Measurement Equipment for BIOMASS DISTRICT heating plants

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Measurement equipment for biomass district heating plants

In order to ensure a comprehensive monitoring and thus, a continuous improvement in the economic and ecological quality of biomass heating plants and district heating networks, appropriate requirements must be met for the measurement equipment of such plants. During operation, standardised annual operating reports are important to enable monitoring, the calculation of key performance indicators and optimisation of the heating plant and, if needed, to facilitate operating data to external experts and funding authorities. The annual operating reports contain the most important operating data of the district heating plant, i.e. heat produced by every single boiler, heat sold to every consumer or electricity consumption.

For this reason, uniform conditions for operational optimisation and monitoring during operation are to be defined for all new biomass heating plants. To ensure the trouble-free fulfillment of these requirements, the measurement equipment of the heating plant, district heating network and heat transfer stations as well as the type of data recording and data evaluation are standardised. Only through consistent implementation of the measures described below it will be possible to reach the set goals, i.e. allow a constant monitoring of the plant operation and achieving high efficiencies and low emissions.

Measurement equipment - Minimum requirements

The determination of the (measured) quantities described here is mainly used for internal monitoring, optimisation and fault detection of the heat generation plant. It is not planned to manage and evaluate these data centrally.

The measurement equipment and data recording of biomass heating plants and district heating networks should meet the minimum requirements described below. The prerequisites for this should be defined already during the planning stage.

The following data must be recorded:

1. Outside air temperature at the central heating plants.
2. At all heat production units (separately at each boiler, economiser, condenser, etc.), at the outlet of the pressureless manifold, at the feeding point into the main heat transport pipeline, as well as at all consumers (external as well as internal, a data connection must be set up from the heating plant to the remote consumers).
	1. Quantity of heat [kWh].
	2. Supply and return flow temperature [°C].
	3. Volume flow rates [m³/h].

The aim here is to be able to allocate the quantity of heat produced and distributed to the producers and consumers. Volume flow rates and temperatures are measured, all other variables are values which may be evaluated if required.

1. Recording of electricity consumption (monthly) of:
	1. Each heat production unit separately (consisting of all electrically operated auxiliary units such as fuel feeder, fans, boiler circulation pumps, boiler control - in other words, all electrical auxiliary energy required to operate the heat production units. The electricity consumption of the above-mentioned aggregates should not be recorded separately, but as part of the heat production unit as a whole. If there is more than one biomass boiler, jointly used auxiliary units, e.g. the hydraulic pump for fuel delivery, should be allocated to the base load boiler).
	2. Electric precipitators.
	3. Network pump(s).
	4. Total electricity consumption of the entire plant.
2. Operating data of each biomass boiler unit (to be applied likewise for all other heat production units)[[1]](#footnote-2):
	1. Activity of the fuel feeder (number of start/stops and intensity - e.g. frequency of the screw drive).
	2. Ash discharge activity/dust discharge activity (number of start/stops and intensity - e.g. frequency of feed screw drive, dust removal).
	3. Boiler flow and return temperature [°C].
	4. Boiler inlet temperature (after return flow increase/mixing valve) [°C].
	5. Setpoint value of the load controller on the boiler [kW].
	6. Heat load of the boiler [kW].
	7. Flue gas temperature [°C].
	8. Measured value of the lambda sensor (Vol-% O2).
	9. Rotation speed set point of the boiler air fans [%].

4.10. Rotation speed set point of the boiler flue gas fans [%].

* 1. . Boiler/flue gas pressure (reference variable flue gas fan) [mbar].
	2. . Automatic malfunction log (with malfunction notification system for feeder, auxiliary fans, grate and ash removal, boiler level monitoring devices, lambda sensor and other emissions monitoring devices, safety devices etc.).

The values listed in point 4 are usually recorded by the boiler control system. An evaluation by the boiler manufacturer, planner and operator should be possible in the event of a fault or for optimisation purposes.

1. Temperatures of integrated heat storages of at least five measuring points evenly distributed over the heat storage height.
2. Result of the standard inspection (safety valves, pressure maintenance system, thermal discharge safety device, sprinkler system, backfire protection, general fire protection, official regulations), result of the visual inspection of the boilers and other components (grate, fireclay and flue gas ducts).

(This is intended as a general indication of the necessity of these activities).

1. Hydraulic/network data:

(It should be possible to provide this data for optimisation purposes only).

* 1. Temperature of the main supply and return pipelines [°C].
	2. Pressure loss of the network at nominal load and at summer load.
	3. For speed-controlled main network pumps - actual frequency / setpoint frequency.
	4. Critical system operation/differential pressure - definition of the critical consumer.
	5. Set point value and actual position of the mixing valve for the main flow temperature control at nominal load and at summer load.
	6. Result of the regular heating water analysis according to current national standards.
1. Emission data:
	1. Result of an emission measurement at load > 80 %.
	2. Result of an emission measurement at summer load (May to August; at the time of the measurement the installation should be in the range of the lowest partial loads required by the year).
2. Required data format, recording interval and accuracy:
	1. A uniform data format should be enforced to facilitate monitoring and evaluation by internal and external experts. This might also require adaptation of the products by the control providers. A data interface must be implemented in the production data acquisition system for the operating data. This interface allows the data (e.g. CSV file) to be copied to an external data carrier. The data sequence, accuracy, recording interval and storage format are implemented according to valid standards at the time of implementation. (Note the version number in the file name for later automatic evaluation).
	2. Accuracy of the recorded measurement data.

Heat meters according to current and national standards and regulations (especially if used for billing!). All other temperatures to one decimal place; volume flows not used for billing purposes with +/- 2 % accuracy; all other quantities to one decimal place.



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1. With regard to the data recording of the boiler control system - interface in the data recording of the entire system must be clarified with the boiler manufacturer. [↑](#footnote-ref-2)