TT4: Operation and Optimization
Webinar, 23. June 2021

Plant monitoring according to QM-system QM Heizwerke – Milestone 5

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QUALITY MANAGEMENT PROCESS
MILESTONE 5: MONITORING AND OPTIMISATION

Project idea

Source:
Fernwärme Mariazell

QM for Biomass DH Plants
Milestone 1: Preliminary study
Milestone 2: Detailed engineering
Milestone 3: Call for proposals and assignment
Milestone 4: Construction and comissioning
Milestone 5: Monitoring and Optimisation

Quality manager
Q-Planning
Q-Guidance
Evaluation
Monitoring
Optimisation

- Milestone 5
  - Are Q-requirements agreed in the Q-plan met?
  - Plant monitoring / evaluation of operation
  - Check if technical documentation is complete
  - See checklist in Q-Guidelines (504 – 533) for details

WHY OPTIMISATION FROM THE BEGINNING?

- Despite correct project planning, construction and professional commissioning with trial operation, optimal system operation is usually not possible at the beginning due to:
  - planning uncertainty due to the range of fluctuation in the heat demand calculation
  - trial operation cannot represent all operating conditions occurring during an entire year of operation
  - lack of operational experience regarding the behaviour and control dynamics of the plant
  - changing fuel assortments and quality fluctuations (e.g. water content)
  - increasing heat supply due to heating grid expansion and densification (planned heat sale is often only achieved after a few years)

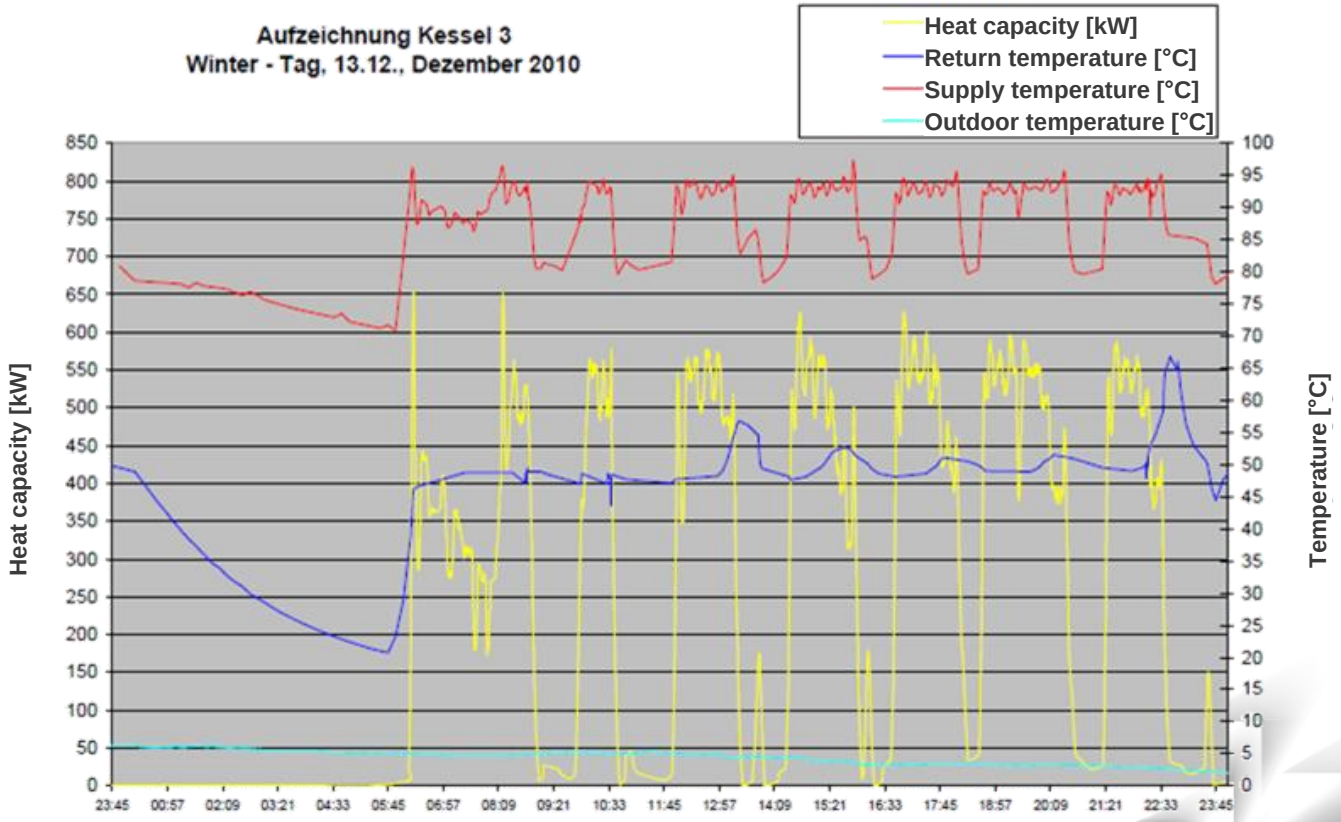
COMPREHENSIVE MONITORING AND OPTIMISATION

