



Fact Sheet

STEAG's solution-toolkit facilitating excellent Flexibility in Power Generation

Typically, existing thermal assets have not been designed to appropriately respond to the fluctuating performance determined by RE and thus need to be enhanced to comply with the requirements of the power system. Subject to the specific market environment this challenge is impressed on plant owners and operators with multiple consequences, like technological demands to upgrade the asset as well as commercial impacts or incentives if complying with the flexible operation schemes of the specific market.

The Challenges:

In order to maintain plant's competitiveness in the market and thus viable commercial performance, targets to be achieved under "Flexibilization" are:

- Decreased, but still robust **low load operation** for periods of high RE share feeding the grid
- Faster **start-up** and **ramping dynamics**
- Controllability: proof of potential to provide **grid services** (e.g. frequency control)

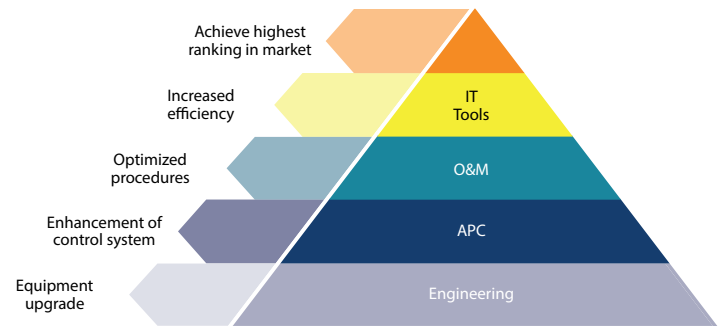
Crucial aspects to be considered in the context of Flexibilization are:

- Increased wear and tear of equipment affecting availability of plants and reliability of components
- Diligent adjustment of O&M procedures and comprehensive technical awareness of the O&M team
- Commercial viability, attributed to revenue loss due to reduced full load operation hours and additional costs associated with flexible operation
- Consequently, the need to even more enhance overall plant performance and efficiency

Impact and Levers:

Within the complex structures and subsystems of a thermal power plant, measures to increase flexibility may be addressed in and have an impact on the following subsystems:

- **Fuel management and handling:** e.g. igniting risks in coal storage due to reduced turnover
- **Furnace/boiler:** optimization of burners for flame stability and balanced heat distribution, reduced mill operation
- **Water/steam cycle:** adjustment of mass flow density, saturated steam in turbine
- **Reusable by-products:** volumes and quality of ashes and gypsum
- **Flue gas path:** Temperature and effectiveness of environmental systems, clogging, particle emissions



Subject to the individual plant and its specific operation and market environment, there is not one best solution to cope with the multiple challenges. Based on our more than 80 years of experience in thermal power generation combined with numerous recent projects, in which Flexibilization has successfully been implemented, STEAG Energy Services elaborates the customized approach, most economically combining elements of immediate **operating expertise**, innovative **software solutions** and special **engineering services**, which makes us unique.

STEAG's particular solution-toolkit:

- Retrofitting with regards to **mechanical engineering** as well as **process engineering**
- Enhancement of the **underlying control loops** and improved utilization of system inherent storage capabilities
- Applying advanced process control (APC) and optimization with predictive analytics concepts, both, based on **physical modelling** (e.g. water-steam cycle) as well as **neural network solutions** ("big data analytics", e.g. combustion)
- Implementation of **lifetime monitoring** and **condition assessment**, thus mitigating the cycling stress of components
- Upgrading and adjustment of respective **operational procedures** and documents for the immediate use of the operation team
- Awareness building and **know-how transfer** sensitizing the operators for Flexibilization and its consequences, e.g. by applying simulator or on the job training

Crucial to the measures to be prioritized are the required investments as well as the lever of contribution to the target of flexibilization.

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Typical approach to Flexibilization

Subject to the distinct plant and its operational environment, the following major steps will be addressed applying the combined STEAG expertise in process and mechanical engineering, C&I and APC, IT optimization systems as well as in operation and training:

- Identification of limiting components, focusing combustion stability, steam temperatures and mass flow, emission limits, safety systems and interlocks, ...
- Development of solutions covering all aspects of STEAG's Flexibilization tool-kit with client's operating staff in On-site workshops, including test runs to confirm the identified limitations and constraints
- Prioritization of the identified measures with regards to cost and effect to Flexibilization
- Benchmarking of flexible performance and potentials referring to our international in-house "Flexibilization"-database
- Preparation of specifications and implementation of identified measures on behalf of the plant owner

Implemented Projects (sample):

Plant:

800 MW Walsum, GER
 780 MW Bexbach, GER
 4x150 MW St Maria, Chile
 2x615 MW Zonguldak, TR
 210/500 MW plants, India
 120 MW CHP, GER

Focus:

Min load, Start-up
 Frequency control
 Ramping, start-up
 Min load reduction
 Min load, ramping
 1 mill operation