

# Get Ready for Flexible Power Plant Operation

Learnings from the Projects under the Auspices of the  
Indo-German Energy Forum

November 2022



# Agenda

**1** Context

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**2** Achievements

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**3** Approach

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**4** Training

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**5** Learnings

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**6** Flexibility++

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# vgbe energy e.V. – Who We Are

- 437 members in 33 countries
- Members represent an installed renewable and conventional capacity of 302 GW



vgbe is the International Technical Association of energy plant operators. Founded in 1920, the association covers a wide range of technologies: from renewable and conventional power and heat generation to energy storage and P2X.

# Background and Working Programm



A special Task Force on Flexibilisation was constituted in May, 2016 under the Sub-Group of the Indo-German Energy Forum, under the Chairmanship of Director (Operations), NTPC and with following members:

- India: Excellence Enhancement Centre (EEC) – Task Force Secretariat, POSOCO, CEA, BHEL and NTPC
- Germany: IGEF/GIZ, VGB and KWS (Power Plant Training Centre)

## Technical Study

- Reference plant assessments at Dadri und Simhadri, 2017
- *Flexibility Toolbox*, 2018
- [Test Runs in different power plants 2018–2022](#)
- Implementation of measures at Dadri, finished in 2022
- Verification of results → *Flexibility Field Report*, to be published in January 2023

## Capacity Building

- > 200 Indian delegates visited Germany for training, study tours and experience exchange
- > 15 National conferences, seminars and workshops
- Development of a flexibility simulator and training programme for power plant personnel

## Framework

- Study on current market design in India
- Regular experiences exchange with CERC

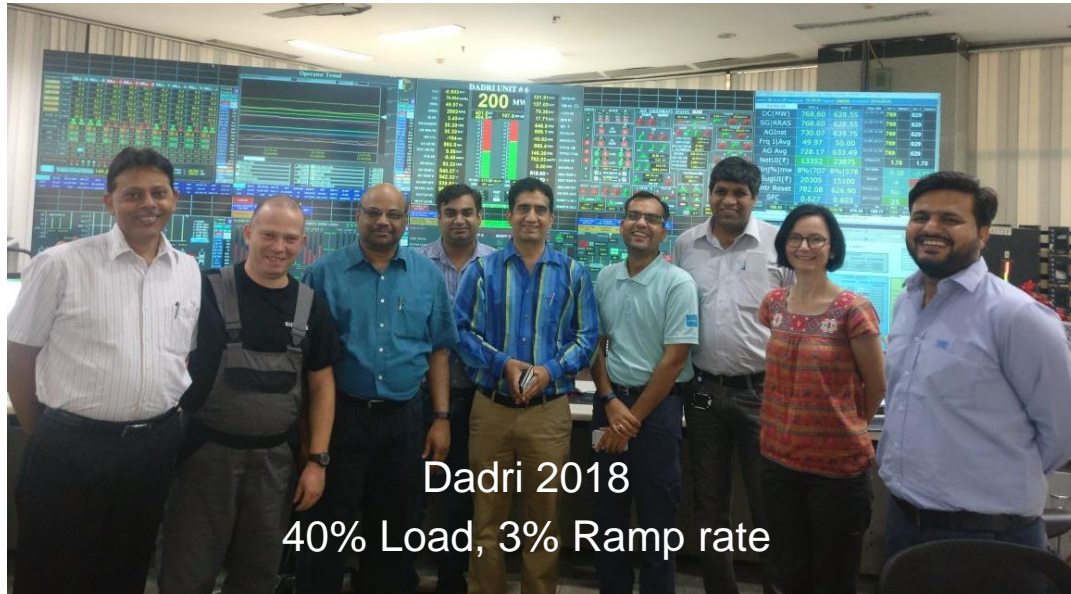
# Technical Flexibility Parameters



	Dadri Unit 6	Maithon Unit 2	Andal Unit 2
Capacity	500 MW	500 MW	500 MW
Operator	NTPC	Tata	DVC
Date	June 2018	July 2021	April 2022
Minimum Load	40%	36%	30%
Ramp Rate	2.0 –3.0%/min	1.5– 2.0%/min	2.0%/min



