Innovation Type:
Process Concept

Development stage:
Theoretical Analysis

Remaining uncertainties at current stage: **Need to be tested and developed further in pilot scale conditions**

Status: In progress, 2021-06

Contact: Samuel Senanu (samuel.senanu@sintef.no)

HighEFF Overall Goals

Energy use & emissions	X
New solutions	X
New methods and tools	

Relevant Sectors

Oil, Gas and Energy	**Metal and Material**
Food and Chemical	Industry Clusters

Energy Recovery and CO_2 Capture for the Aluminium Industry

Presently, close to 40 % of the waste energy generated from aluminium production by the aluminium industry is lost in the off-gas. Also, the CO_2 concentration in the off-gas is very low, thus, making it difficult for economical carbon capture and storage (CCS) by the industry.

Challenge

50 % of the ca. 13.4 MWh required to produce a tonne of aluminium is lost as waste heat during production. Close to 40 % of this waste heat ends up in the off-gases leaving the electrolysis cell. Additionally, the CO_2 concentration in the off-gas is very low for economical carbon capture and storage (CCS).

Solution

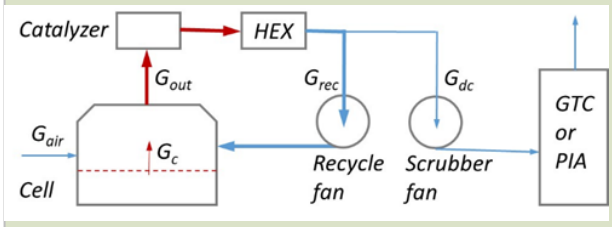
A concept involving recycling of the off-gases to increase the CO_2 concentration and recover the waste energy by using a heat exchanger (HEX) provides a possible solution.

Potential

- 2 TWh annual energy savings for the Norwegian Aluminium industry
- Increased CO_2 concentration in the off-gas to ca. 3-4 vol%
- A CO_2 -free aluminium production by 2030 using a suitable CCS technology.

HighEFF Activities

- WP1.3 and WP4.2 2022: Design a PGR system fitted with a CO to CO_2 catalyser, and HEX unit that fits into the PIA system by REEL Norway.
- WP1.3: Run tests with the installed PGR system to investigate the potential for increased CO_2 and energy recovery.



Simple concept sketch

Reference

- [1] Solheim A, Senanu S (2020): Recycling of the Flue Gas from Aluminium Electrolysis Cells Light Metals 2020, 803-810.
- [2] Senanu S, Solheim S (2021): Gas Recycling and Energy Recovery. Future Handling of Flue Gas from Aluminium Electrolysis Cells Light Metals 2022.