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USG E-Boiler & Superheater

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USG Strategy

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The strategy and motivation to incorporate an E-steam boiler into the existing Steam supply system at USG were:

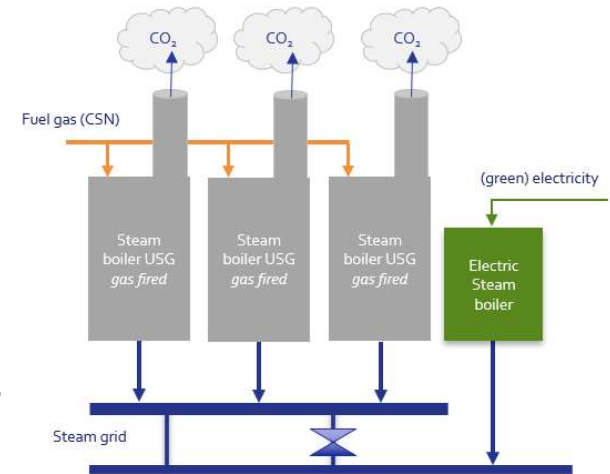
1. Sustainability: requirement to reduce CO₂. Based on the Paris agreement on reducing CO₂, also USG and Chemelot-site will be asked to reduce the CO₂ emissions. CO₂ emissions will be reduced by 2% based on a 23% full load of the E-Boiler.
2. Innovation: USG will realise a partial Hybrid steam system. The focus will be to produce maximum steam with the E-boiler system when E-prices are low, were the normal USG gas fired steam boilers will be reduced in their capacity.
3. Increase of steam production: In case of a trip of the Naphtha cracker, there is a high need of 140 bar steam. The introduction of the 26 bar E-boiler system, with a very short response time, will be able to support the total steam system of USG and avoid production reduction at other location sites at Chemelot.

USG System requirements

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The system requirements of the E-Boiler where USG based their choice on:

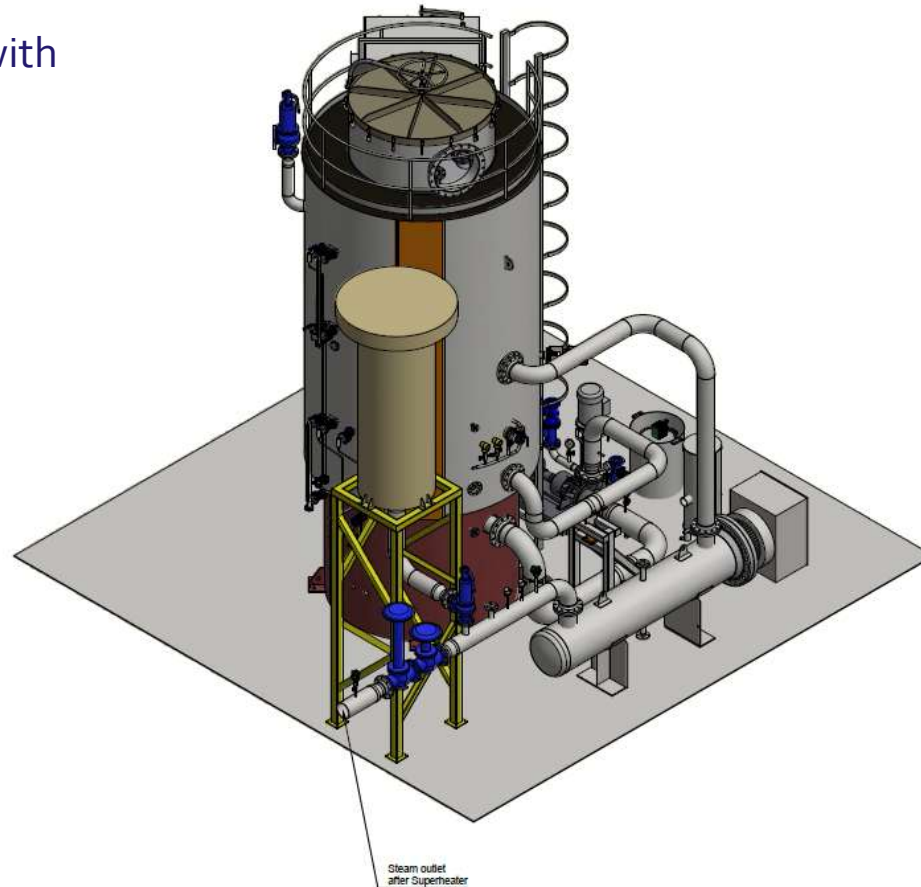
1. Integration into existing 26 bar steam system.
2. Supply of 30 ton/h of 26 bar superheated steam (275°C).
3. Start – stop strategy with very short response time (< 2 minutes).
4. Start – stop strategy at USG or even with 3rd party.
5. High availability of system (>99%).
6. Electrical Hot Stand-by control.
7. Expected running time (supply of the specified steam): 2.000 h/a.
8. High TRL-system.
9. System will be placed outdoor.



