



ETN Webinar Series
FLEXIBLE POWER GENERATION
March 2nd, 2021, 12am-1pm CET

Meeting Complexity with Flexibility: TURBO-REFLEX

Christian Aalborg, GE (Project Coordinator)

“TURBO-REFLEX. TURBOmachinery RETrofits enabling FLEXible back-up capacity for the transition of the European energy system”



Industrial Partners

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

SMEs

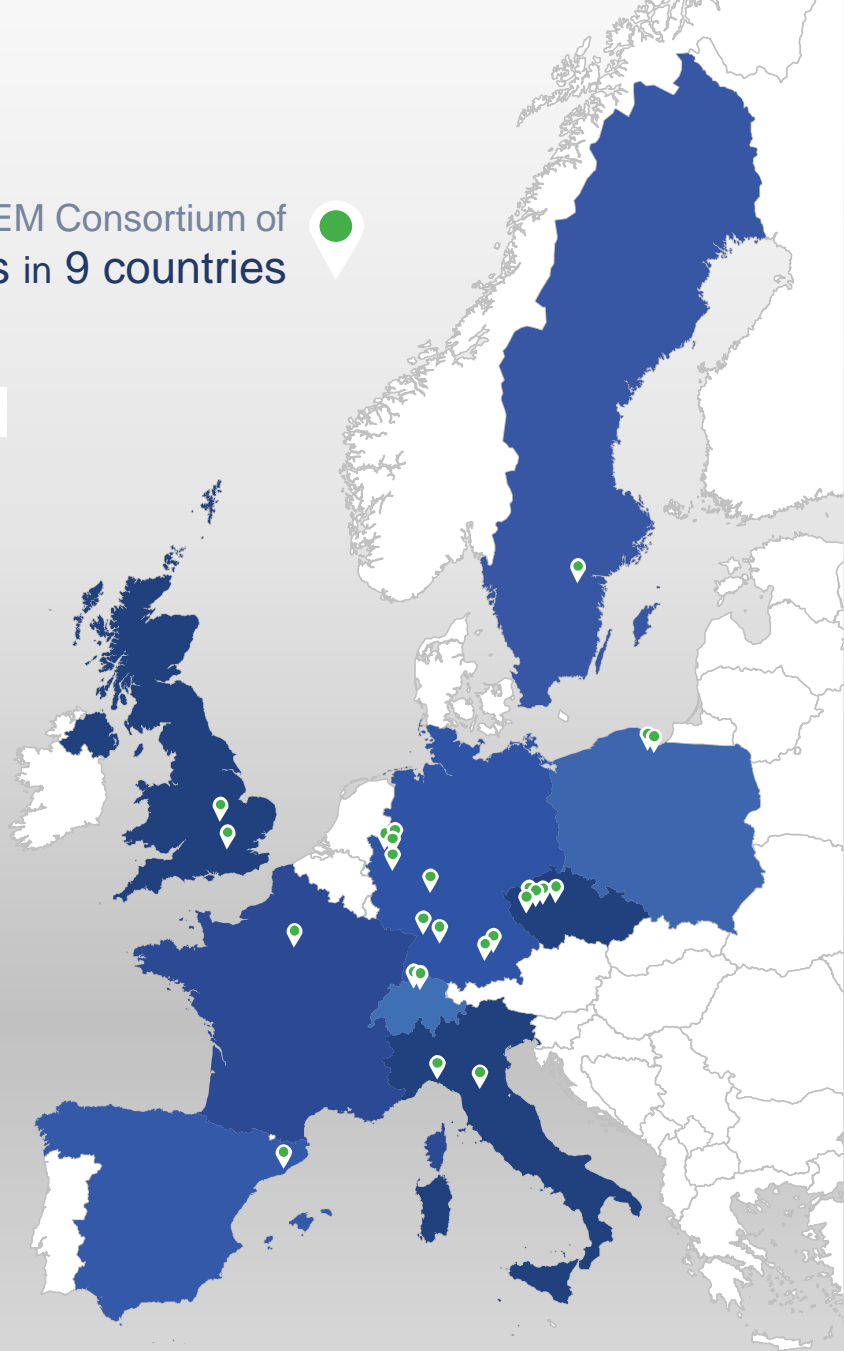
11. ASINCO
12. COMTES
13. GES
14. T-Elektronik

