



ETN Webinar Series
FLEXIBLE POWER GENERATION
April 20th, 2021, 11:30am-1pm CET

Meeting Complexity with Flexibility: TURBO-REFLEX Christian Aalburg, GE (Project Coordinator)

TURBO-REFLEX. TURBOmachinery **RE**trofits enabling **FLEX**ible
back-up capacity for the transition of the European energy system



Industrial Partners

1. GE
2. Ansaldo Energia
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4. Doosan Skoda Power
5. GE Switzerland
6. MAN Energy Solutions
7. Mitsubishi HPS-EDE
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9. SIEMENS Energy
10. Naturgy

SMEs

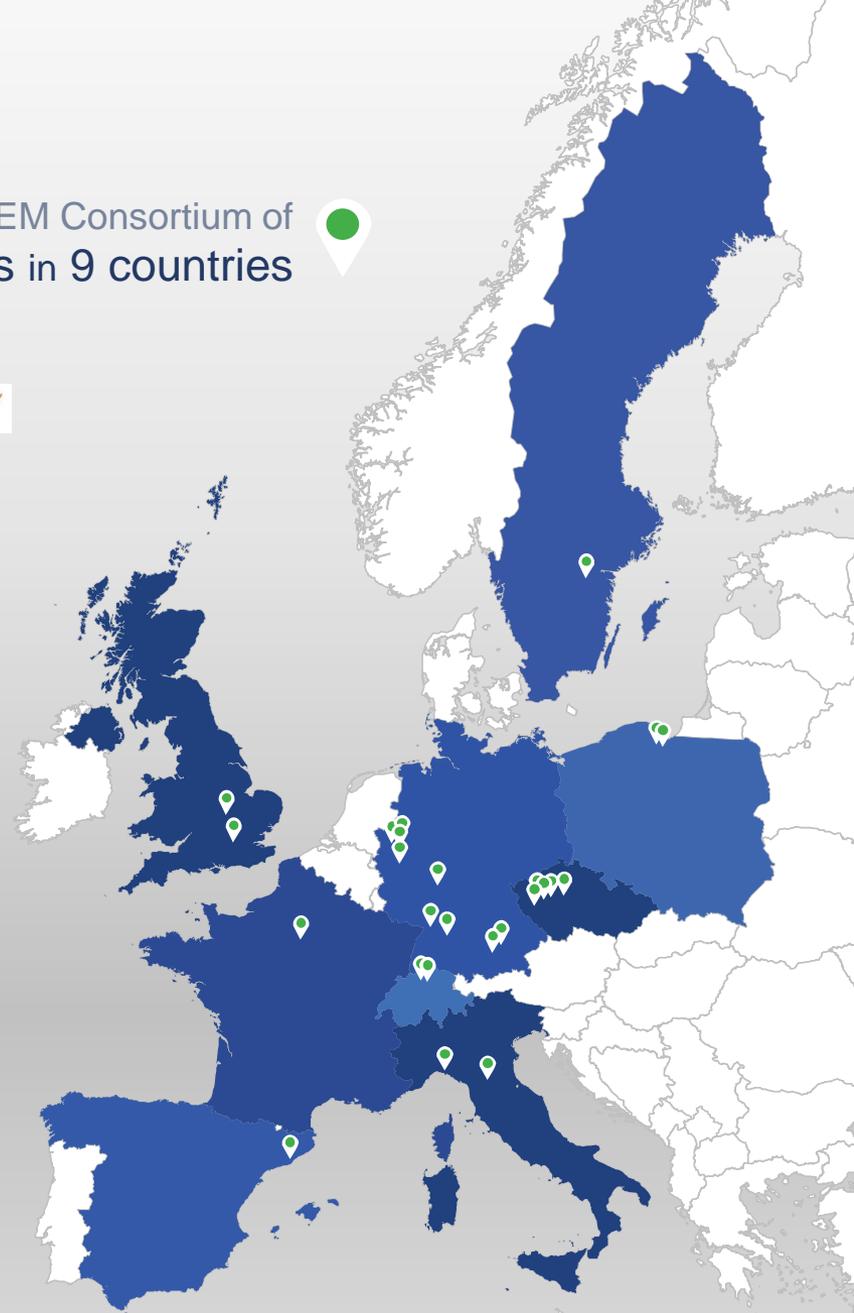
11. ASINCO
12. COMTES
13. GES
14. T-Elektronik

Universities/Res. Inst.