# Flexibility Test Runs at 500 MW Units



Dadri 2018  
40% Load, 3% Ramp rate



DVC Andal 2022  
30% load, 2% ramp rate

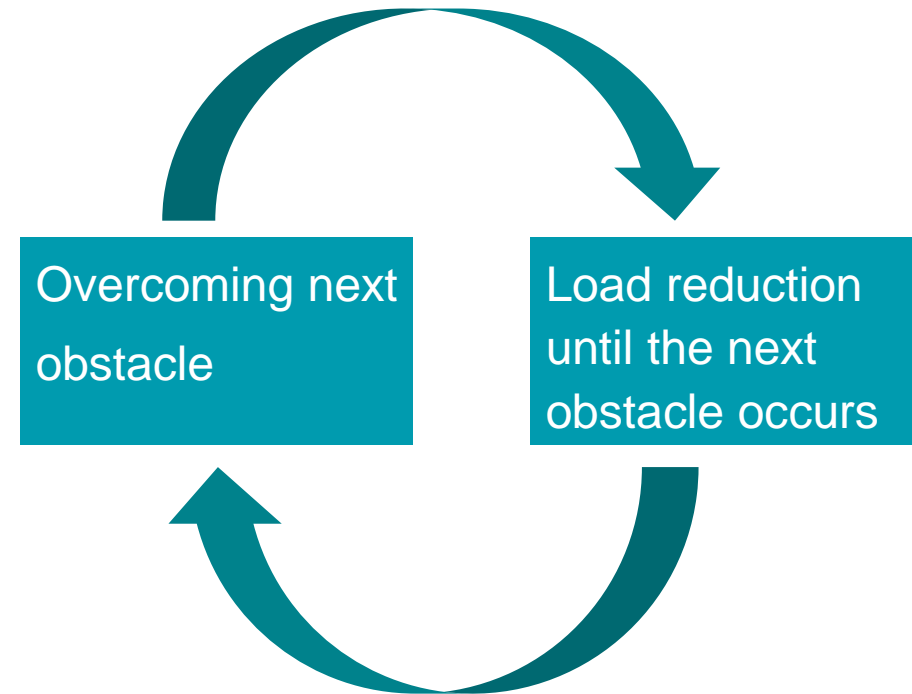
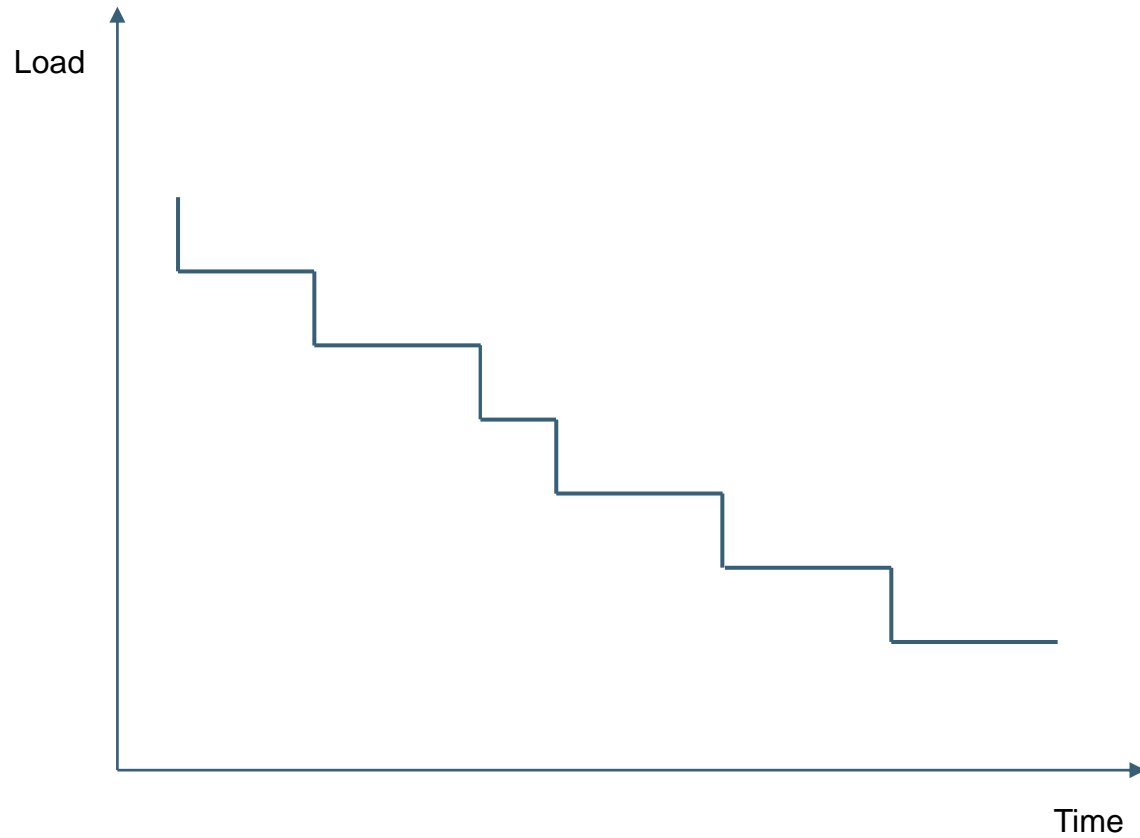


