 18 HV substations. Energy production and storage includes solar PV, CHP, 3 emergency generators, and a total capacity of 2,5 MWh in battery storage, mainly under the form of UPS.

The microgrid serves the hospital complex, 250 student dwellings, the faculty of health sciences, a primary school and a fitness center. The microgrid system is conceived to go in island mode with complete automatic transition in maximum 15 seconds in case of critical need and in 3 min to comfort need. The financial bookkeeping and billing of the different consumers in the microgrid is carried out by means of an ERBIS software platform. Cutting edge control technology and maximal reliability are the focus points of this demonstration site.

Seasonal demand

The climate introduces a cyclic component to the consumption of gas. This supplies the heating needs of the hospital. The electricity consumption does not show any cyclical behaviour, but due to the effect of the CHP, which generates electricity as a by-product, the electricity bought by the hospital is reduced during winter, when the CHP is used to heat the buildings in the hospital. The PV generation on site presents cyclical behaviour which is negligible when compared to the total electricity consumption and purchase of the hospital.

Electrical energy

The hospital's energy system comprises the electrical and thermal vectors. Both vectors have a distribution system owned by the hospital. Purchase of electricity is about 30GWh per year in the early years 2010, but there is a clear decreasing trend starting in 2016.

Table 1 lists the PS electrical production assets

Installation type	Power (electric)
Emergency generators (diesel)	4.4MW/5.5MVA
Solar	PV 817kWp
CHP	2.8MVA

Distribution network

The hospital has its own distribution network, shown in Figure 1. The topology of the network presents a closed-ring shape for increased reliability. The network is connected to the grid through two links C1A and C1B, located at the same place.

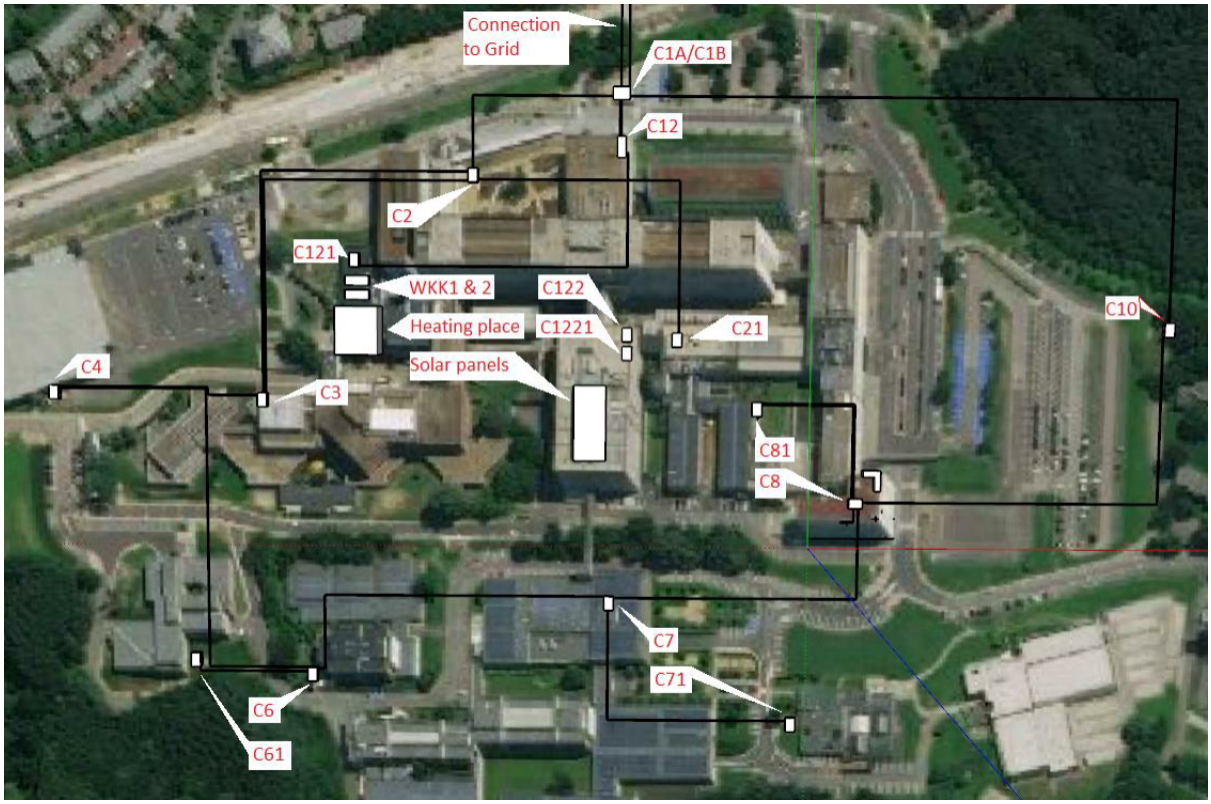

Figure 1 - UZB electricity distribution network

Consumption

Electric consumption data are available for the buildings listed in Table 2:

Table 2 - VUB Health Campus Electric consumption data (Source: VUB)

High voltage cabin Power		[kVA]	Number of transformers	Connected stakeholder
C1	Head cabin (grid connection)			UZB
C2	Emergency stream production	2000	2	UZB
		2500	2	UZB
C2.1	Temporary ophthalmology	630	1	UZB
C3	Children's hospital	800	3	UZB
		1250	1	UZB
C4	Parking 1	630	1	UZB Parksite MacDonaldH Villa Samson
C6	Animalarium	+/-		VUB

		1600		
C6.1	Dentistry	320	1	VUB
C7	Faculty Medicine	630	2	VUB
C7.1	Student's restaurant	320	1	VUB
C8	PR4	630	2	UZB
C10	Student's houses	630	1	VUB
C12	hospitalization building (main entrance)	800	8	UZB
C12.1	CHP	1250	2	UZB+VUB
C12.2	Operational Services	800	2	UZ
C122.1	PV installation	800	1	UZ +VUB + third investor

Measurement infrastructure

Measurements are taken on the secondary (LV) terminals of the transformers.

Contractual framework

Billing is done internally following the consumption of the different actors for UZB and VUB. Other stakeholders are sent 12 bills a year, for delivered electricity (in kWh). Distribution and transformation losses are distributed according to the energy consumed. Accounting and billing are managed through ERBIS software. Stakeholders are free to co-invest in generation, but currently only VUB and UZB jointly invested in CHP. Solar panels are obtained through a third-party investor. Roof space is given for free in return for free electricity for 10 years. After 10 years the panels become property of UZB. The third-party investor creates revenue through green energy certificates.

Thermal energy

The natural gas consumption chart shows an increasing consumption trend over the years. This is due to the increasing energy demand of the hospital, where part of the electricity consumption is generated on the spot, thus is not bought for the DSO, but the natural gas consumed is always bought.Table 3 lists the thermal production assets of the PS.

Table 3 - VUB Health Campus Thermal production assets (Source: VUB)

Installation type	Power
Central heating boilers (Gas fueled) (12+6+3)	21MW
CHP (2x1.5MW)	3.0MW

Distribution network

There is a high-temperature heat distribution network in place. 11 heat circuits are connected to the distribution network.

Consumption

Information about the fuel consumption and the consumption of certain parts of the hospital can be retrieved from the PRIVA building management system if needed.

Measurement infrastructure

A PRIVA building management system handles part of the consumption and production of heat, as well as the information on fuel consumption.

New energy assets

Improvement of the building energy management and the microgrid control, optimized energy consumption. Currently the load balancing is mainly carried out by balancing the loads and production at HV level. In such scenario it is possible that certain substations need to be shut down resulting in a partial shut-down of the subsystems. In order to avoid such situations a smarter management of the consumption at the various departments of the hospital may consistently help in sustaining the balance within the microgrid. For that purpose, intelligent scenarios need to be implemented in the controllers of the energy management of the buildings, prioritizing the most important consumers (e.g. surgery rooms), delaying and adapting/reducing consumption for less important components systems. Several scenarios need to be programmed in order to ensure fast response on various levels of balancing needs.

This methodology will be implemented and tested out in large scale on the site. This methodology/intelligence is an enabler for the deployment of microgrids in a broad sense. It not only increases efficiency of the microgrid but is also an enabler in a more rural area or less complex system. The design of the Brussels Health Campus microgrid for abundant redundancy minimizes the effect of shutting down a substation, however in a simple constellation with a limited number of substations the impact is far more important and implementing this intelligence will mitigate this issue. VUB will develop and introduce the scenarios in the controllers of the Priva. Building Management System in collaboration with SDME.

Inclusion of student rooms in the energy community and improved energy consumption

100 ABB Smart meters will be installed in the adjacent student houses owned by the VUB, monitoring the electricity consumption of each student room. The students will have access to a data platform that shows their behaviour and give suggestions for an improved consumption behaviour. They will be incentivized through e.g. reduction of house rent. The customer sensitivity to incentivizing measures is monitored. In addition, the different services of the VUB will be separately billed in order to incentivize their behaviour towards a more efficient use pattern, e.g. carrying out energy intensive operations on moments electricity is cheap/abundant.