1.1.5 Biomass fuelled district heating station - Smolyan (BG)

Smolyan is a municipality of Rhodope Mountains region of Bulgaria located at about 1.000 meters above sea level, with 41.452 inhabitants. On 26 September 2013 the Municipal Council approved a decision to join **CoM initiative** and the SEAP is currently under elaboration.

In the framework of Green-Twinning project, Smolyan assessed the **reconstruction and modernisation of the District Heating (DH) station** (fuel switch from heavy fuel oil to biomass and consequently installation of a CHP unit to generate electricity and heat for better efficiency) with the aim to achieving energy and cost savings by fuel switch from expensive heavy fuel oil to local biomass, replacement of individual electricity and coal space heating of Smolyan residential buildings, increasing comfort for the citizens and reduction of GHG emissions. This sustainable energy action is considered an important part of the municipal RE/EE policy and is expected to significantly contribute to CoM obligations as well as to the local socio-economic development.

The DH station has currently a pipe-line network and heavy fuel oil boilers for supply of municipal buildings and tertiary sector private dwellings with heat; nevertheless due to the big increase of heavy fuel prices in the recent years, the station stopped operating. Before ceasing operation, it consumed about 630 t/year of heavy fuel oil and 1.230 t/year coal and 3.550 MWh/year electricity were additionally consumed for space heating by the tertiary sector (hotels, offices and private dwellings) that are now planned to be supplied by the new biomass fuelled DH station.

The current heavy fuel oil price is around 650 €/t (VAT excluded), electricity price is 0,08 €/kWh in average and the price of coal is around 115 €/t. Taking into account these parameters, the baseline expenses amount to **834.950 €/year** and the CO_2 emissions, as per emission factors approved by Bulgarian Ministry of Environment and Water, amount to **5.850 tCO_2/year**.

Technical aspects

The first major component of the project is to switch the fuel base of DH station in Smolyan from currently used heavy fuel oil to waste biomass (**Component 1**). The station currently supplies nine municipal buildings and has the capacity to connect more users who have expressed interest. In order to increase network efficiency the project envisages also partial reconstruction of heat distribution network as well as measures for EE in connected buildings. Following measures are foreseen:

- Fuel switch by means of replacement of existing heavy fuel oil boilers with new, modern ones on biomass with automatic fuel feeding; The technology currently being considered involves two boilers for hot water production (115/70º C) of 3 MW each

with moving grates for direct combustion of wood biomass with horizontal oil-tube heat exchanger and exhaust gasses recuperation unit.

- Replacement of 2.770 meters of existing DH network with new pre-insulated pipes;
- Replacement of 13 substations with new ones with modern automatic controls and low consumption pumps;
- Energy saving measures in municipal buildings.

The project involves collection and transportation of biomass wastes - barks and branches from wood logging and saw-dust from wood processing. There are respective industries in and around Smolyan municipality involved in wood-logging and wood processing and the investor in the DH station will deal with contracts for biomass fuels supplies with them. The role of the municipality will be to facilitate and assist the process.

The foreseen fuel is wood chips and waste wood from wood- processing industries with minimum calorific value (LHV) 2,5 kW/kg and maximum humidity (WC @ WB) up to 55%. Technology providers include Austrian made **POLYTECHNIK** biomass fueled boiler (already installed in biomass DH station in Bansko, Bulgaria), as well as Uniconfort (Italy) biomass fueled boiler Global 500 OD.

The operational data of the biomass boiler:

- Annual operational hours: 3.000 hours/year (at 4,5 months heating season);
- Heat output generated: 18.000 MWh/year;
- Fuel consumption: 12.900 t/year;

Environmental aspects

The action will contribute significantly to the municipal targets for environmental performance as follows:

- Emission reductions:
    - CO_2 emission reductions - 4201 tonnes/annum;
    - N_2O emission reductions - 1578 kg/annum;
- Reduction of environmental pollution due to the disposal of waste biomass.

Financial aspects

The foreseen method of financing of Component 1 is PPP/TPF. Interest is shown by private companies specialized in construction and operation of biomass fueled DH and currently possible private investors are being investigated. Also variants of the partnership are being discussed form share-holding participation of Smolyan municipality in the project (eg. with in-kind contribution -land, existing heating pipe-line network) or selling the project to a private investor with no participation in the DH company ownership and operation.