USG Project

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Typical E-Boiler overview with
superheater and silencer



USG Project

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- USG Project phase is in Detail engineering.
- Due to the long deliveries and situation on the global market the pre-funding of the E-Boiler system was accepted. E-Boiler system is ordered.
- The project will be integrated into a new Steam distribution system at the Chemelot site.
- The required Demi-water will be supplied by the Steam distribution system. Quality of the Demi water is according "VGB-Richtlinien" for 140 bar steam.
- Based on the SDE++ subsidy very interesting project payback-time for the Chemelot site.
- For 2025 a gas- or oil-fired flam tube boiler would be required to meet the spare- and peak demand. This however will be covered by the E-boiler system.
- When an E-Black out occurs, the E-Boiler will be one of the 1st system, which will be back online and will support the Chemelot site to start up the critical systems which need steam.

USG system safety

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Based on the Basic design information, the USG project team performed a 1st HAZOP (Checklist method).

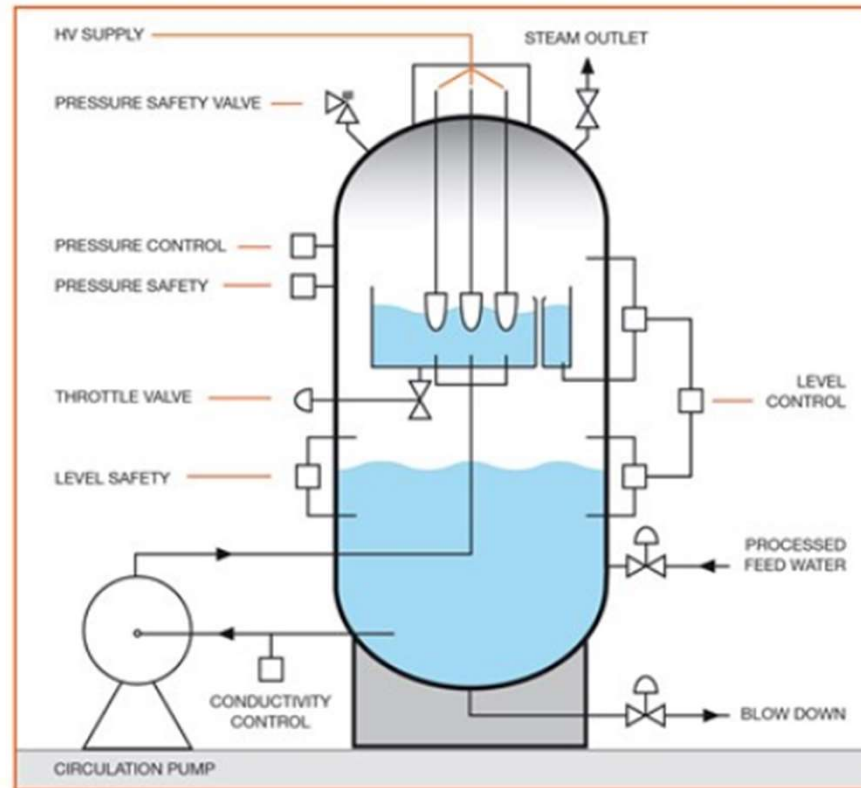
Unfortunately the HAZOP information of the E-Boiler system was limited.

Based on the HAZOP study following points are identified and need special attention:

1. Safety valve (100%) on E-boiler / behind superheater. Discussion with supplier / Lloyds.
2. In case of power failure, start up sequence of the system.
3. E-boiler system is flow regulated and has no pressure regulation.
4. Power of Standby heater is higher than heat loss. Overheating of E-Boiler and rise in pressure. Discussion with supplier.
5. Possible vacuum E-boiler. Vent valve to prevent vacuum.
6. Failure of Feed water pumps E-Boiler: backflow into LPFW system. Supplier to explain specific valves on P&ID.
7. Rising of conductivity: Supplier to explain control of conductivity.
8. Special attention on earthing of E-Boiler (10kV).
9. Start up; 85 dB
10. Opening Safety valve (100%); 95 dB

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Principle diagram of Electrode Boiler Steam generation system.

Questions?