

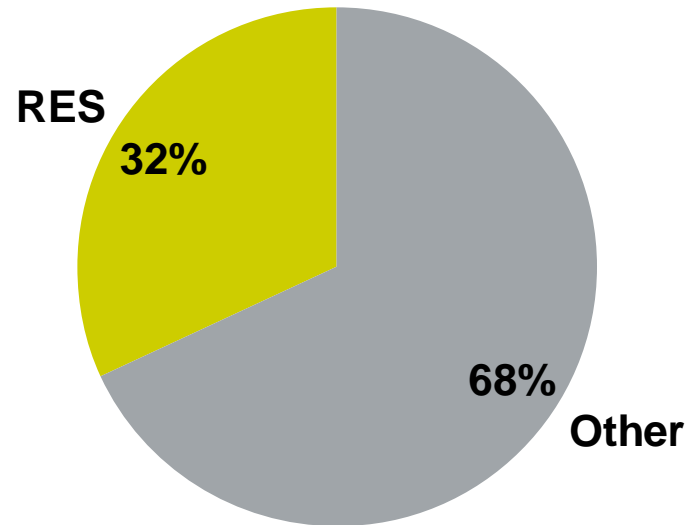
Energy Efficiency and demand side management: A case study of a holistic energy concept in polymer processing.

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German “Energiewende” aims 80% generation from renewable sources in 2050*.