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

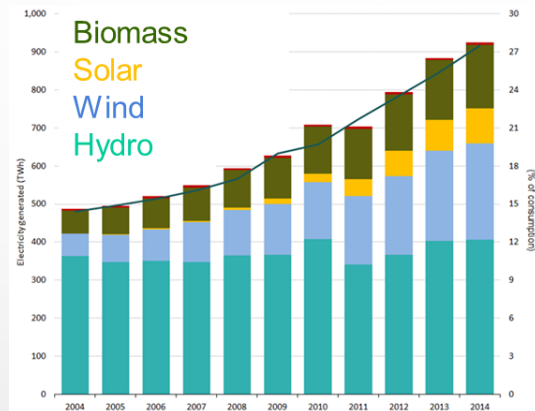
26. ARTTIC



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

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

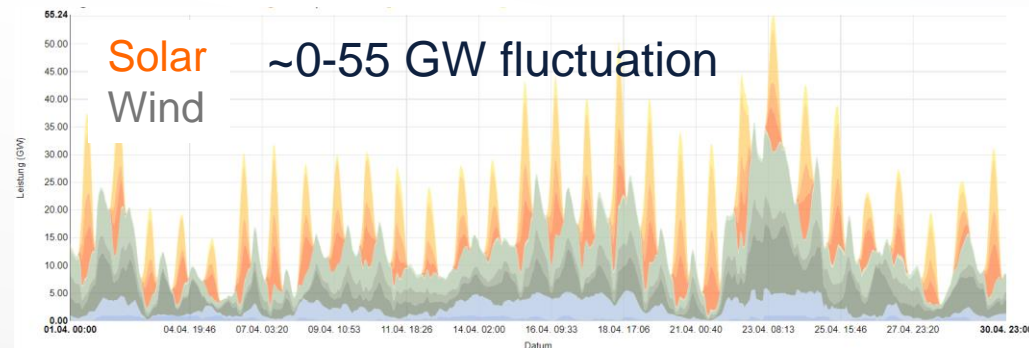
➤ Renewable electricity generation is growing substantially ...



Renewable electricity generation and share of consumption in Europe 2004–2014.

Source: Eurostat

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



Electricity generation from Wind and Solar in Germany in April 2019.

Source: Fraunhofer ISE

No large-scale storage solutions available yet ...

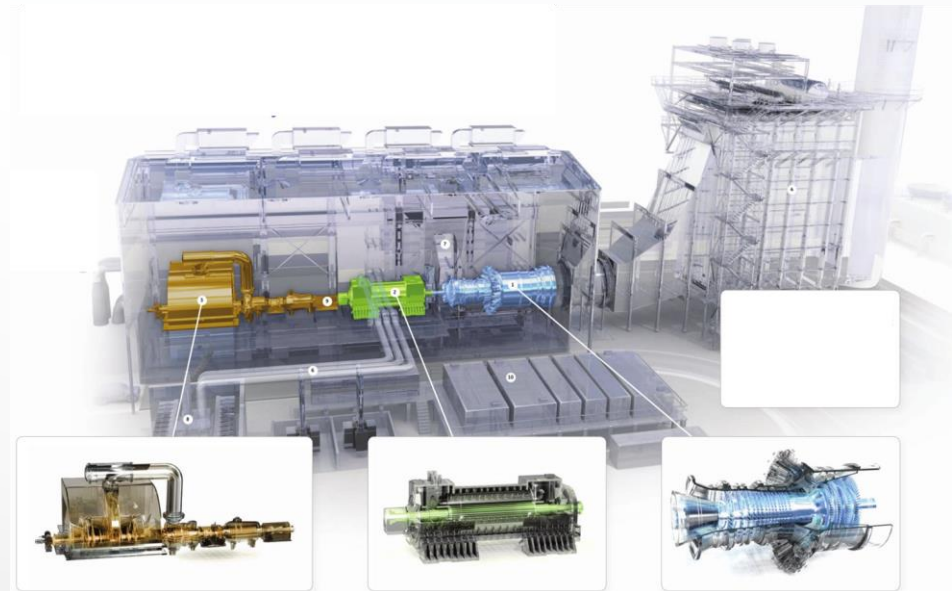
- Existing fossil fuel plant infrastructure can fill the gap cost effectively, BUT needs to shift role from providing baseload to flexible backup power

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 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.