15. Cranfield Univ.
16. Czech TU Prague
17. DLR
18. KIT
19. Linköping Univ.
20. Polish Academy of Sciences
21. TU Munich
22. Univ. of Florence
23. Univ. of Stuttgart
24. Univ. of West Bohemia
25. Institute of Aviation

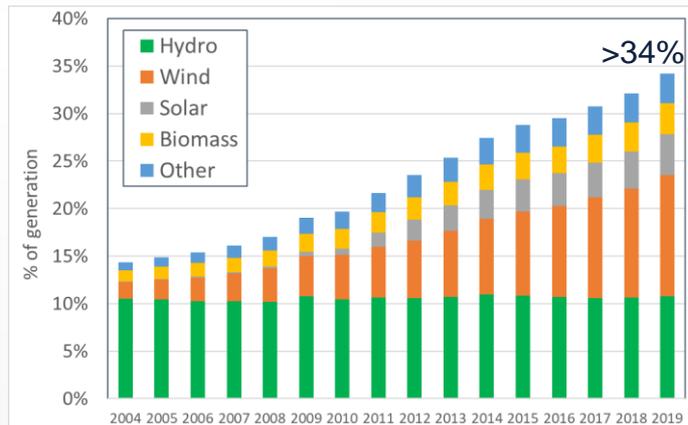
Management

26. ARTTIC



EU is developing a low-carbon economy incl. the energy sector with large scale deployment of renewable energy sources

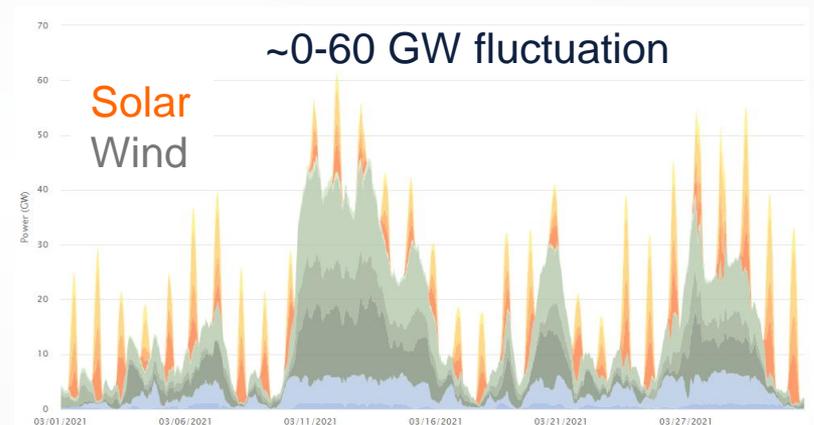
➤ Renewable electricity generation is growing substantially ...



Share of renewable electricity generation in Europe 2004–2019.

Source: Eurostat

➤ ... BUT intermittency requires back-up capacity almost equal to renewable generation



Electricity generation from Wind and Solar in Germany in March 2021.

Source: Fraunhofer ISE

➤ To enable more Renewable Energy Sources on the grid, highly flexible back-up power is needed at large scale

No large-scale storage solutions available yet ...

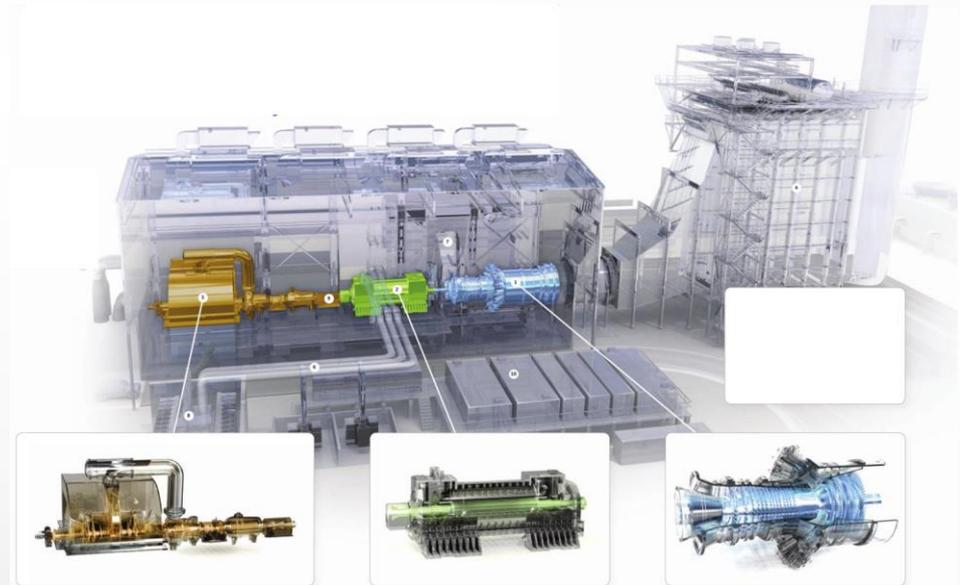
- Existing fossil fuel plant infrastructure can fill the gap cost effectively, BUT needs to shift role from providing baseload to flexible backup power