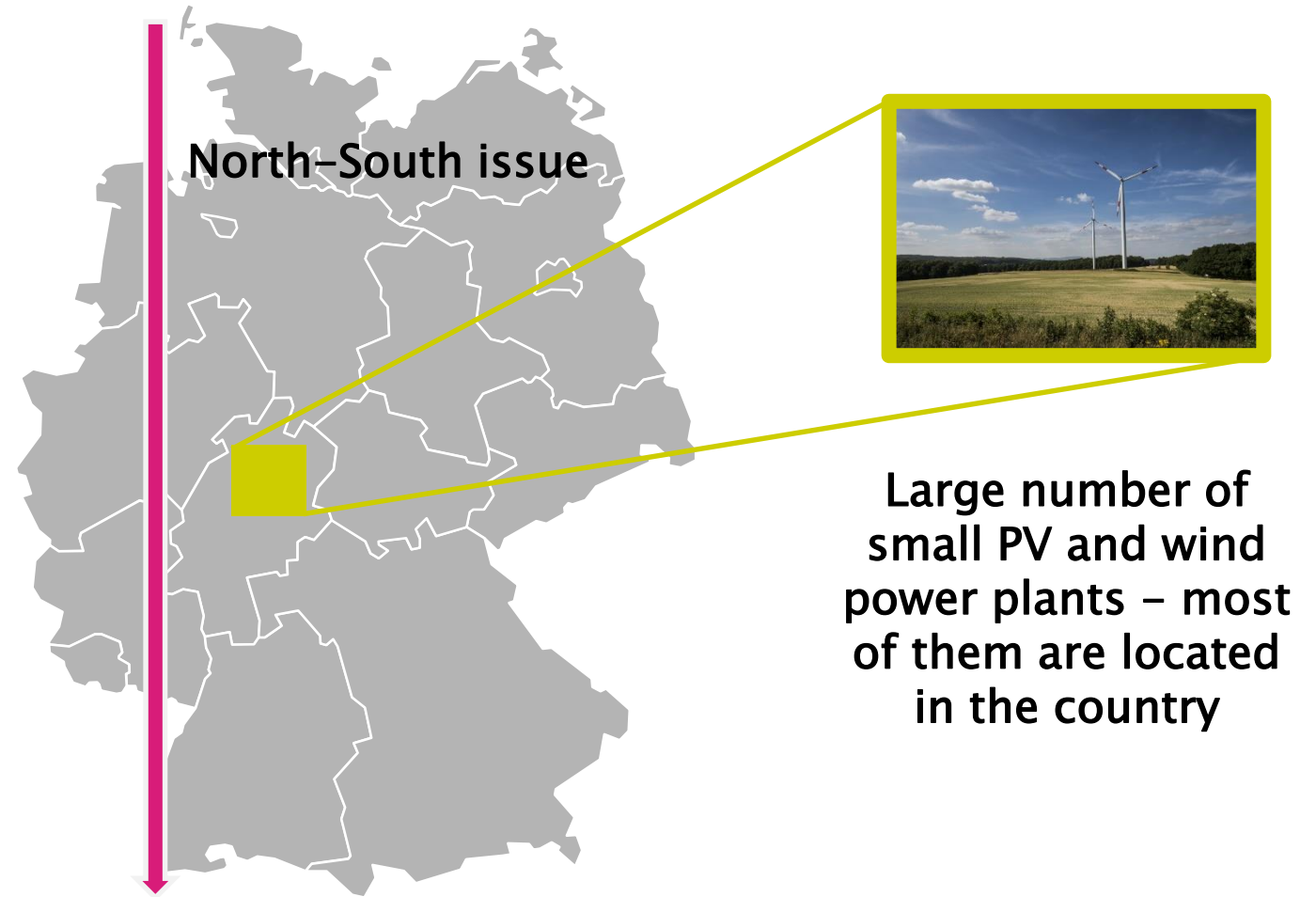
German energy mix in 2016**



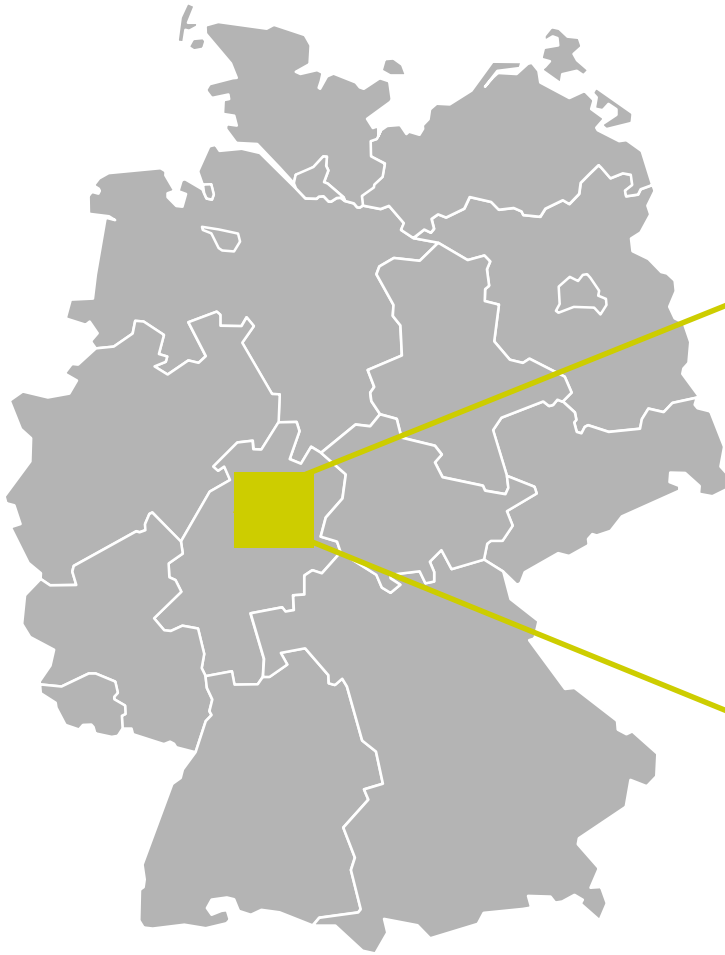
Sources:

* The Federal Government, General Information on Energiewende, 2017

** Federal Ministry for Economic Affairs and Energy, Entwicklung der erneuerbaren Energien in Deutschland im Jahr 2016, Februar 2017, p. 7



Increasing generation from renewable sources in distribution grids requires new approaches and solutions.