36% Load, 1.5% Ramp rate

## How to flexibilize the plant



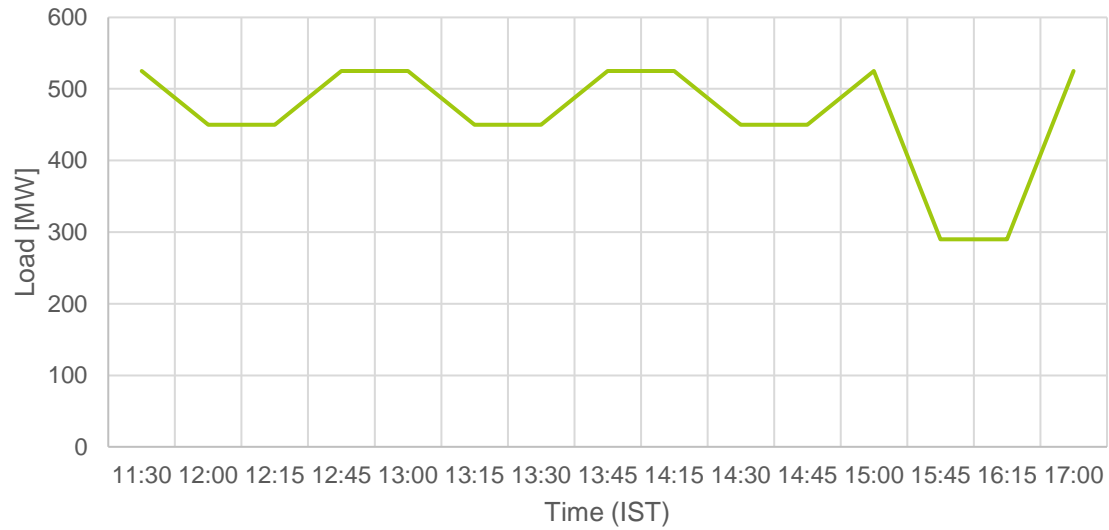
# Test Runs: Minimum Load Approach



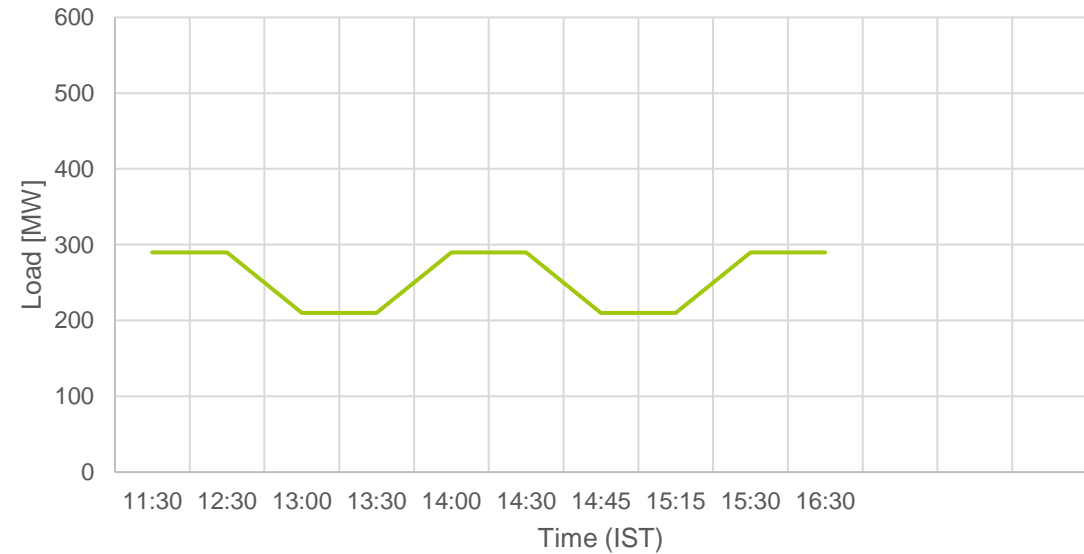