New demands on existing fleet

- ⊗ High load change velocities
- ⊗ Full turndown capability
- ⊗ Start/stop mode w/very fast re-start

Increase in cost due to

- ⊗ Increased wear, shorter lifetimes
- ⊗ Decrease in efficiencies
- ⊗ Unplanned outages, etc.



Objective

“Develop technologies to retrofit existing fossil-fuel power plants to enable more flexible operation to allow a larger share of renewables in the energy system.”

Objective 1 - Reduce costs per cycle

Reduce cycle costs of CC plants by:

- Increasing part load efficiency.
- Increasing resistance to wear.
- Having more accurate life information.

Objective 2 - Increase low load capability

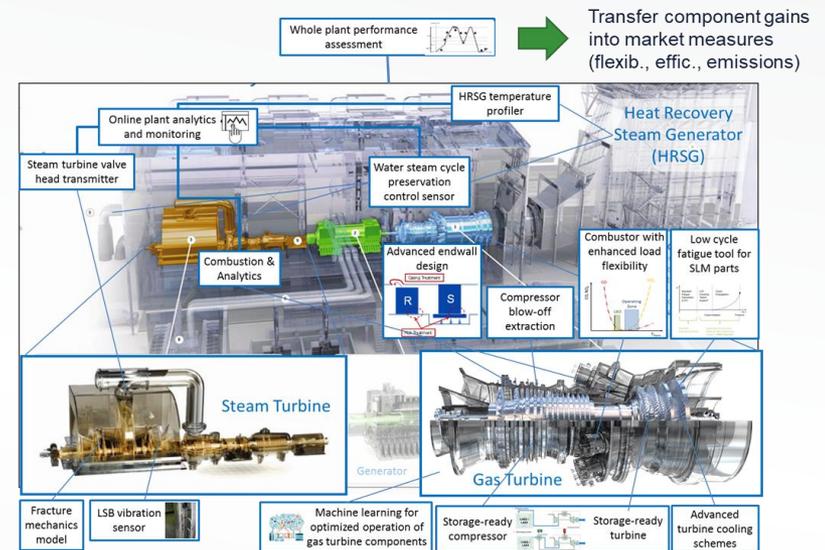
Reduce the number of hot starts required by increasing the low load capability of existing plants to avoid shut down.

Objective 3 - Increase load following capability

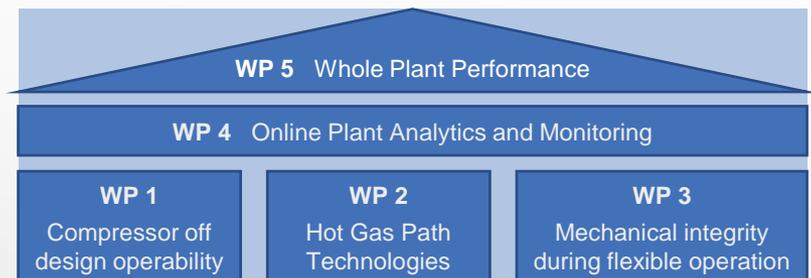
Increase the load following capability of existing CC plants.

Methodology

Technologies



WP Structure



› Expected Impact

- › TURBO-REFLEX will provide retrofittable solutions for faster load changes, improved low load capability and economic benefits for plant operators.
- › TURBO-REFLEX will reduce fuel consumption and emissions due to shorter start-up times and higher part load efficiency.
- › TURBO-REFLEX solutions could allow a significant amount of the installed fossil capacity in Europe to be retrofitted by 2030.

› Challenges

- › Dealing with a changing and highly volatile market.
- › Large differences in electricity markets between countries in Europe make standardization challenging.
- › Low capacity factors associated with back-up power role of fossil plants make financial viability of additional flexibility investments challenging.

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An OEM Consortium of
26 partners in 9 countries



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