- On sunny or windy days electric generation from renewable plants increases.
- Conservation of energy and flexible demand are necessary and can be managed by **Demand Side Management (DSM)** measures.

Five categories of flexibility measures exist in manufacturing.

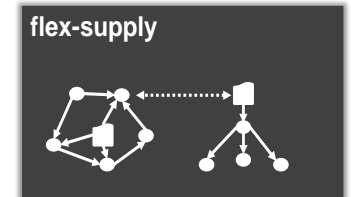
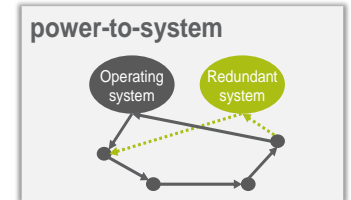
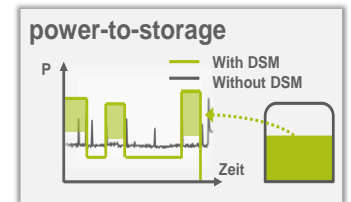
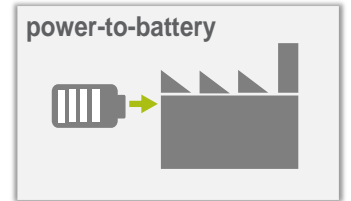
Power-to-battery describes flexibility from operating a battery for direct electricity conservation.

Power-to-storage means decoupling of production and consumption over time by storing energy in a converted form, e.g. thermal energy or compressed air.

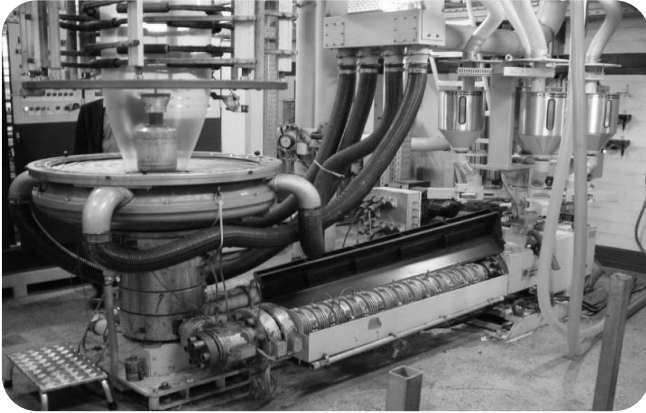
Power-to-product is indirect energy storage from shifting production processes that are mostly batch-operated.

Power-to-system refers to the ability to switch between at least two energy sources to operate supply systems such as electrical and fuel boilers.

