

CHP Unit in a bus and metro depot STIB (Brussels)

CONCEPT

STIB installed a CHP unit for the production of heat and electricity in the Delta bus and metro depot in Brussels. The heat produced by the CHP unit is used to heat the depot and workshop as well as to produce hot water for sanitary needs. The electricity produced by the CHP unit covers 27% of the depot's energy requirements.

Technical Data

Thermal power	590 kW
Electrical power	400 kW
System efficiency	92.2%
Surface of the building	70,000 m ²



© STIB

OBJECTIVES

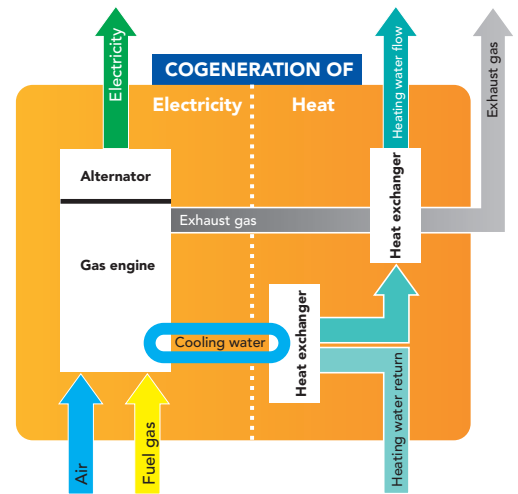
- Improve the efficiency of energy production systems;
- Reduce the primary energy consumption;
- Replace an old boiler.

INVESTMENT DESCRIPTION

Combined Heat and Power (CHP) is a technique to generate electricity and heat simultaneously. Most systems producing electricity produce heat as a by-product, and this heat is usually lost, decreasing the global efficiency of the system. CHP is the principle of recovering this otherwise lost energy. The heat recovered can be used to heat a depot or an office building and to produce hot water. The CHP process improves the global system efficiency and offers large cost savings, as it consumes less primary energy than the separate production of heat and electricity. Compared to conventional power plants, CHP energy savings vary between 15 and 40%.

In the case of STIB, the system consists of a gas engine, which is connected to an alternator generating electricity. The depot covers an area of 70,000 m². Besides some offices, it has a workshop for the light maintenance of buses and the light and heavy maintenance of metro-cars. To maximise the gain, the heat produced by the system is recovered at three levels:

- Recovery of the heat through an exchanger heating the water flow. This water flow is sent to the radiators and air heaters of the heating system;
- Recovery of the exhaust gas heat. This low temperature heat is recovered through condensing and directed to the low-temperature circuit. This heat is finally sent to air heaters and a heat plate exchanger, for domestic water production;
- Recovery of the heat produced by the CHP ventilation system. This hot air is used to heat the bus workshop.



Results	
Energy savings (%)	15-20%
Energy savings (kWh)	3,044,500 kWh
CO ₂ savings (TCO ₂)	467 TCO ₂
Implementation costs (€)	€475,000
Operational costs (€/year)	€20,000
Cost savings (€/year)	€154,500 (with green certificates)
Payback time (years)	3 years

COST AND FUNDING

The cost of the investment amounted €475,000. It is important to note that the Brussels Region supports the investments in CHP systems through the delivery of green certificates and a regional investment grant. Green electricity producers receive €70,000 green certificates, which can be sold on a virtual market. Buyers are generally electricity providers required to hold a number of green certificates corresponding to the amount of green electricity sold to their customers. With this CHP system, STIB can earn green certificates by saving around 467 tons of CO₂ each year.



© STIB

RESULTS

The performance levels of the previous heating system were 90% for the boiler and 53% for the high-efficiency gas and steam turbine. Hence, the total performance level of separate production of electricity and heat amounted to 71.5%. Compared to this total, the new cogeneration performance level is 92.2%. With this investment, STIB was able to reduce its annual energy consumption by more than 3,000,000 kWh and saves around 467 TCO₂.

LESSONS LEARNED

Since this was the first investment in a CHP unit for STIB, it was strategic to study the best place to achieve this. The Delta Depot, built in the '70s, was chosen mainly for three reasons:

- All activities are done in a single building;
- The building has an efficient and centralised heating network;
- The requirements in heat (and electricity) are significant.

This enabled STIB to halve its production losses and to save 15% to 20% of primary energy compared to the separate production of the same amount of heat and electricity. This investment has a payback time of three years without external funding. Given these outstanding results, STIB will continue to deploy the CHP technique in its depots.

CONTACT

STIB

T2K@stib.irisnet.be