The main means of financing will depend on the chosen PPP. If the project is sold to a private investor, it is foreseen to involve about 25% own financing of the investor and the rest from external sources - bank loans.

The action shows good profitability with a discounted IRR of 13 % for the project lifetime. The financial parameters are improved significantly (discounted IRR of 19 %) when taking into account socio-economic considerations as per the Guide to Cost Benefit Analysis of investment projects issued by the Directorate General Regional Policy of the European Union in July 2008.

The major risk associated with the project results is the ability to attract clients mainly from the private housing sector and the standard of living/solvency of the private housing clients, i.e. citizens.

Socio-economic aspects

The project considers significant socio-economic revenues related to the reduction of costs of thermal energy due to the utilization of local resource located in the vicinity of the DH station. Furthermore heavy fuel oil is currently the most expensive energy source and is imported to Bulgaria; its substitution with local waste resource will have positive economic impact over heat energy prices. Important socio-economic benefits are also the improved comfort in the heated buildings, the local socio-economic development and the GHG emissions reduction.

Organisational aspects

The working team created is cross-departmental and combines different skills (Figure 3).

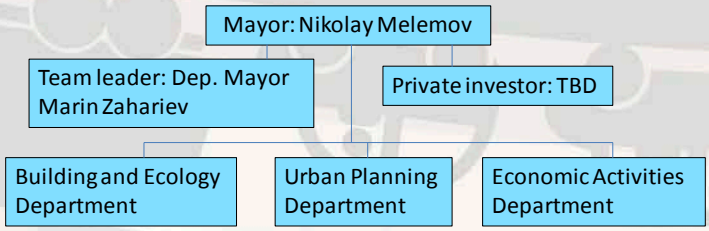

Figure 3 Project Organisational structure in Smolyan

The next steps of the project include decision of the Municipal Council in March 2014 and announcement of a public procurement tendering procedure (executed according to the current Bulgarian legislation governing Public Procurement issues, such as Public Procurement Law, Guidelines for Public Procurement Law Enforcement, Public-Private Partnership Law (in force since 01.01.2013), Guidelines for Public-Private Partnership Law Enforcement, Ordinance for the ways and criteria for public-private partnership project inclusion, Methodical Guidelines for Public-private partnership (2009), Concession Law, etc.) on the municipal web-site. Information dissemination to the public will be done via

announcement on the municipality web-site and presentation of the project goals and expected benefits during different workshops and dissemination events.

In July 2013, Mr. Marin Zahariev, vice-mayor of the Municipality of Smolyan, and Ms. Luisa García Chamorro, mayor of the Municipality of Motril, signed the Memorandum of Agreement. During the meeting in Spain (9-10 July 2013), Bulgarian representatives visited several facilities such as Churriana de la Vega waste water treatment plant with biogas cogeneration, Motril public street lighting system, solar thermal plants in the municipal building, Pinos Puente biomass company, municipal electricity vehicle station and a green roof build up by Otero's company.

Figure 4 Signing of the Green-Twinning agreement in Motril Town in June 2013

Table 5 summarises the results of the technical, financial, socio-economic and organisational analysis of the action entitled "Biomass DH in Smolyan".

Table 4 Summary of the findings of the assessment study of the action "Biomass DH in Smolyan"

Technical/ Environmental Assessment	**Title**	Biomass DH in Smolyan
	Baseline scenario data (kWh, tCO_2, €)	• 630 t/year of heavy fuel oil • 1.230 t/year coal • 3.550 MWh/year electricity • 5.850 tCO_2 • 834.950 €
	Technology employed	Biomass fuelled District heating with consequent CHP
	Technology providers	Various
	Technical specifications	Two water heating boilers on waste wood biomass of 3 MW each plus network rehabilitation.
	RE produced	18 000 MWh/year
	CO_2 savings	4.201 tCO_2
Financial assessment	**Financing scheme**	Public-private partnership
	Project cost	3.031.960 €

	Annual maintenance costs	122.710 €
	Annual project revenues	1.127.340€
	Discount rate	10 %
	IRR (%)	13 %
	NPV (€)	1.037.335 €
	Payback period (years)	11 years
Socio-economic assessment	**Annual socio-economic costs**	563.890 €
	Annual socio-economic benefits	1.127.340 €
	IRR	19%
	NPV	4.970.903 €
Organisational assessment	**Time-schedule**	1/1/2014-1/1/2015