From baseload to daily cycling – Technologies for flexible turbine operation

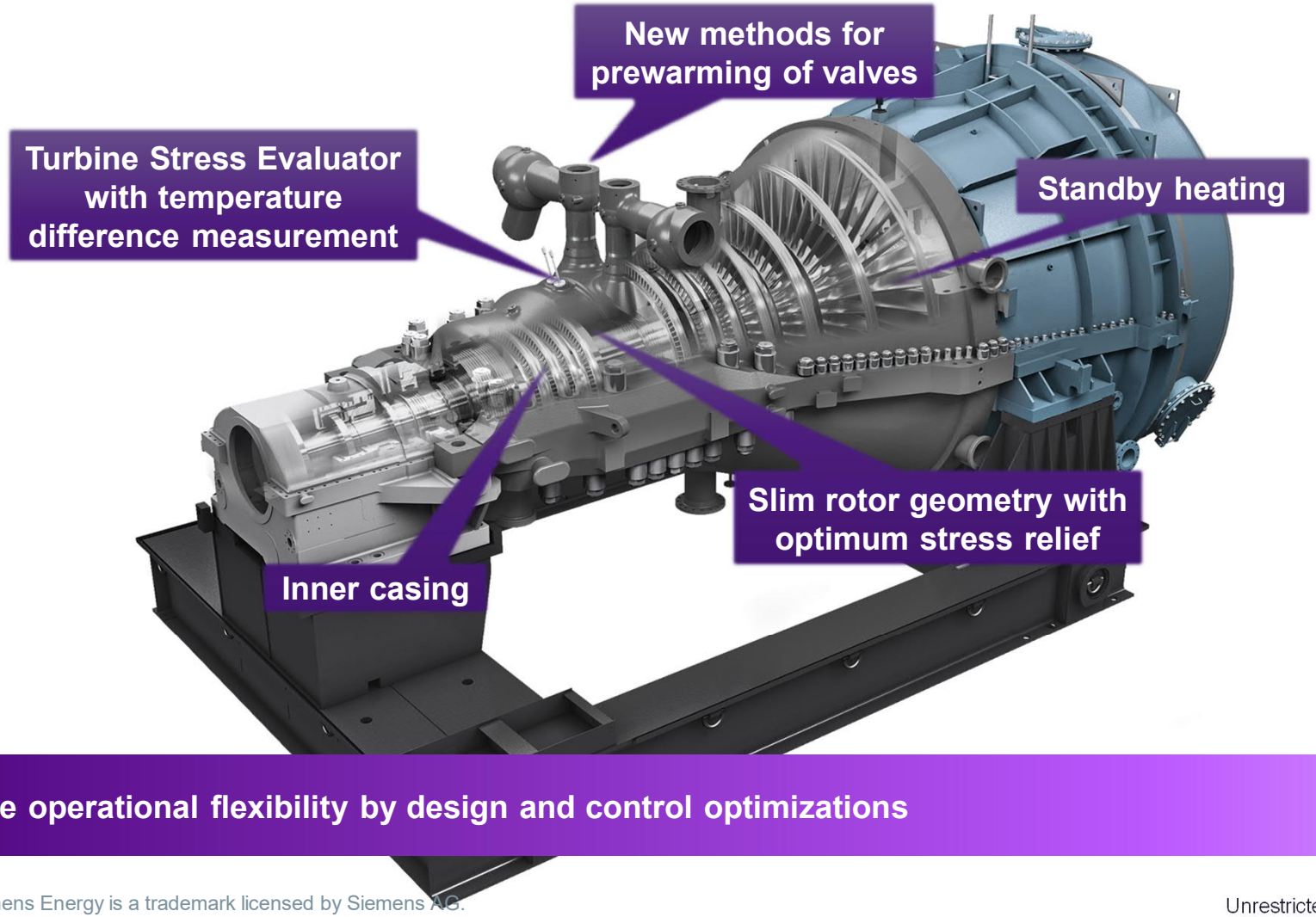
Customer Event Steam Turbine and Generators 2023



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Overview - Technologies for flexible turbine operation

