Speeding up combined cycle power plants

Reference No: B74077

CHALLENGE

The integration of renewable power generation has not only lead to decreasing prices, but also the residual load, that has to be covered by conventional generation, becomes more variable. This is the reason why next to the costs of electricity generation, power plant flexibility gets more and more important. Combined cycle gas turbine power plants are very efficient but have too slow start up times to participate in the lucrative short term electricity spot market.

INNOVATION

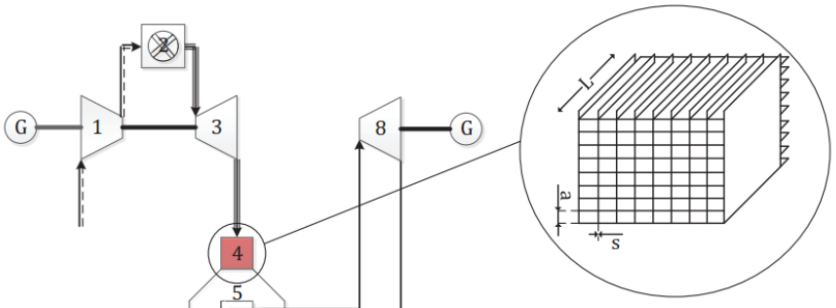
Ta novel buffer storage for the thermal decoupling of gas turbine (GT) and heat recovery steam generator (HRSG) during startups and shutdowns has been developed. The storage consists of a matrix of metal plates, placed in the flue gas channel between GT and HRSG, which is heated up during startup and cooled down during shutdown and therefore reduces the thermal gradients in the actual HRSG. The limitation to fast startups in combined cycle gas turbine (CCGT) plants is usually fatigue induced damage in critical components in the HRSG. A transient modeling strategy of both, storage and HRSG, finds, that in the investigated plant such a storage is capable of reducing the cycling fatigue damage in the most critical part of the HRSG by up to 90 % and therefore enables to act the GT as flexible as if no HRSG was connected to it.

COMMERCIAL OPPORTUNITIES

- Gas and steam power plant are enabled to take part in the electricity spot market
- Reduced cost by reduced fatigue damage by up to 90%
- retro fit possible

DEVELOPMENT STATUS

Proof of concept and simulations



1: Compressor
2: Combustion chamber
3: Gas turbine
4: Storage with
L: Length in direction of flue gas flow
a: Width of a channel
s: Thickness of the metal plates
5: HRSG (simplified) with
a: Superheater
b: Evaporator
c: Economizer
6: Stack
7: Steam drum
8: Steam turbine
9: Condenser
G: Generator

Figure: Reduced cost by thermal buffer storage in a combined cycle plant (by Angerer, TU München)

REFERENCE:

1. Anal. Chem. 87, 3134-3138 (2016)
2. EP 3 134 725 A1; US 2017 0030860 A1
3. Anal. Bioanal. Chem. 410, 6321-6330 (2018)

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