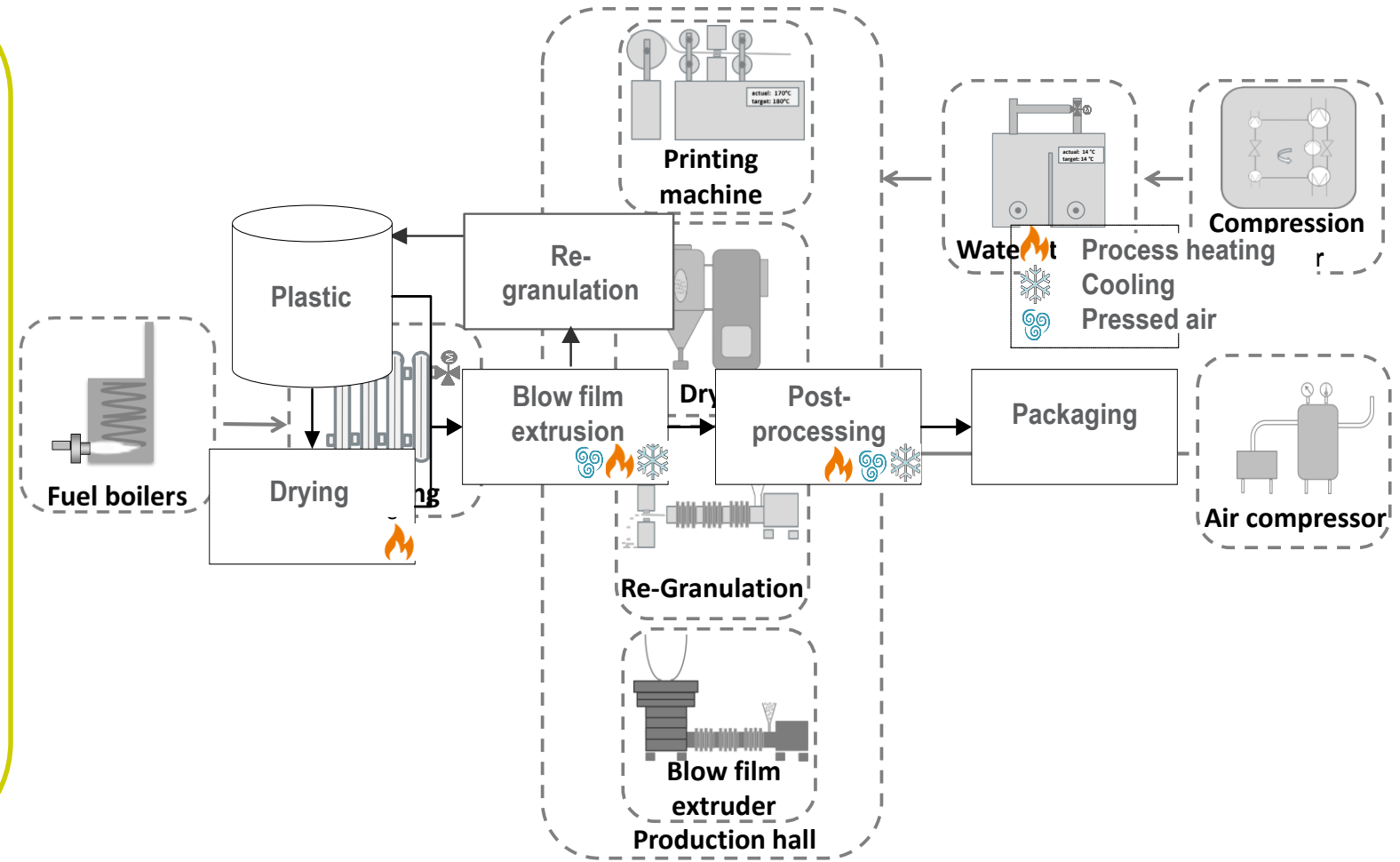
Flex-supply requires the existence of a decentralized energy supply which operation plan considers grid-oriented usage.