# Test Runs: Minimum Load Schedule: Examples

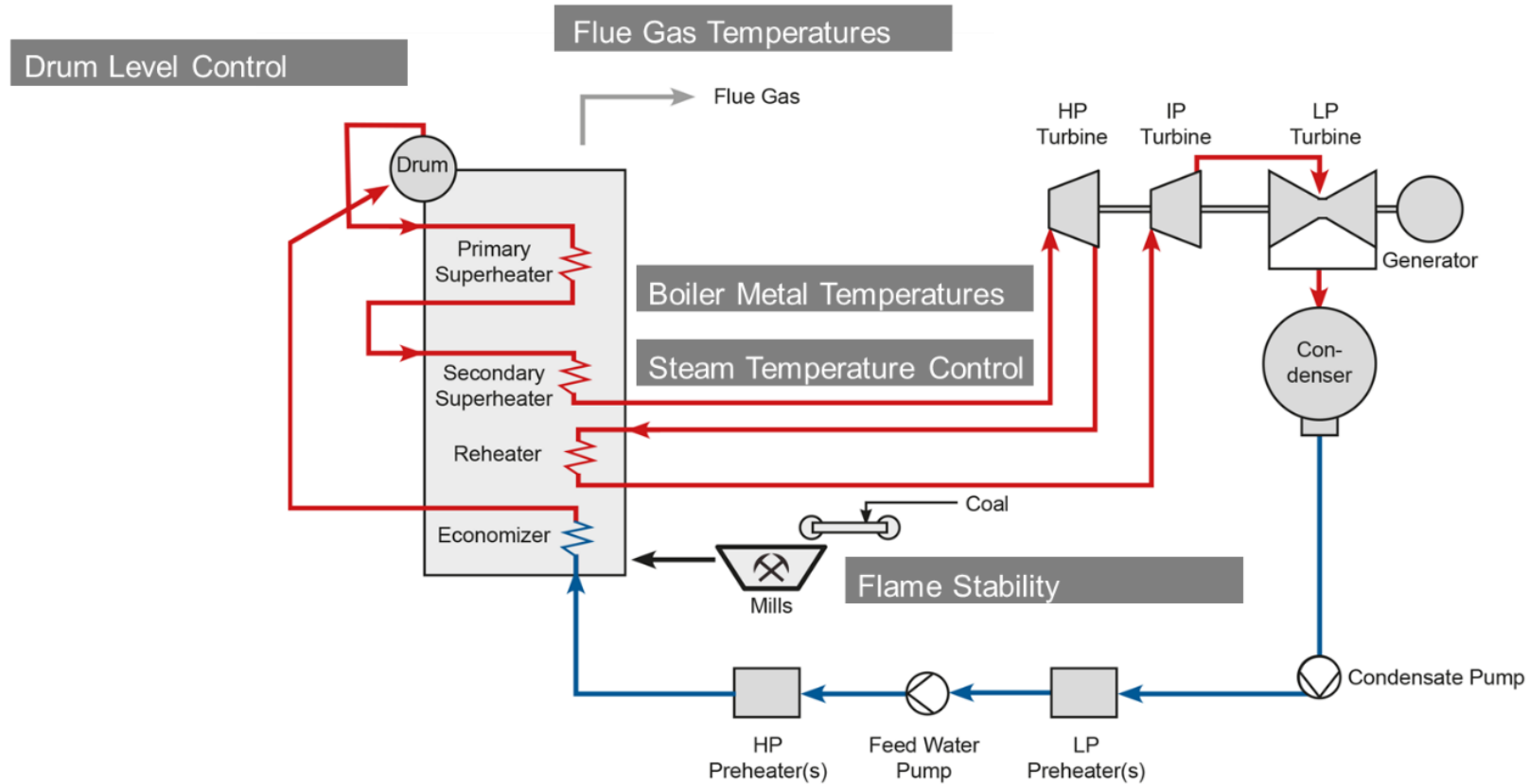
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# Issues Resulting from Flexible Operation