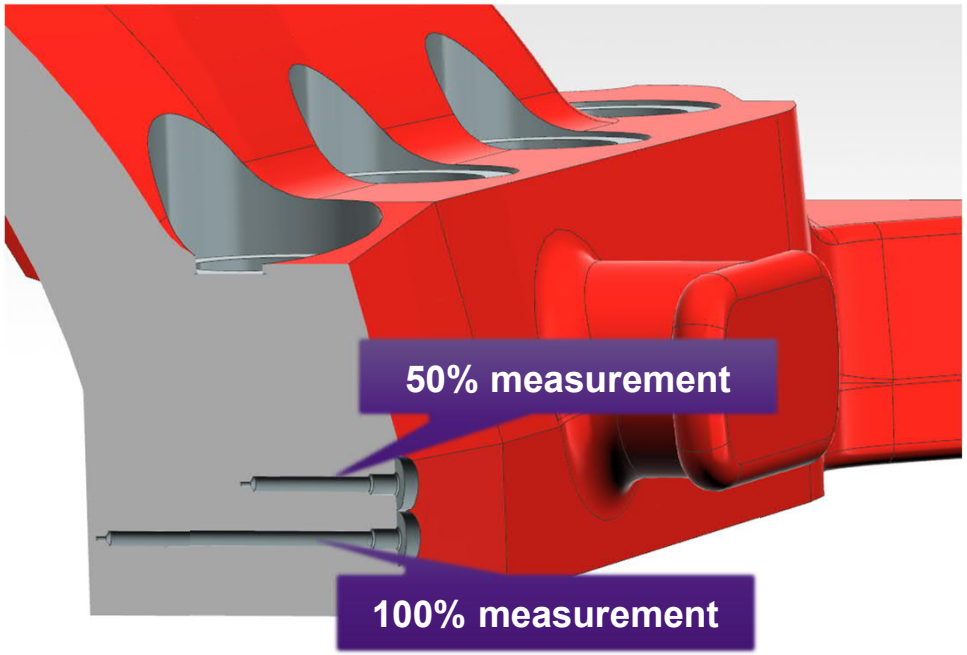


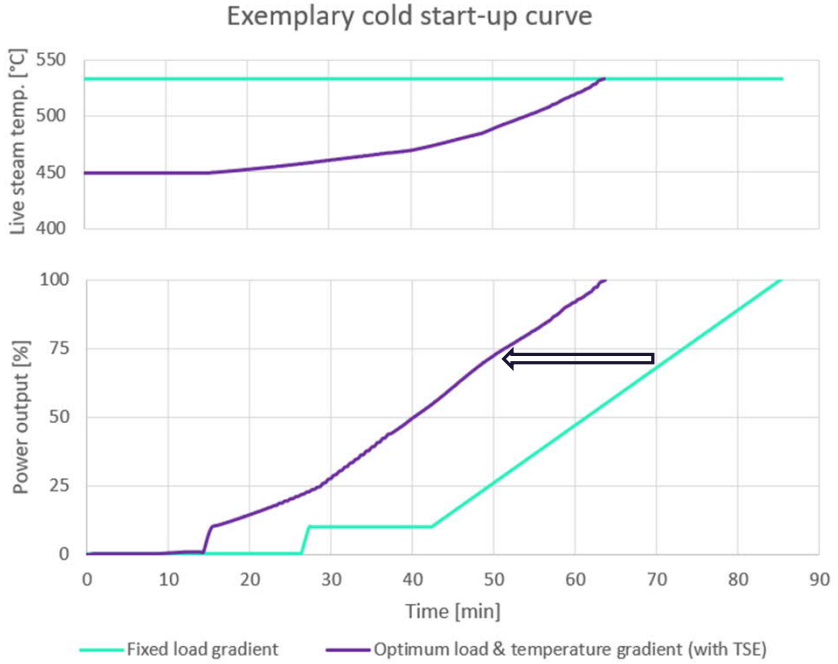
High turbine operational flexibility by design and control optimizations

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Turbine Stress Evaluator (TSE)

- Monitoring via integrated **wall temperature difference** measurement
- **Automatic power gradient** adaption to fully utilize the intended lifetime consumption per cycle / start





- **Optimum live steam temperature** control during start-up for fast cold and warm starts

