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FLEXIBLE OPERATION OF CHP – CHANCES FOR THE INTEGRATION OF RENEWABLES

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OVERVIEW

To implement the European decisions on climate and energy policy the "Integrated Energy and Climate Programme (IEKP)" was established by the German Government on 23. August 2007 [1]. This programme includes ambitious climate protection targets, as well as targets for the expansion of renewable energies and increases in energy efficiency up to 2020.
Mainly two measures have a major impact on electricity generation:

- The share of electricity production from CHP should double from about 12 % to 25 %.
- Renewable energies are to increase up to 30 % of electricity production.

The subordinate project "Flex: Flexible operation of CHP" [2] analyses the possibilities of making CHP operation more flexible to integrate the renewable energies more efficiently and in addition reach the objectives for CHP.

METHODS

To assess the interaction of electricity from renewable energies and cogeneration, it is essential to model the load profile of the renewables and the CHP-plants. Hence, methods were developed for modelling the load curves of consumers and so called must-run-plants like wind power, photovoltaics, biomass, hydroelectricity and fossil fired cogeneration combined with district heating systems.
An analysis not only of the electrical load profiles but also of thermal load profiles for district heating is used to determine a potential for more flexible CHP operation.

RESULTS

Fig.1 shows the load profile achieving the IEKP in case the implementation of the regenerative power generation (green load curve) will be carried out mainly by wind power plants. The consumers´ load profile is partly covered by the CHP power generation and the fluctuating regenerative energy generation. In Germany CHP and renewable energies may feed into the grid preferably.
High power peaks require negative balancing power. In times of high heat demand this problem becomes even more problematic because of cogeneration in CHP plants.
In some times the power curve of the must-run-plants exceeds the consumer load profile for this IEKP scenario and a part of climate friendly electricity production cannot be used any more. This means that an additional development of must-run-capacities isn't sufficient to reach the ambitious political targets. Other measurements have to be taken to increase the share of electricity from renewable energies and CHP.

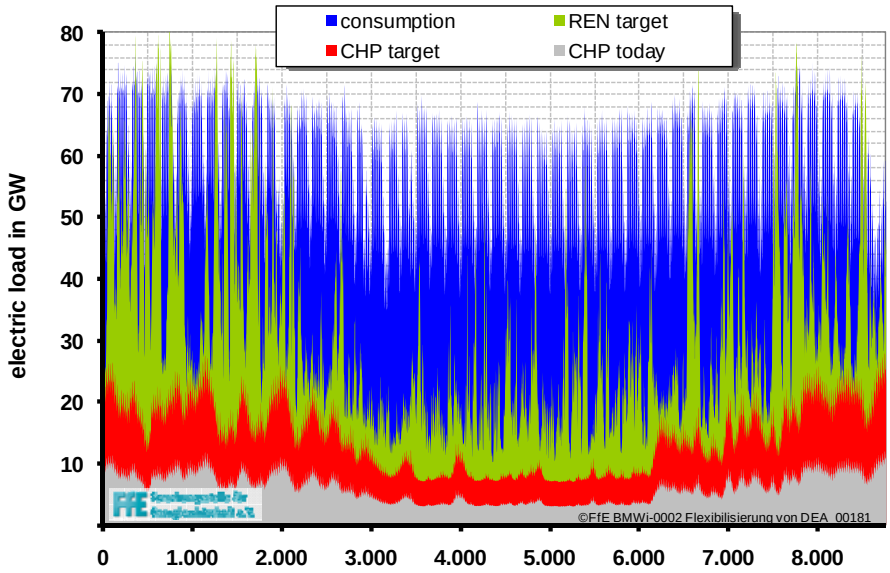

Fig.1. Electric load profiles regarding Germans political targets

Decoupling heat and electricity production in CHP-units makes CHP operation more flexible. This can help to decrease the loss by the non-useful production and increase coverage. Technically two options are possible:

- **Modulation of the power and heat ratio**
  Different possibilities to modulate the CHP coefficient can be applied; in particular variating the amount of the extracted steam mass flow in extraction condensing turbines shows great success.
- **Thermal storage as important element in the energy industry**
  Heat can be stored without any great technical efforts. Thus one possibility to uncouple the CHP heat- and electricity generation is to use thermal storages. As a result, the plant utilisation period of the CHP electricity-generation can be increased.

CONCLUSIONS

Political aims for the share of renewable energies and CHP often are very ambitious. Regarding the load profiles additional measurements have to be taken to integrate electricity from fluctuating energy sources and CHP. Decoupling electricity generation and heat production of CHP-units can help to reduce the loss of electricity when exceeding the consumers load.
Therefore CHP and district heating combined with both thermal storage and the use of extraction condensing turbines have a chance to make the energy system more efficient and less expensive than using conventional peak load power plants or electrical storage systems.

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