Means to achieve a higher power production exchange-possibilities, restrictions, risks

by
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Optimisation potential of energy recovery and saving resources by W-t-E plants

To improve energy recovery and by this increase the energy recovery rate and plant efficiency factor, plant optimisation actions should be taken.

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General personal requirements are e.g.:

- good management in the hierarchy (teamwork)
- high technical qualification of the staff
- training and further education of the staff
- motivation of staff to work in personal responsibility

General technical requirements are e.g.:

- high degree of process automation in an understandable way for the staff
- suitable low pressure loss and high accurate measuring instruments over the whole instrument scale like pitot tubes (ask: PVT [muc@pvt-tec.de])
- use of longterm comparing trend curves to observe the main operation criteria
- precise determination of NCV of incinerated waste (see e.g. BREF/BAT formula)
- accurate balancing and control of energy input and output

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Technical optimisation measures can be classified into 4 main categories:

- Optimisation of process methods for thermal treatment (very low to medium investment)
- Increase of electricity production (medium to high investment)
- Increase of heat/cool utilisation (medium to high investment)
- Methods to decrease the need for primary energy (low to medium investment)

Increase of availability of the plant at max. steam capacity

Steam production with low variations at max. boiler capacity as put down in the stoker capacity diagram and not in part load

If building or rebuilding steam boilers choose optimal steam parameters taking into account the kind of energy recovery e.g. as CHP or as electricity.
Increase of steam parameters in the boiler by superheating (comparison to a saturated steam 20 bar/212°C, 0.2 bar (100% steam); 91% efficiency)

Advantages:
- e.g. 50 bar/500°C input: 821 kcal/kg steam; electr. prod. = 48 +162 kWh/Mg steam
- e.g. 40 bar/450°C input: 793 kcal/kg steam; electr. prod. = 48 +132 kWh/Mg steam
- e.g. 40 bar/450°C input: 796 kcal/kg steam; electr. prod. = 48 +135 kWh/Mg steam
- e.g. 40 bar/400°C input: 768 kcal/kg steam; electr. prod. = 48 +106 kWh/Mg steam
- e.g. 30 bar/400°C input: 773 kcal/kg steam; electr. prod. = 48 +111 kWh/Mg steam
- e.g. 20 bar/212°C, 0.2 bar basis: 668 kcal/Mg sat. steam; electr. prod. = 48 kWh/Mg steam

Restrictions and risks: e.g. high steam temperature corrosion, lower availability by the superheater pipes, more frequent cleaning of the boiler, boiler material questions

Decrease of steam parameters at the end of a turbine (91% efficiency turbine +generator)

Advantages:
- e.g. 40 bar/400°C input: 768 kcal/Mg steam
- e.g. 40 bar/250°C output: 670 kcal/Mg steam; electr. prod. = 104 kWh/Mg steam

back-pressure turbine:
- e.g. 4 bar/143°C output: 658 kcal/Mg steam; electr. prod. = 116 kWh/Mg steam

condensation turbine:
- e.g. 0.4 bar/75°C output: 632 kcal/Mg steam; electr. prod. = 136 kWh/Mg steam
- e.g. 0.04 bar/29°C output: 610 kcal/Mg steam; electr. prod. = 158 kWh/Mg steam

Restrictions and risks: e.g. higher electricity selfconsumption, problems with density of air cooled condensers, higher demand of cooling water, heating up of condensate to reach boilerwater temperature, freezing of air cooled condensers at minus °C, high (>25-30°C) outside temperatures reducing throughput of air cooled condensers by increasing pressure

Use of turbines inured to 3-5% water content in the steam at the end of the turbine

Advantages:
- equal to an increase of energy flow in the turbine of 3-5% of the corresponding condensing enthalpy

Restrictions and risks: e.g. mechanical wear, reduced availability, more imported electricity, special materials
Increase of steam production e.g. by reduction of the flue gas quantity (low O2) and by using ecos in combination with the boiler to reduce the flue gas temperature after boiler and by this possible energy losses

Use of the remaining energy in the flue gases by heat exchangers e.g. to increase temperature of the boiler water

Use of additives in the flue gases cleaning system with high reaction temperatures in dry system instead of lime (reac. T 130°C) sodium bicarbonate (reac. T 170°C) e.g. to increase temperature of the boiler water

Use of turbines with high efficiency even at steam quantity variations

Use of extraction condensing turbines for max. electricity production in combination with changing heat-/steam demand and export

Heating up of steam from multi-stage extraction condensing turbines by own superheated steam

Use of back-pressure turbines only in combination with a constant basic supply of heat/steam over the year