Significant start-up time reduction by load and temperature control

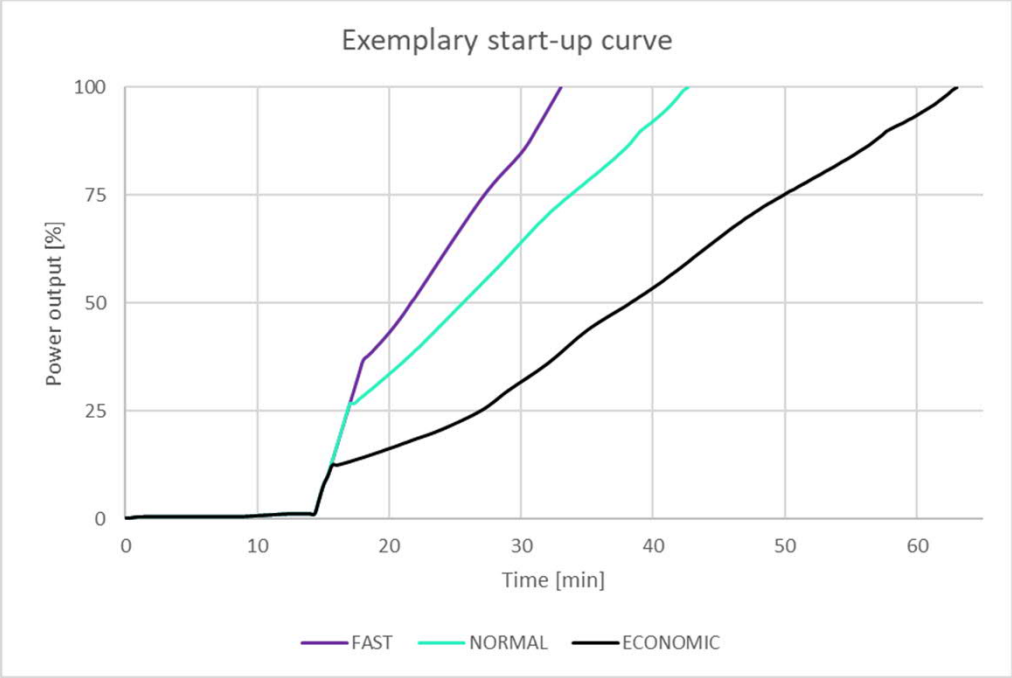
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Turbine Stress Evaluator (TSE)

- Up to **3 start-up modes** with different lifetime consumption (**E**quivalent **O**perating **H**ours)
- **Specific design** and modes optimized **for customer load collective**

Example:

- FAST with 75 EOH (800 Starts)
- NORMAL with 27 EOH (2200 Starts)
- ECONOMIC with 7.5 EOH (8000 Starts)



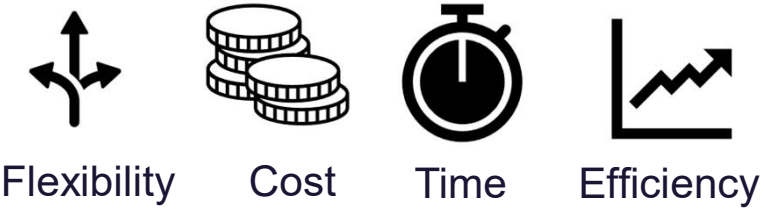
More operational flexibility by start-up modes with different lifetime consumption

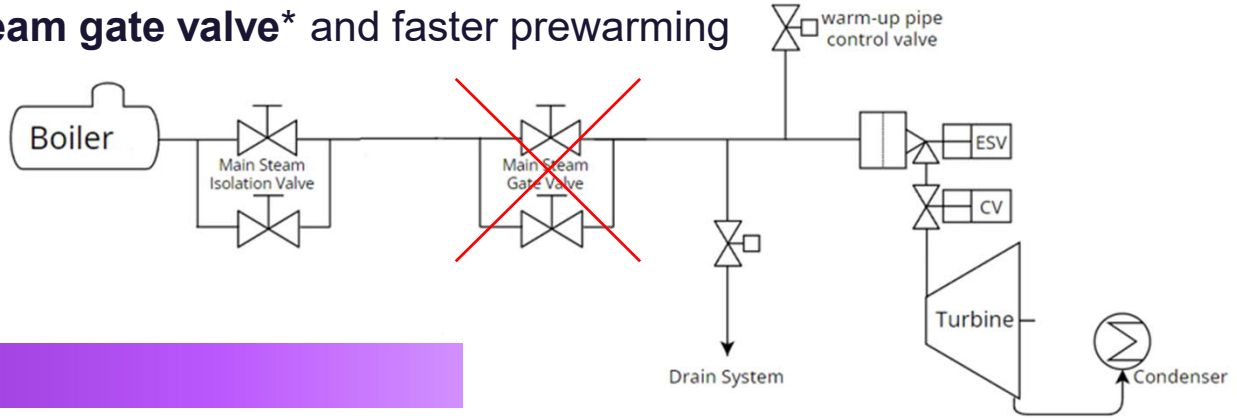
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Prewarming of valves

- New features allow **omission of main steam gate valve*** and faster prewarming



