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New, eco-friendly technologies could transform the European aluminium industry by 2050

March 3 2016

Adopting innovative technological solutions – currently in early research phase – instead of following a conservative technology development path could slash the direct greenhouse gasses (GHG) emissions of aluminium production by 66% in 2050 and reduce the associated energy consumption by 21%, according to a JRC report. The reductions between 2010 and 2050 for primary aluminium production are even higher, amounting to 72% and 23% respectively. The findings stem from an analysis of the current status of the aluminium industry in EU28 and Iceland, which quantifies the potential for GHG emission reduction and energy efficiency.

The current EU target for 2030 of reducing GHG emissions by at least 40% below 1990 levels will help the long-term objective of emissions cut by 80-95% by 2050 in the context of necessary reductions by developed countries as a group.

The work carried out for this report supports the European Commission's 2015 Energy Union package which – among other – highlights the need for additional research priorities such as carbon capture and storage (CCS) and inert anode technology (in the aluminium production process) to reach the 2050 climate objectives in a cost-effective way. The European aluminium industry has made substantial efforts to improve its performance in terms of energy efficiency and GHG emissions. However, to achieve the ambitious EU targets, further improvements are required.

JRC scientists compiled data on existing aluminium production facilities, their production characteristics as well as the best available and promising innovative production technologies. The latter involve the use of dynamic AC magnetic fields, wetted drained cathodes, inert anodes or carbon capture and storage (CCS).

The model used identifies cost-effective improvements in aluminium production at facility level and the impact of their implementation on energy consumption and GHG emissions, based on the condition that investments are recovered within five years and on the assumption that there are no barriers for the timely commercialisation of the identified technological solutions.

The analysis shows that most of the resulting reductions come from technologies that are in early stages of research (e.g. inert anodes that are in a technology readiness level (TRL) 4 or 5, or CCS at even lower level). Therefore, harnessing this potential requires effective policy push to create the right conditions to allow the further development and commercialisation of these innovative technologies.

Background

Primary aluminium production is energy intensive process – it requires approximately 37 GJ of thermal energy and 58 GJ of electricity per tonne of sawn aluminium ingot produced (this thermal energy consumption is around twice the required per tonne of steel produced from the integrated route -blast furnace-basic oxygen furnace- and the electricity consumption is more than ten times the required per tonne of steel from the recycling route (electrical arc furnace).

The overall direct CO_2 equivalent emissions from the process amount to around 3.5 Mt of CO_2 per tonne of sawn aluminium ingot. If the average CO_2 associated with the generation of the electricity used is calculated, this would add additional 7.4 Mt of CO2 per tonne of aluminium ingot. Secondary aluminium production requires as little as 5 % of the energy needed for primary aluminium production.

The total indigenous production of European aluminium industry was about 8.9 Mt in 2013, excluding the ingots imported (3.3 Mt) and the re-melted aluminium (6.1 Mt). The primary aluminium contributes to the aluminium output with about 4.2 Mt and the recycling route with 4.7 Mt.

Provided by European Commission, Joint Research Centre (JRC)

Citation: New, eco-friendly technologies could transform the European aluminium industry by 2050 (2016, March 3) retrieved 7 May 2024 from https://phys.org/news/2016-03-eco-friendly-technologies-european-aluminium-industry.html