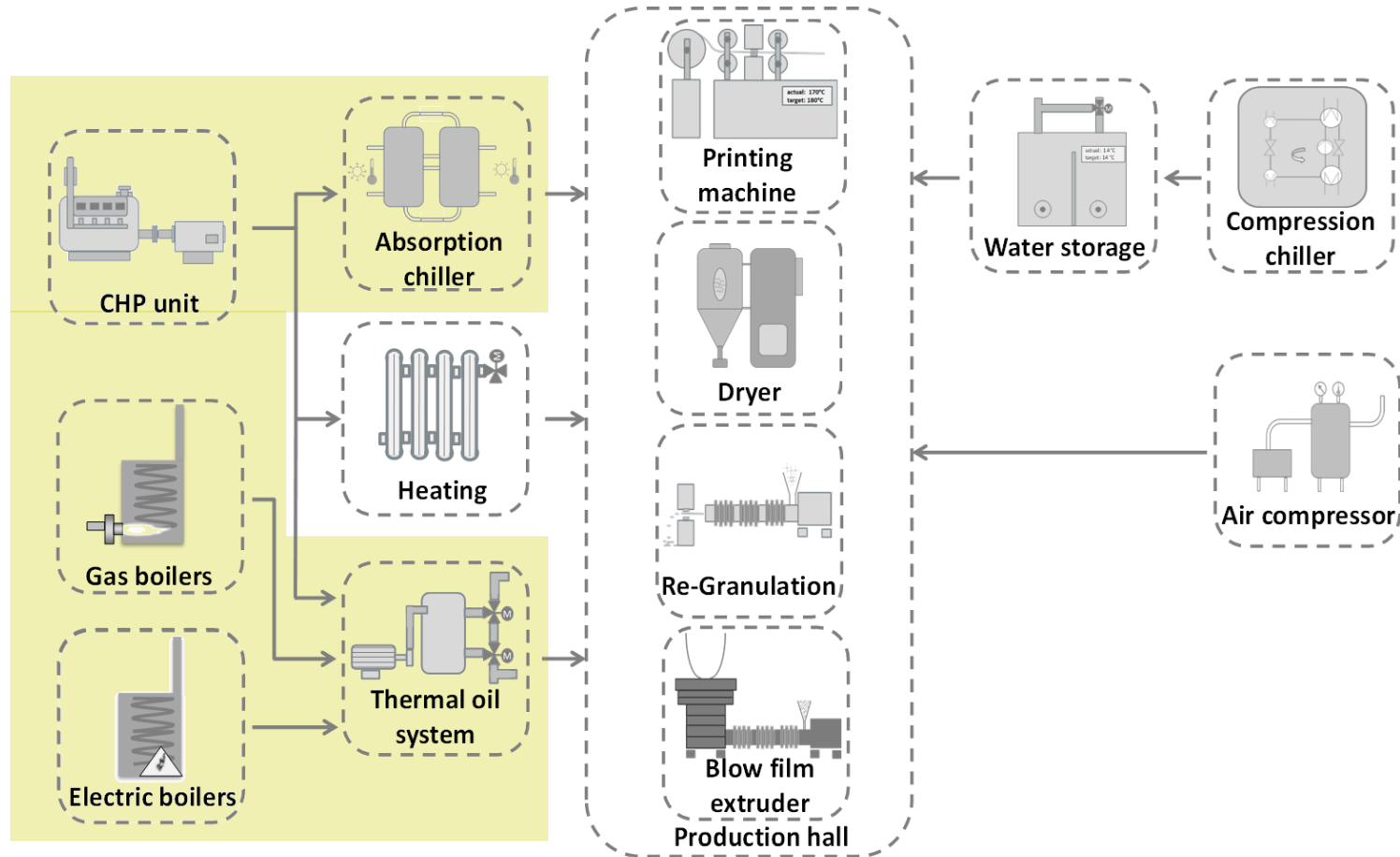
A case of a polymer processing company represents the industrial structure in the estimated region.