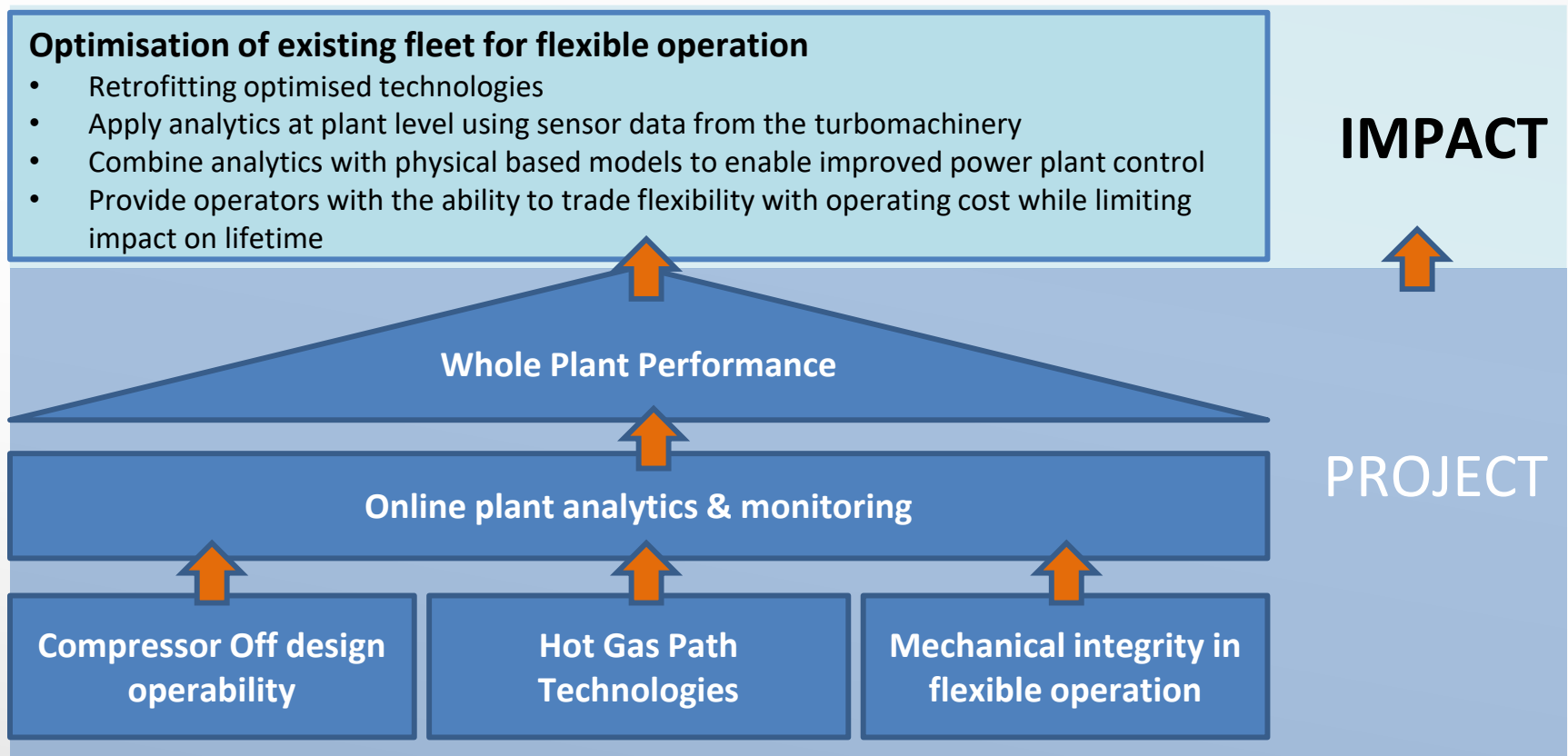
Objective 2 - Increase low load capability

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.