- Monitoring and operation optimisation is essential
  - already at the beginning of the operation phase (Milestone 5)
  - continuous plant monitoring during operation and continuous operational optimisation should be established
- QM: compulsory monitoring and optimisation for Milestone 5
  - see QM Planning Handbook for further details how to proceed
- Obligatory annual operating reports (in Austria for the first 10 years of operation)
- Once, during a plant visit, the control/operation strategy of a plant was questioned and the responsible operator answered:

"We had 50 groups visiting our plants and all where enthusiastic! How can you criticize my plant?"

THAT´S HOW THE OPERATING DATA LOOKED LIKE!

- Monovalent 3-boiler plant + storage
  - One day operating data of boiler 3 – 800 kW
  - All 3 boilers showed similar behaviour



MONITORING REQUIREMENTS ACCORDING TO QM

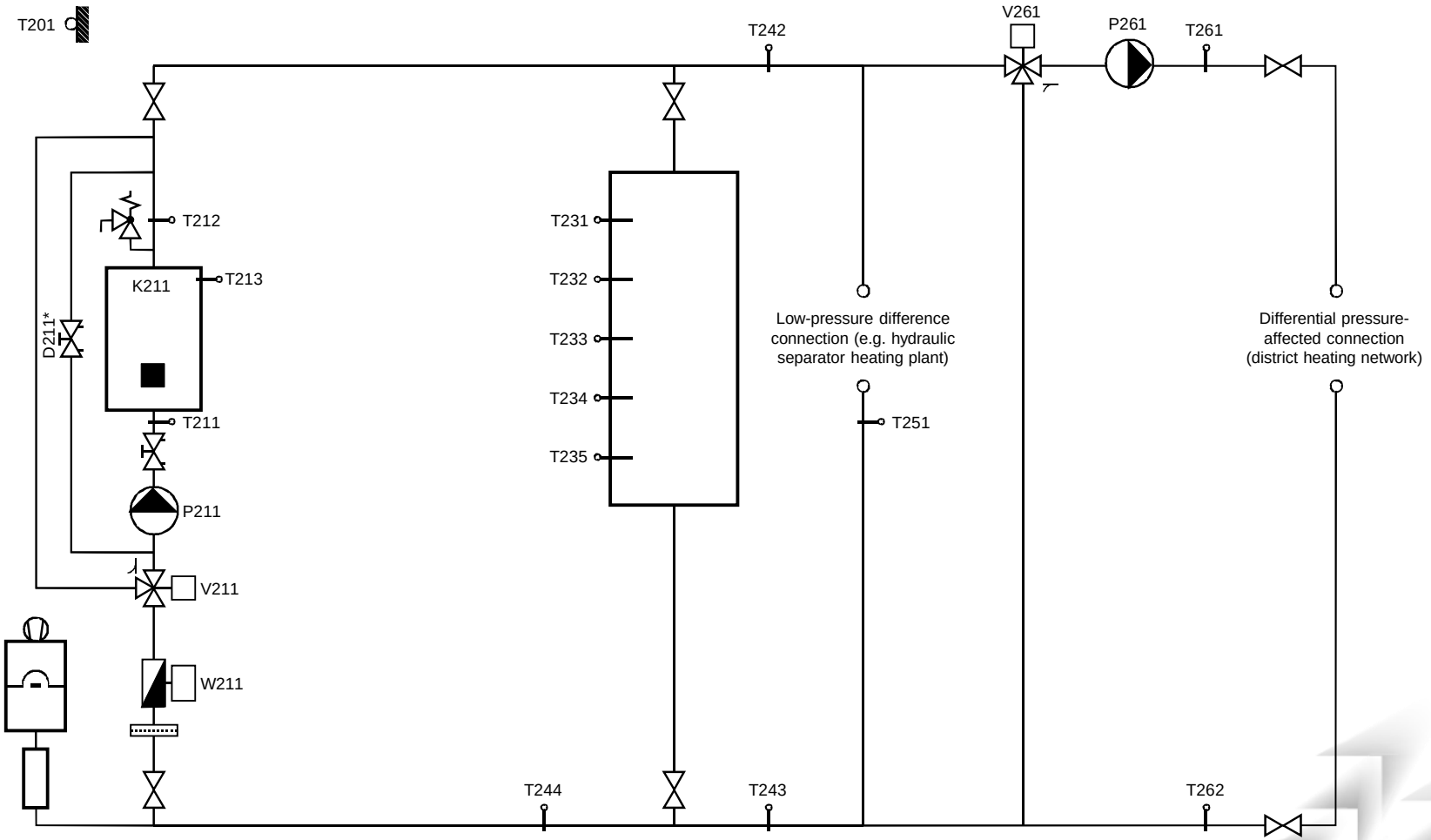
- Requirements for monitoring equipment according to QM are defined by standard hydraulic schemes (translation into english currently ongoing)
  - Standard hydraulic schemes offer a holistic solution regarding hydraulic circuit solution / suitable control concept and strategy / monitoring – more details will be part of the next webinar TT5
- Measuring points list in chapters „Data recording for operational optimisation”
- Definition of how the data recording and monitoring is implemented
  - Mandatory according to QM already during planning!
  - Hardware – data logger/PLC/I&C system and access
  - Data recording – format and handling
  - Responsibilities – who exports and evaluates data?

REQUIREMENTS DATA RECORDING SYSTEM

- The data recording system must meet the following minimum requirements (among others):
  - Automatic recording and storage of all measured values in high temporal resolution (recommendation QM Holzheizwerke: measuring interval of 10 seconds and a recording interval of 5-minutes mean values).
  - User-friendly export option for all measured, calculated and stored operating data in a generally readable data format (e.g. text-based files in .csv format)
  - Regular back-up of all operating data on an independent system

