EUROPEAN pathways

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Prospects for radical reductions of CO_2 emissions from large industrial emission sources in the EU

Our analysis confirms that EU:s short-term goal for GHG emission reduction in the sectors covered by the EU Emission trading system, 21% reduction by 2020 compared to 2005, is attainable with abatement measures already available. The 21 % reduction is also manageable for the industry sector as such. However, despite optimistic assumptions regarding the potential for, and implementation of, available abatement strategies within current production processes, our analysis show that the industry sectors will fail to comply with more stringent reduction targets in the medium- and long term. A reduction of 80 % to 2050 is e.g. not possible to reach for the industry sector using present technologies/processes (”BAT”). Thus, to realize the goals of further, extensive, emission reductions, efforts to develop, and deploy, low carbon production processes (including CCS) must be intensified. This is also closely related to the risk of ”lock-in” if traditional processes and technologies are favoured.

Shift towards low carbon production technologies are needed

Many European industries and power and heat plants, still in operation, were commissioned in the period from 1960 to 1980 when most externalities accompanying the use of fossil fuels were ignored. Today there is a relatively broad understanding that to mitigate global climate change a shift towards low carbon production technologies are needed and the EU has committed itself to take a leading role in this process. In February 2011 the European Council reconfirmed the EU objective of reducing greenhouse gas (GHG) emissions by 80-95% by 2050 compared to 1990. To achieve such far reaching emission reductions all sectors of the economy, obviously, will have to contribute.

Explore the limits for CO_2 emission abatement

This study assesses the prospects for CO_2 emission abatement in three of the four major CO_2 emitting activities in the EU stationary sector by applying scenario analysis. The analysis covers petroleum refining, iron and steel and cement manufacturing, in EU27 and Norway. An important element of the analysis has been to consider how factors such as age structure, fuel mix, activity levels, demand structure and the types of production processes applied contribute to facilitating or hindering the shift towards less emission-intensive production. While some abatement strategies are applicable in all branches, i.e., fuel switching and energy efficiency improvements, the specific scenario generation approach has been adjusted to reflect the conditions in respective branch. The general methodological approach involves:

1) A thorough description and characterization of the current industry structure
2) Assessment of key factors and trends relevant to future CO_2 emissions in each branch
3) Scenario analysis; exploring the prospects for short- and long-term CO_2 emission reductions with the emphasis on the role of existing production processes and abatement options.
4) Impact analysis; including a discussion of the relevance and possible implications of the scenario outputs.

The overall aim has been to explore the limits for CO_2 emission abatement within currently dominating production processes. Thus, assumptions on the performances and potentials for specific individual abatement options can generally be described as optimistic. The analysis has been restricted to the technical potentials of available abatement options and, thus, largely neglects possible economical and institutional constraints. By comparing the emission scenarios with indicative emission trajectories for the period 2010-2050 we provide an indirect measure of the importance of new low carbon technologies or production processes.

The major share of the emission reduction occurs in the power sector

Three emission scenarios have been generated, one scenario for each of the industry sectors. In the iron and steel and cement industries, retired production capacity is replaced with new production capacity in line with the dominating technological designs albeit with improved performances in terms energy efficiency and CO_2 intensity (i.e. technological options that deviate from the existing processes have not been considered). In the refining industry possible new investments are assumed to be directed towards desulfurization units or advanced conversion units, no new

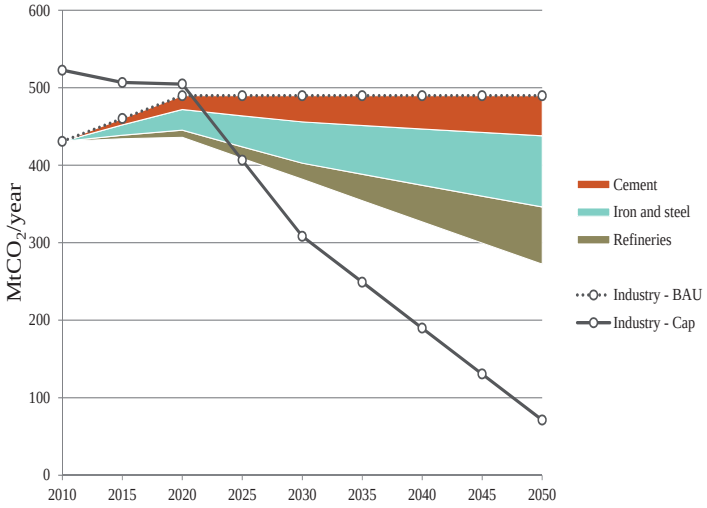
investments in primary refining capacity takes place. Table 1 summarizes key drivers and estimated annual CO_2 emissions in each sector.

Table 1. *Emission scenarios and key drivers, by sector (EU27 and Norway).*

		2010	2020	2050
Petroleum refining	**Internal energy demand** (% of total transformation output)	7,1	7,2	7,5
	Total transformation output (Mtoe/year)	682	625	289
	Total CO_2 emissions ($MtCO_2$/year)	142	133	68
Iron and steel production	**Production structure** (Mt steel/year)			
	Primary steel (BF/BOF), of which - Existing capacity (%) - New capacity (%)	100 100 0	108 61 39	77 5 95
	Secondary steel (EAF) , of which - Existing capacity (%) - New capacity (%)	72 100 0	92 97 3	123 52 48
	Total CO_2 emissions ($MtCO_2$/year)	161	161	96
Cement production	**Total cement production** (Mt cement/year), of which - Existing capacity (%) - New capacity (%)	190 100 0	240 64 36	240 6 94
	Average thermal energy consumption (MJ/t cement)	3770	3492	3093
	Clinker to cement ratio (%)	75	71	60
	Total CO_2 emissions ($MtCO_2$/year)	127	142	108

Industry sector would fail to comply with reduction targets

The estimated aggregate CO_2 emission reduction potential, over the period 2010-2050, amounts to approximately 160 $MtCO_2$/year, corresponding to a 40% reduction. However, despite the extensive measures assumed to be implemented, the results indicate that the industry sectors would fail to comply with the long-term reduction targets. The chart below shows the estimated abatement potential in the industry sector relative an aggregate business as usual scenario (i.e. frozen technology and fuel mix).



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