## How to become a FLEXPERT

### Study

e-learning, awareness workshops and professional seminars

Target: acknowledge the need for flexibility, understand principles of flexible power plant operation

4 weeks

### Try

a) Simulator training to try out flexible operation at an Indian reference plant

b) Test runs at own plant (according to IGEF procedure) guided by own senior or external experts

4 weeks

### Apply

Implement new procedures in the operational scheme (e.g. mill sequences, switch over of pumps and fans)

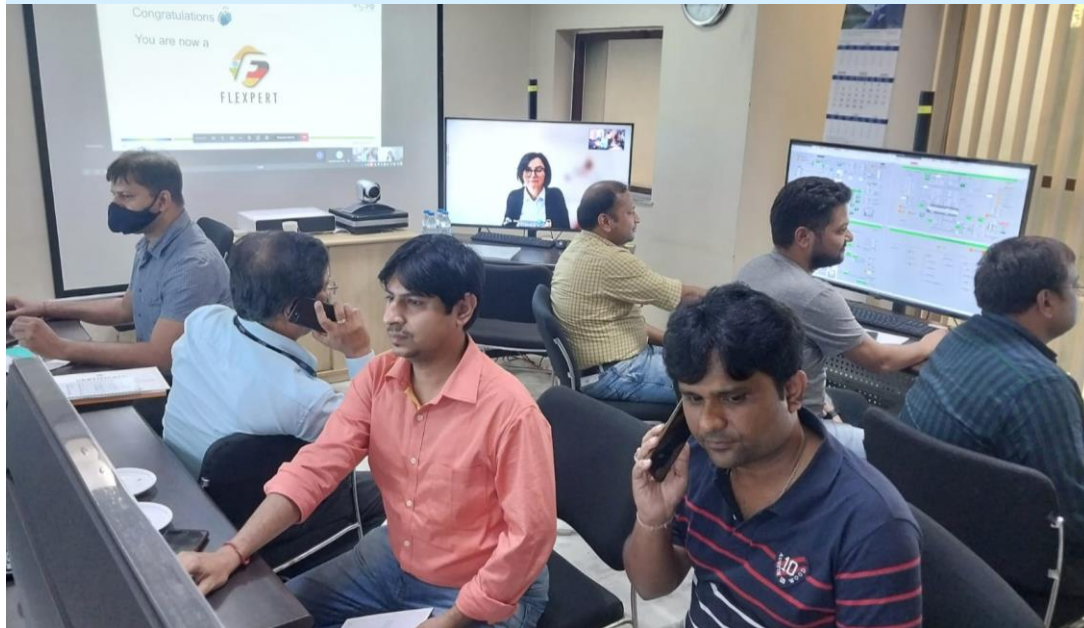
- Increase level of automation for routine sequences and optimize subordinate controls
- Optimize main control loops and implement advanced control solutions