EXAMPLE STANDARD HYDRAULIC SCHEME

- Monovalent biomass heating system with storage tank



CORRESPONDING MEASURING POINTS LIST

☑	Standard	Measuring points	Ref.
☐	Standard	Outdoor air temperature	T201
☐	Standard	Biomass boiler inlet temperature	T211
☐	Standard	Biomass boiler outlet temperature	T212
☐		Boiler water temperature (other measuring point)	T213
☐	Standard *	Main supply temperature after storage tank	T242
☐	Standard	Main return temperature before storage tank	T243
☐	Standard *	Main return temperature after storage tank	T244
☐	Standard	Storage tank temperature (top)	T231
☐	Standard	Storage tank temperature	T232
☐	Standard	Storage tank temperature (middle)	T233
☐	Standard	Storage tank temperature	T234
☐	Standard	Storage tank temperature (bottom)	T235
☐	Standard *	Return temperature of the low-pressure difference connection	T251
☐	Standard	Flow temperature of the differential pressure-affected connection	T261
☐	Standard *	Return temperature of the differential pressure-affected connection	T262
☐	Standard	Heat quantity/output Heat meter biomass boiler **	W211
☐		Water quantity/flow rate Heat meter biomass boiler **	W211
☐	Standard	Setpoint value of the firing rate biomass boiler	
☐		Boiler-internal setpoint of the firing rate (feedback biomass boiler)	
☐	Standard	Actual value of the storage tank charging state	
☐	Standard	Exhaust gas temperature biomass boiler	
☐		Furnace temperature biomass boiler	
☐	Standard *	Residual oxygen biomass boiler	
		Measuring points Particle separator; type:	

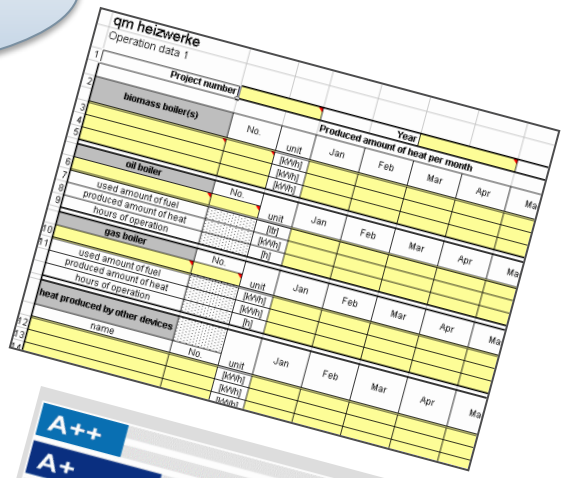
* In order to reduce the effort for data recording, a reduction by these measuring points is accepted as permissible deviation for operation optimisation.

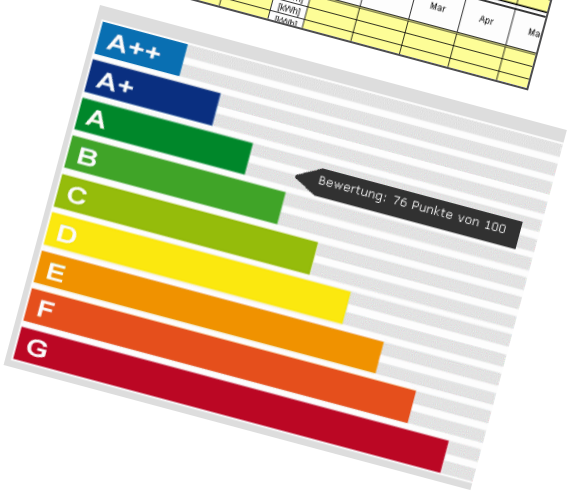
** The heat meter must be equipped with an interface for recording the heat quantity [kWh] or water quantity [m^3]. Trends in terms of power [kW] or volume flow [m^3/h].

OPERATING REPORTS

More than 2.100 reports

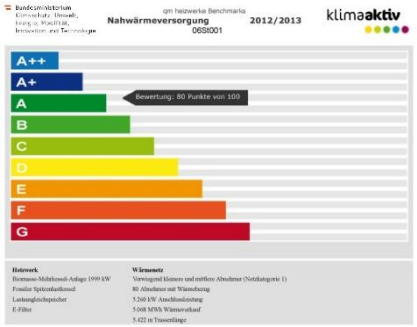
- Annual operating reports are uploaded to the QM database in Milestone 5 in Austria
  - Contains basic operating data
- Feedback to funding authority, plant operator, Q-manager, …
- Enables benchmarking – a service by QM Heizwerke to motivate operators to evaluate operating data, identify optimisation potentials and implement optimisation measures

