

CASE STUDY CZECH REPUBLIC

3.5

3.5.1 Description of Wastewater Treatment Plant

Central Prague WWTP is a large site with a capacity of 1,641,000 PE (population equivalent), WWTP is the mechanical-biological system with the thermophilic anaerobic digestion of sludge. WWTP is situated in the northern part of Prague at river island, very close to residential areas as you can see in Figure 3.8. In 2019 new biological treatment

line was put into operation. Sludge produced at both treatment lines of Prague WWTP is processed by thermophilic anaerobic digestion (AD).

Veolia operates Prague central WWTP including sludge line with AD thermophilic process. The biogas is now burned at CHP plant 5 MW of electric power (gas piston engines) with limited heat utilizing, which affected overall energy efficiency. The results of AD and energetic data are shown in Table 3.8

Figure 3.8

Aerial view of the Prague WWTP



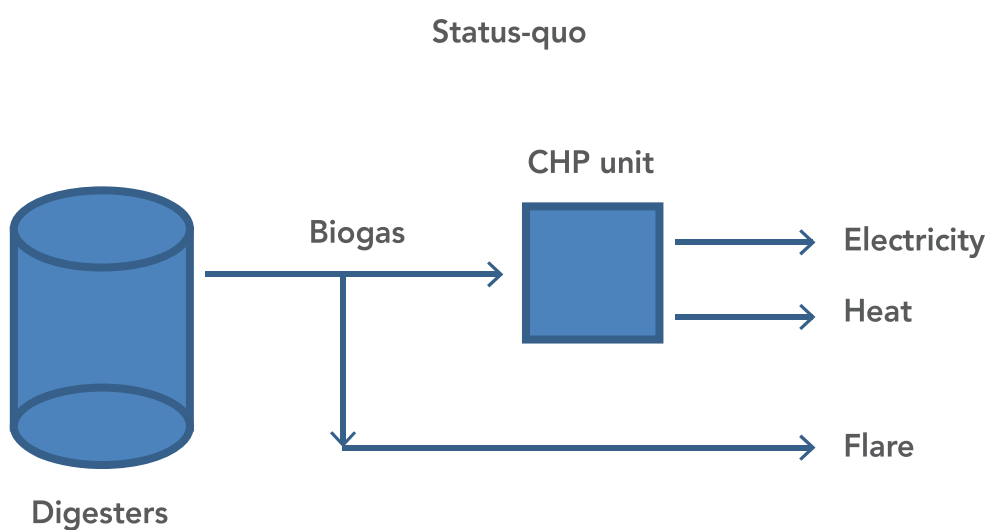
Table 3.8**Average results of AD**

Biogas production (Nm ³ /year)	18,066,974
Electricity production (kWh/year)	32,029,000
Plant self sufficiency	75 %
Biogas for other purposes (Nm ³ /year) (now burned on flares without purpose)	1,150,000
Methane content of raw biogas	61 %

3.5.2 Selected scenarios by REEF 2W decision support tool

For Prague WWTP there is designed membrane biogas upgrading unit for biomethane production and vehicle refueling station.

This measure changes the status quo when part of the biogas is burnt in the flare as shown in Figure 3.9. The biomethane plant can positively affect the energy efficiency of WWTP and reduce the air pollution generated by transport.

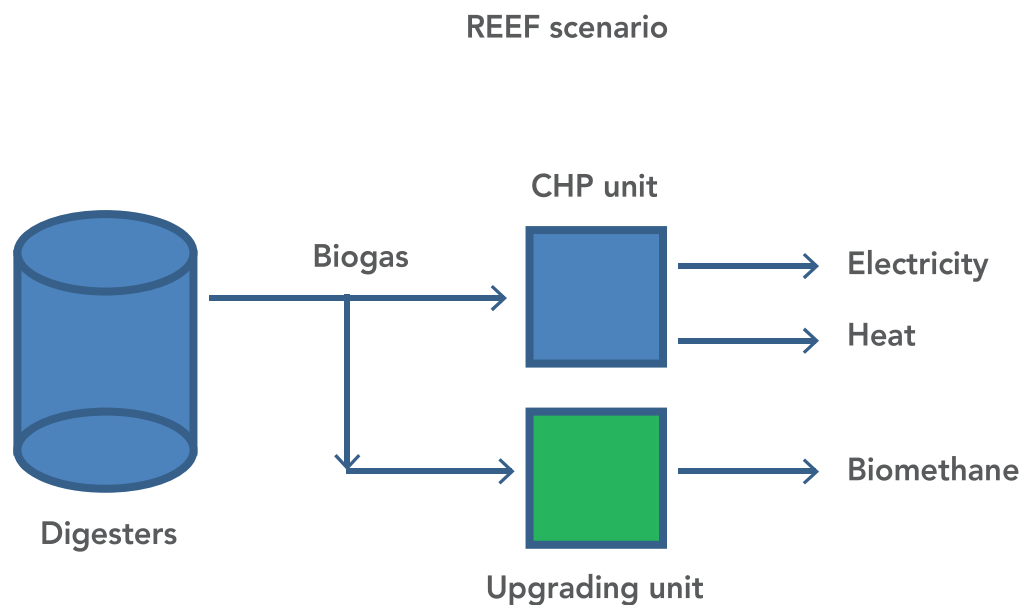
Figure 3.9**The technological scheme of the current state**

The installation of biogas upgrading unit causes only minor changes to WWTP site as shown in Figure 3.10. Installed technology is small and compact because the unit is situa-

ted in standard containers. Only small part of produced biogas (now not used) will be upgraded.

Figure 3.10

The technological scheme of the future situation



Biogas upgrading unit will operate with 250 Nm³/hour of raw biogas. Biomethane production will be 160 Nm³/hour. It means that 2,500 kg of CNG per day will be produced. By energy point of view it means 1,370 kWh of green energy will be produced from - now unused - biogas.

biomethane production, the introduction of membrane biogas upgrading unit increases energy consumption; however this increase is about below 1 kWh/PE₁₂₀*year while the total energy consumption of WWTP is 23.6 kWh/PE₁₂₀*year.

3.5.3 Results and Discussion

Energetic point of view

From an energetic point of view, the difference between "Status quo" and "REEF scenario" is negligible. Electricity and heat production from biogas stays unchanged. Biogas currently burned in flare is used for

Economic point of view

From an economic point of view, it is important to evaluate what will be the costs and benefits of investing in the membrane biogas upgrading unit. The benefits are in the current conditions of the Czech Republic and Central Europe also highly dependent on subsidies related to biomethane production. Under current circumstances, the benefits

from sales of biomethane allow estimating the return of investment as about 6 years, which is acceptable.

Ecological point of view

From an ecological point of view, the crucial benefit is the replacement of fossil fuel (natural gas) by fuel from renewable sources (biomethane). The production of biomethane offers improved use of biogas energy because the heat produced in the current CHP technology is hardly usable in the summer month. Production of the fuel instead of heat is much more environmentally friendly.

3.5.4 Conclusion

Considering the comprehensive environmental, social, economic and technical analysis, the REEF 2W technology -introduction of biomethane production -is beneficial for the selected WWTP. As shown in the Table 3.9. REEF 2W scenario has the better composite index in three categories and it is equal in one of them, which means that implementation of proposed REEF 2W solution could bring additional benefits in these fields.

Table 3.9
The result of multi-criteria decision analysis

Criterion	Composite Index (Status quo)	Composite Index REEF 2W technology
Environmental	3.2	2.4
Social	3.2	2.0
Economic	4.0	2.4
Technical	2.2	2.2