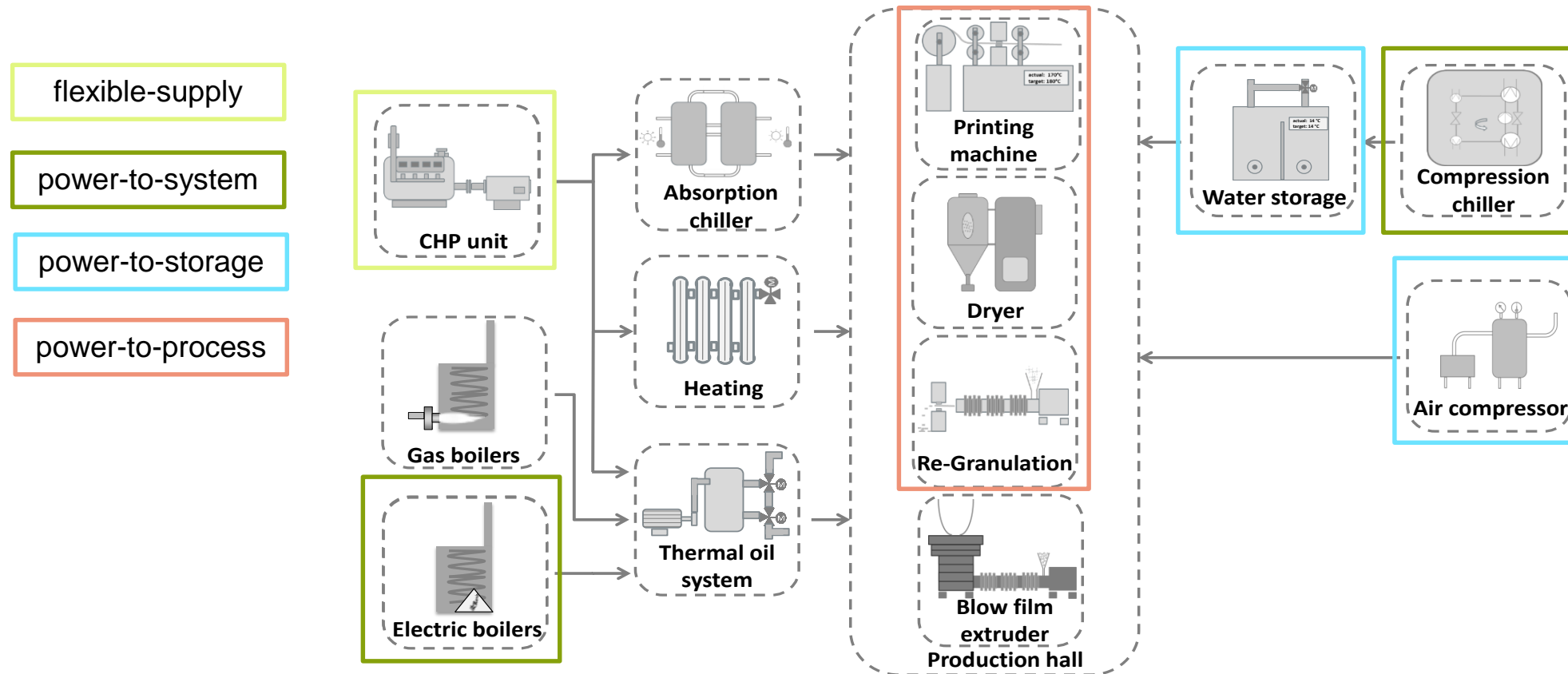
Source: Firma Horn und Bauer, B. Rommel, upp