Continuous improvement process

# Simulator Training for Flexperts



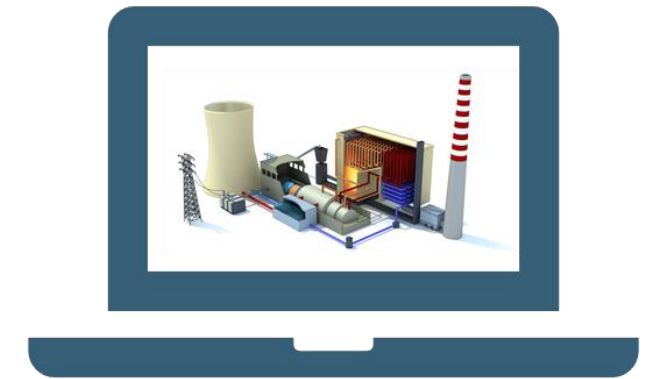
- Online-Trainings to conceptualize future courses
- In co-operation with KWS
- Remote training with simulator located in Germany
- One-week program based on a blended learning approach
- Local infrastructure placed in Steag's facilities



First of its kind in India



Bridging time  
Create learnings








Simulator

# What About You?

[www.arsnova.thm.de/3](http://www.arsnova.thm.de/3)

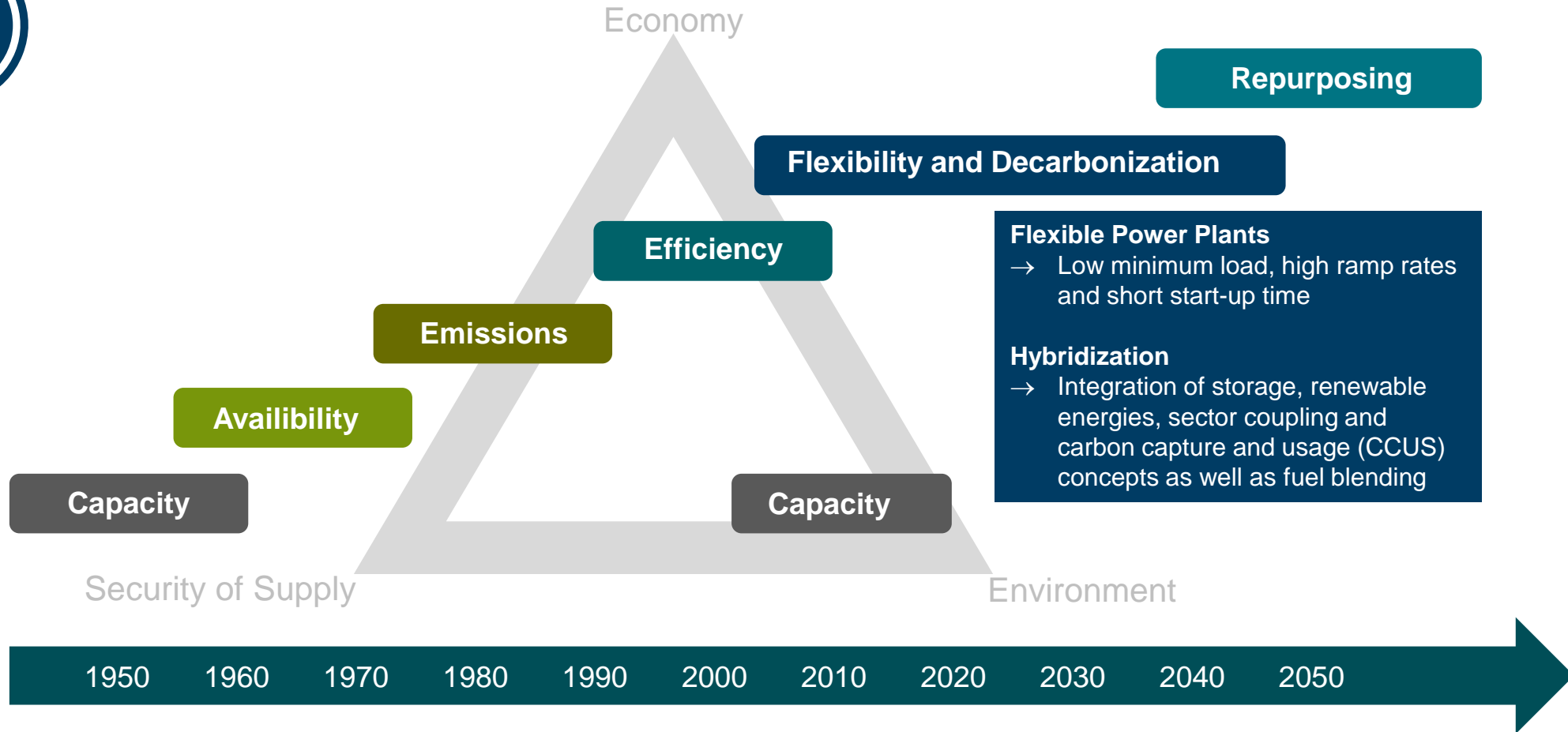
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-  Conduct own test runs to in order to enhance your knowledge about the plant behaviour in part load
-  Collect your own best practices – e.g. for start-up, shut-down, mill scheduling and frequency control – and identify new procedures for your plant
-  An automatized start-up and shut-down sequence of main equipment is beneficial for flexible operation → check, if your DCS system has such sequences which were never commissioned
-  Develop a concept for condition monitoring in order to mitigate the consequences of flexible operation
-  Simulator training is very useful to obtain practical skills in flexible operation as well as to try out different operational concepts



# Development of Power Plant Technology Drivers



# Options for Hybridization of Power Plants

## Renewable Energies



Capacity extension with PV and/or wind energy plants

## Sector Coupling



From heat and steam provision to the integration of H<sub>2</sub> production and CCUS as well as the production of green gases and/or biofuels

## Storage



Integration of storage systems such as large scale batteries as well as thermal and mechanical storage

Source of picture: Steag GmbH

## Fuel Blending



Partial fuel substitution with biomass or green gases

# Decarbonization and other Benefits through Hybridization

## Renewable Energies



- direct impact through carbon-free generation



- efficient use of existing infrastructure and space
- diversification of generation portfolio

## Storage



- indirect impact through enhanced flexibility of the site



- additional income through new services, e.g., primary frequency control, heat and steam provision

## Sector Coupling



- Heat: direct impact through higher overall plant efficiency
- H<sub>2</sub> production: indirect impact, enhancing flexibility by adjustable demand, provision of fuel to decarbonize other sectors
- CCUS: direct impact through reduced CO<sub>2</sub> emissions
- Green gases/biofuel: indirect impact, provision of fuel to decarbonize other sectors



- additional income through new products, particularly suitable for captive power plants or plants close to industrial sites

## Fuel Blending



- direct impact through reduced carbon emissions



- cost-effective measure w/o compromising the plant performance

Thank you for your attention.

**be energized**

**be inspired**

**be connected**

**be informed**

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