

MEASUREMENT & VERIFICATION

Refurbishment of district heating systems

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EU4Energy



**Covenant of Mayors
for Climate & Energy**

**Demonstration Projects
Eastern Partnership**



1 General

1. All projects are obliged to prepare and submit monitoring and verification data
2. The monitoring and verification data shall be prepared for each subproject.

2 Calculation of savings

The savings of each subproject have to be calculated by comparing the energy consumption before and after the project implementation. BUT the situation before is often not comparable with the situation after the project (heating comfort, operation time, weather conditions, etc.) → establishment of a “**baseline**” is needed to have comparable conditions before and after the project implementation. The baseline usually represents the calculated (theoretical) energy consumption before the project implementation considering the same service level as after the project implementation (i.e. same heating degree days, operation hours, same indoor temperatures, same heated floor area, etc.).

It is recommended to prepare the following table after finalization of the technical design of the project.

Parameter	Unit	Baseline	After implementation	Savings
District heating system (consumers):				
Number of consumers	#			
Heat load of consumers	kW			
Heat consumption per year	MWh/a			
Boiler house:				
Total heat produced per year (biomass + natural gas)	MWh/a			
Heat produced per year (biomass boiler)	MWh/a			
Heat produced per year (natural gas boiler)	MWh/a			
Fuel consumption biomass	t			
Fuel consumption natural gas	m ³			

Total fuel costs (natural gas, biomass)	UAH/a			
Electricity consumption of the boiler house per year	MWh/a			
Electricity costs per year	UAH/a			
CO2 emission per year ¹	tCO2/a			

Please attach the basic calculation steps in a separate document.

3 Ongoing monitoring after completion of the subproject (actual measurements)

The PT has to ensure that the following meters/measurement equipment are installed and data will be recorded.

Meters in the boiler house:

- 1 electronic heat meter incl. internal data storage
- 1 electronic electricity meter incl. internal data storage
- 1 fresh water meter
- 1 electronic natural gas meter

Meters at the consumers:

- 1 electronic heat meter incl. internal data storage

It is recommended to continuously measure and record the following values after the project implementation for the entire building.

The monitoring data shall be submitted to the ST after completion of the project on a monthly basis.

Value	Measurement device	Measurement interval	Unit
District heating system (consumers):			
Total heat consumption for each consumer	Electronic heat meter	weekly	kWh
Temperature of flow/return for each consumer	Electronic heat meter	Average per week	°C
Boiler house:			
Total heat produced in kWh	Electronic heat meter	weekly	kWh
Temperature of flow/return from/to the district heating	Electronic heat meter	Weekly (average)	°C

¹ Emission factor natural gas: 0,2 tCO2/MWh; Ukraine: Emission factor electricity: 1,058 tCO2/MWh

network			
Total electricity consumption	Electricity meter	weekly	°C
Total fresh water consumption	Water meter	monthly	m ³
Total biomass consumption	estimation	weekly	t or m ³ , kWh
Water content of the biomass	Scale	weekly	%
Total natural gas consumption	Gas meter	weekly	m ³ , kWh
Additional parameters to monitor:			
Heating degree days	-	monthly	-
Operating hours		weekly	h
Calculated energy performance criteria:			
Efficiency of the gas boiler (heat produced/fuel consumed)		monthly	%
Efficiency of the biomass boiler (heat produced/fuel consumed)		monthly	%
Heat losses in the district heating system (heat produced - heat consumed)		monthly	kWh
Electricity consumption in kWh per produced MWh heat energy		monthly	kWhel/MWhth