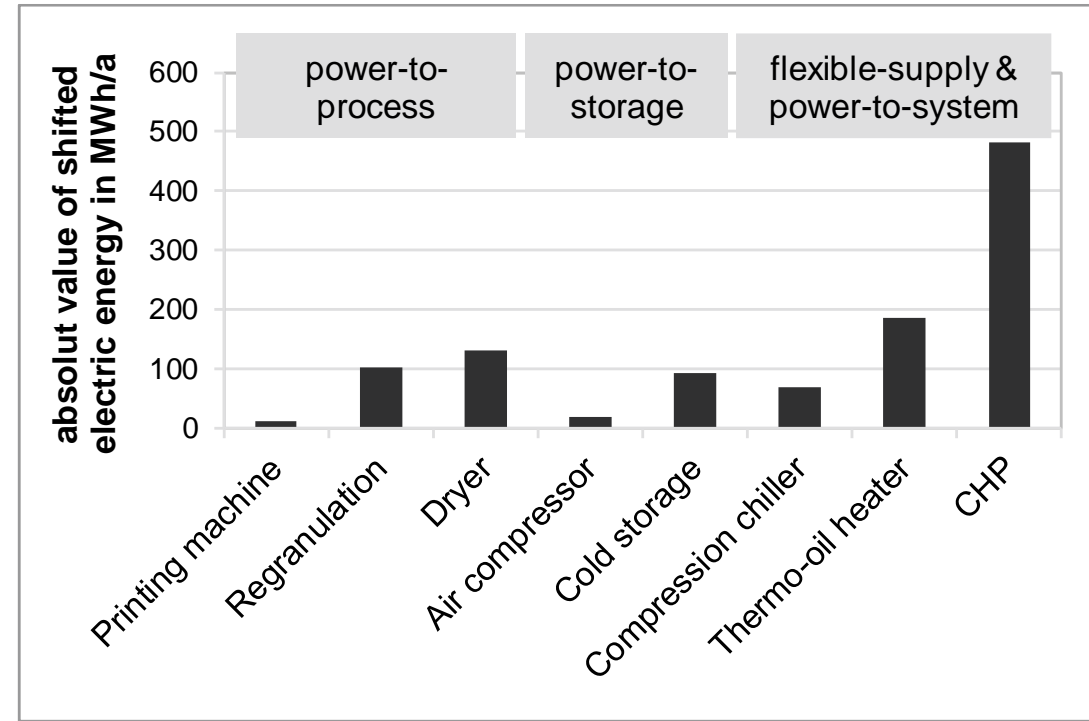
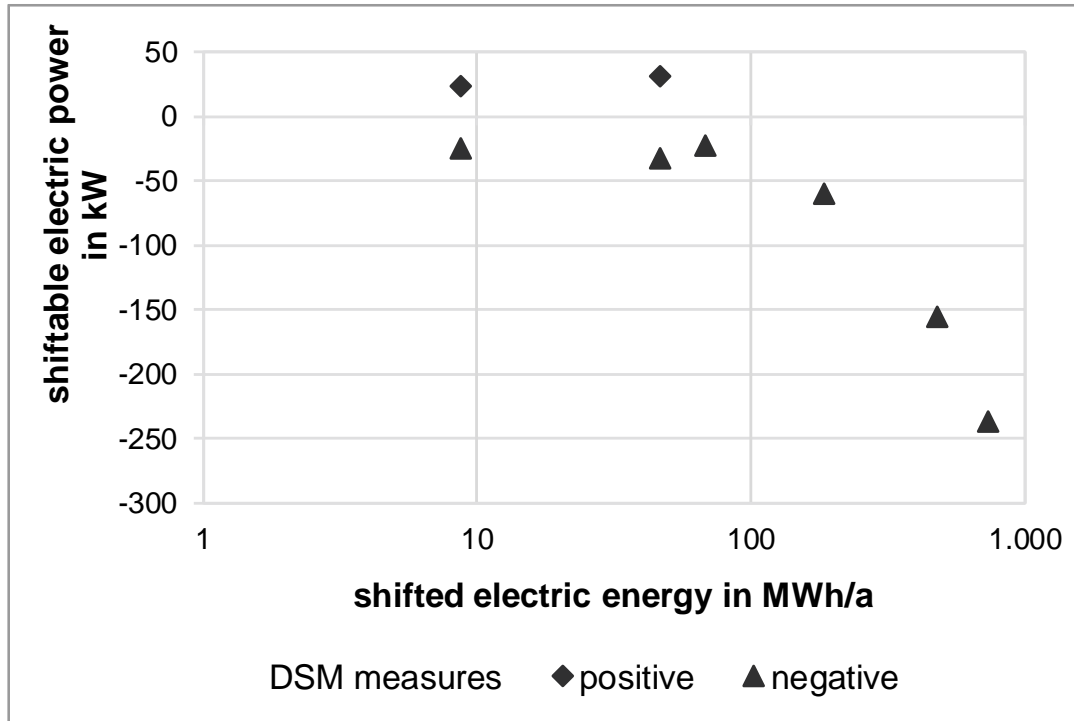
CCHP-based energy supply reduces energy costs and increases energy efficiency of the production.



