Roadmap for Norwegian Process Industries - combining growth and zero emissions by 2050
2050

Global
- Population: 9 billion
- Higher consumption
- Higher demand for energy
- Scarce resources
- Technological breakthroughs

National
- Access to renewable energy
- Stable economic and political framework conditions
- Norway an attractive host nation
- Authorities support industries’ efforts to develop new technology and new products

Cap: 2°C innen 2050
Carbon negative by 2100

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Carbon negative by 2100
Process- and product development

- BALI – biochemical and bioethanol
- Aluminium in transport
- Systemized circular economy
- Energy efficiency Karmøy
- Waste-to-Value
- Quartz for climate-friendly technologies
- CCS Norcem
- CCS Yara
- Bioethanol production
- Hydrogen as reductor
- Microfibrillar cellulose
- New aluminium products
- Lignin in concrete
- Biocarbon in ferro-alloys
- Cement with flyash
- New copper-based electrolysis technology
- Silicone, heat, power and salmon in Finnfjord
Two alternative pathways:

ALT.1
Stricter climate regulations push some Norwegian industries out of market. Norwegian phase-outs replaced by new industry in areas with lax climate regulation.

ALT.2
Norway fortifies its position through investments in new climate technology, new processes and new products. Higher value-added and zero emissions.
Technologies exist

- Biomass
- CCS
- H₂ and biogas
- Future technologies
Emissions and emission reductions by technology

Reference case: Emissions w/o reduction efforts

2050: Other techs incl. hydrogen etc 4 mill. tonnes CO₂
2050: CCS 5.5 mill. tonnes CO₂
2050: Biomass raw materials 3.1 mill. tonnes CO₂
2050: BioCCS 3.7 mill. tonnes CO₂
2050: Emissions -1.2 mill. tonnes CO₂
The Roadmap