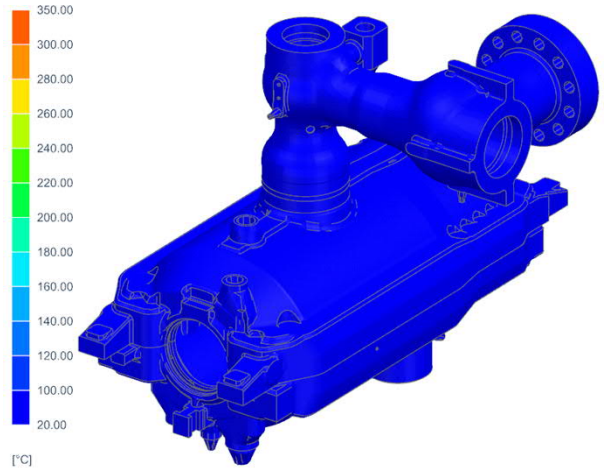


Option 1: Common prewarming

- Pressure built-up and prewarming of turbine valves together with main steam piping prewarming by early opening of ESV
- During such prewarming, seal steam and evacuation not required
- Retrofittable per control system update*

Option 2: Electric heat tracing of valve casing

- Prewarming independent from steam conditions
- Prewarming time from 2 to 6 hours from cold condition



Simulation of valve heating with heating blankets

**depending on control system & boiler configuration*

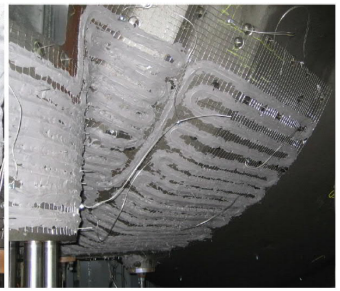
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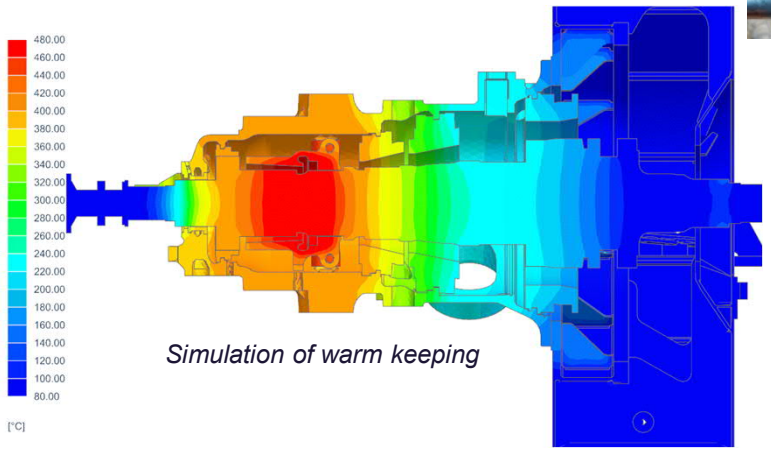
Standby heating

- Warm-keeping of turbine after shut-down with electric **heat tracing of outer casing**
- Retain **warm start conditions**, even after long stand still times