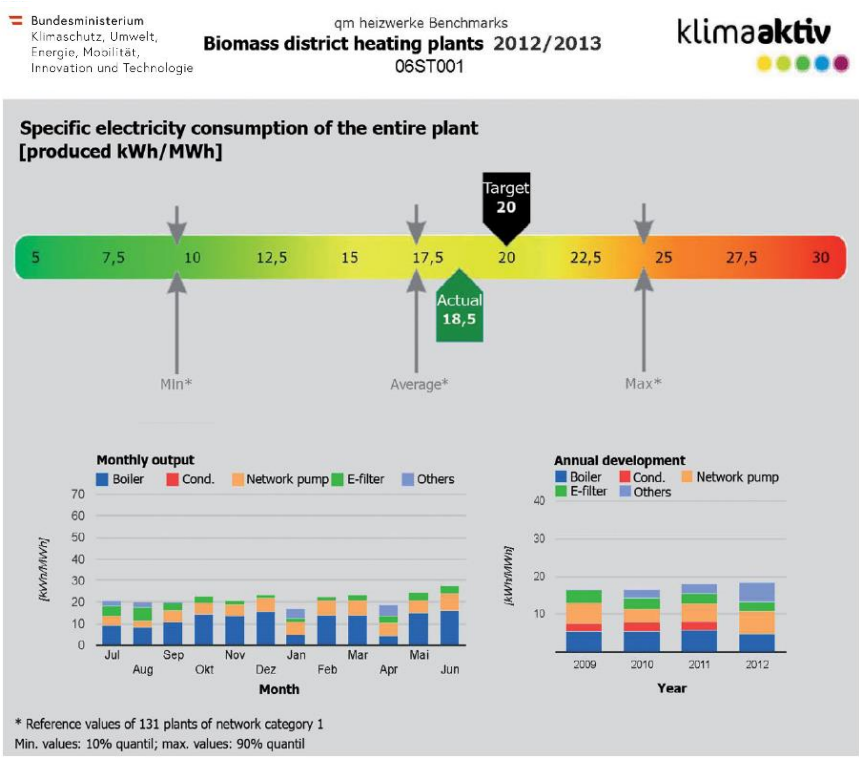




QM HEIZWERKE BENCHMARKING

- Evaluation of annual operation reports
- Calculation of KPIs
- Benchmarks
  - Comparison of KPIs with
  - Target values (QM/funding) and
  - Reference values (comparable other plants)
- Rating of the plant





Service and information for operators, designers and Q-managers

KEY PERFORMANCE INDICATORS (KPI)

- Important Key Performance Indicators (selection)
  with mean values of 215 to 364 plants from the QM Heizwerke data base

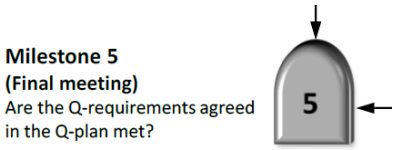
KPI	unit	target value	mean value
Sold heat compared to planned heat	%	100	89.0
Linear heat density	MWh / a / m (trench)	1200	1143.0
Full load operating hours (total biomass boilers)	h / a	2500	2616.1
Annual efficiency heat production	%	85	86.2
Overall energy efficiency	%	75	71.2
Heat losses district heating grid	%	15	18.6
Average temperature difference between supply and return of the district heating grid	K	30	28.6
Specific electricity consumption of the whole plant	kWh / MWh heat produced	20	17.9

CONCLUSION

- Monitoring and optimisation should be established as integral part of the ongoing operational management and performed periodically – QM Milestone 5 an initial step …

QM

Biomass DH Plants



- In-depth evaluation
  - in case of technical/economic problems
  - before (major) grid expansions
  - plant expansion/modernisation
- Monitoring data is a treasure – reliable planning basis for the sustainable future development of a plant

THANK YOU!

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