- 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



An OEM Consortium of
26 partners in 9 countries



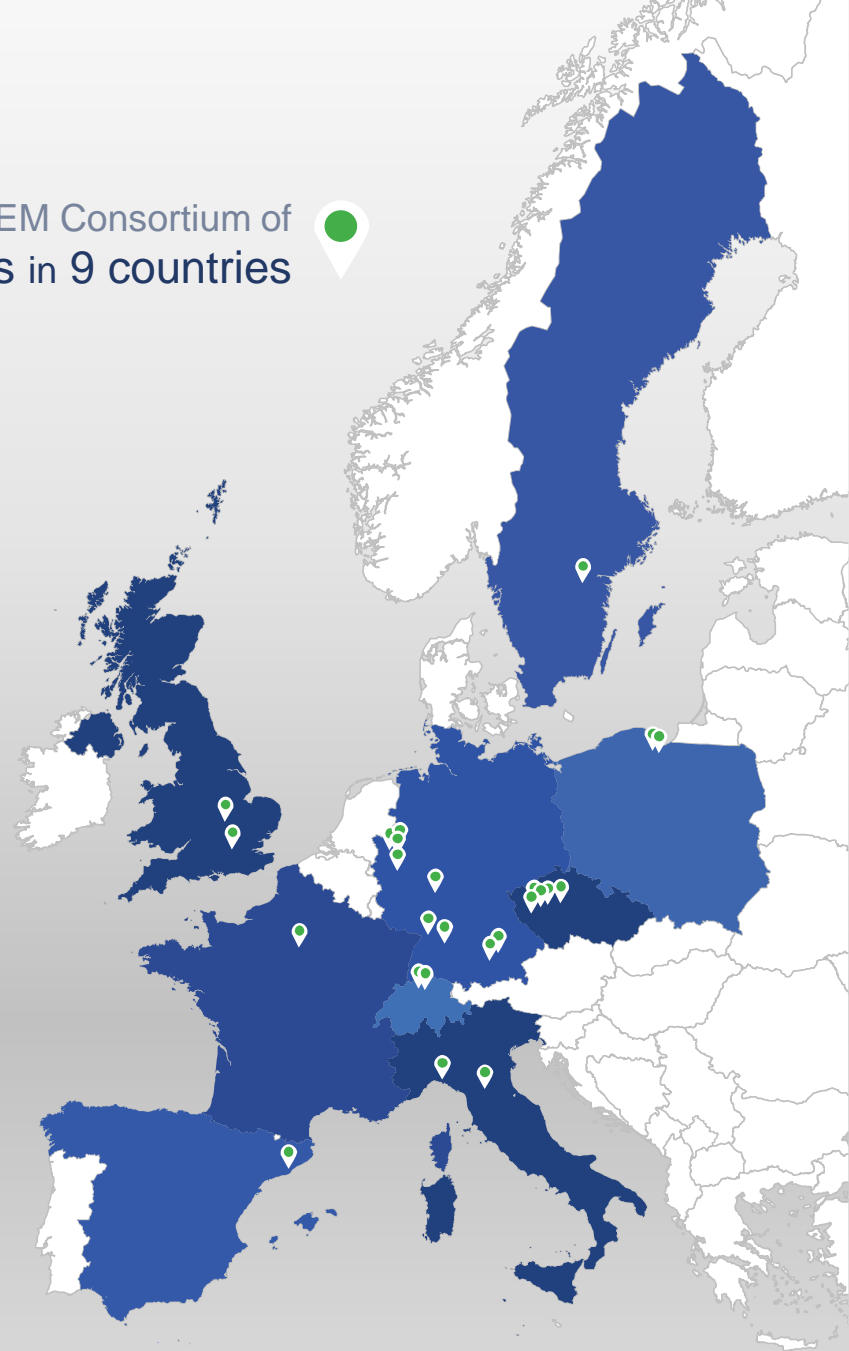
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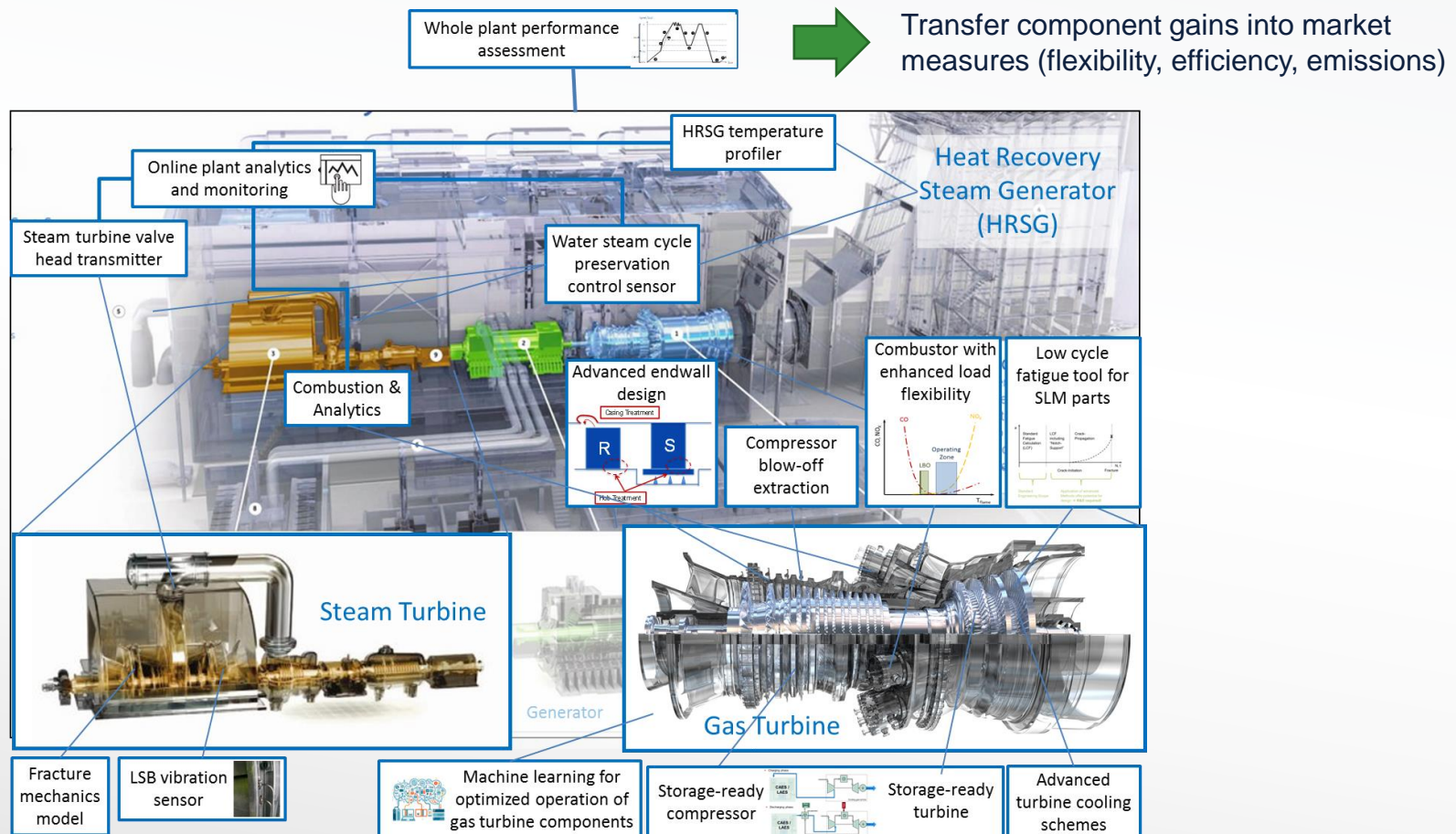
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BACKUP

- 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



› Technical Level

- › Covid impact on lab tests

› Industry Level

- › Dealing with a changing and highly volatile market
- › Industry reorganization

› European Level

- › 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