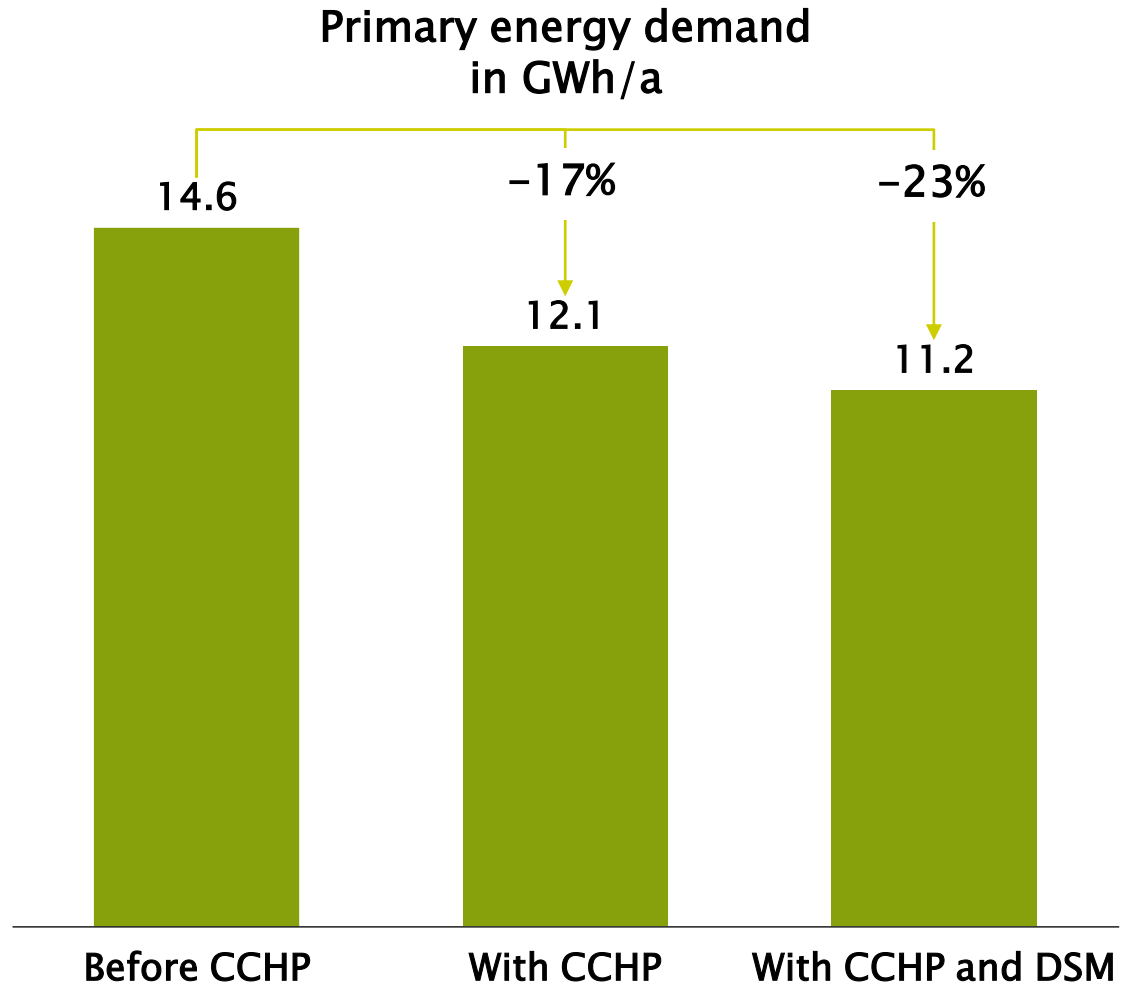
Moreover, the new energy system allows a higher flexibility.



The highest flexibility potential is provided by measures “flexible-supply” and “power-to-system”.



Both estimated measures reduce primary energy demand of the factory.



- Primary energy demand was used as the indicator for sustainability of energy supply
- The primary energy demand reduces according to the step-wise concept implementation

Transferability and Conclusion

Introduced CCHP approach as well as the DSM measures are applicable to other polymer processing factories.

But in other climatic zones, different energy flows may mean that the potential share between DSM measures will change.

**Understanding of the energy flows in manufacturing is key to implementing
“energy efficiency measures and
demand side management measures”**

The key factor of a decentralised energy supply concept is the innovative development of thermal-oil heating of polymer processing machines.

The energy market transition requires a holistic approach including energy efficiency in production as well as grid-oriented operation.

THANK YOU!