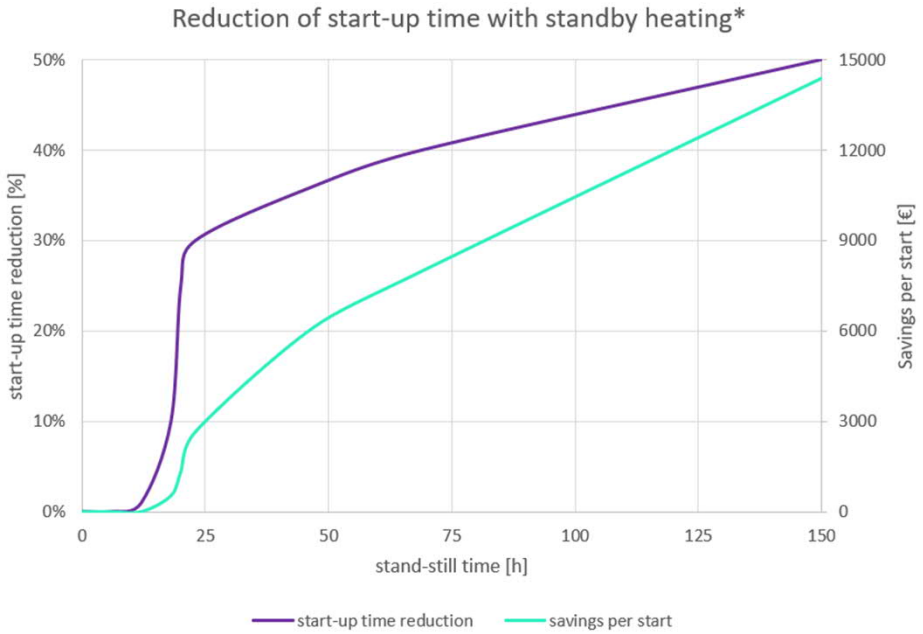








Simulation of warm keeping



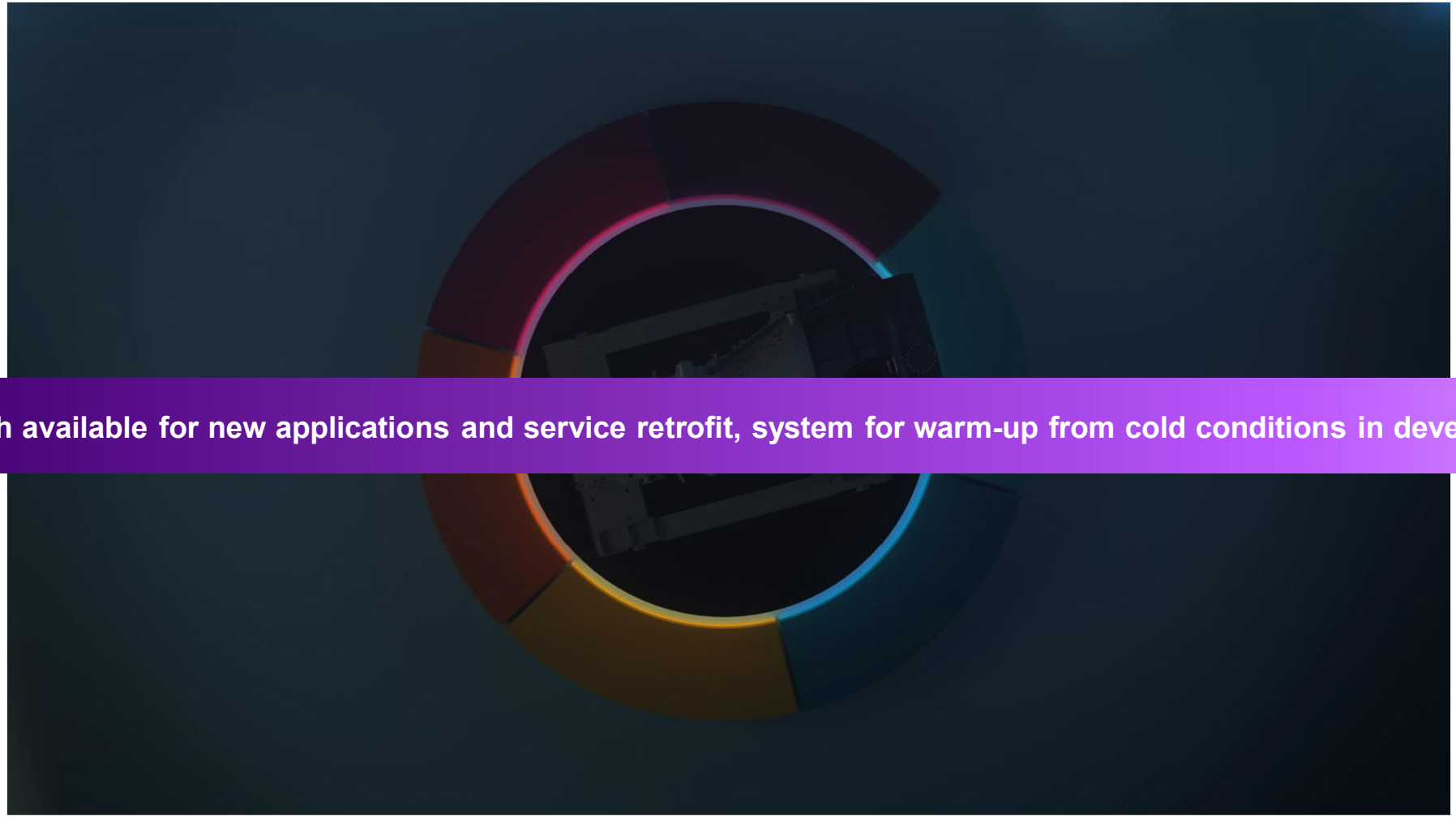
**example for 200 MW powerplant with 80 €/MWh*

Significant start-up time reduction and fast Return On Investment

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Standby heating



Both available for new applications and service retrofit, system for warm-up from cold conditions in development

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Key Take Aways



Start-up time reduction

By optimized design and controls (e.g. Rotor, Turbine Stress Evaluator, Start-up modes)



Omission of main steam gate valve

More flexibility, lower costs, faster operational readiness, more efficiency



Standby heating

Retain warm start conditions, no matter how long you are out of operation

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Contact

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