New Energy Outlook Industry

BloombergNEF

Executive summary

Industrial production makes up roughly 20% of global CO_2 emissions today. By 2050, the sector will need to be abating more than seven billion tons of CO_2 per year to reach net-zero. This will require emerging economies to build clean industrial capacity from now on. Developed economies face a choice of retiring or retrofitting polluting capacity.

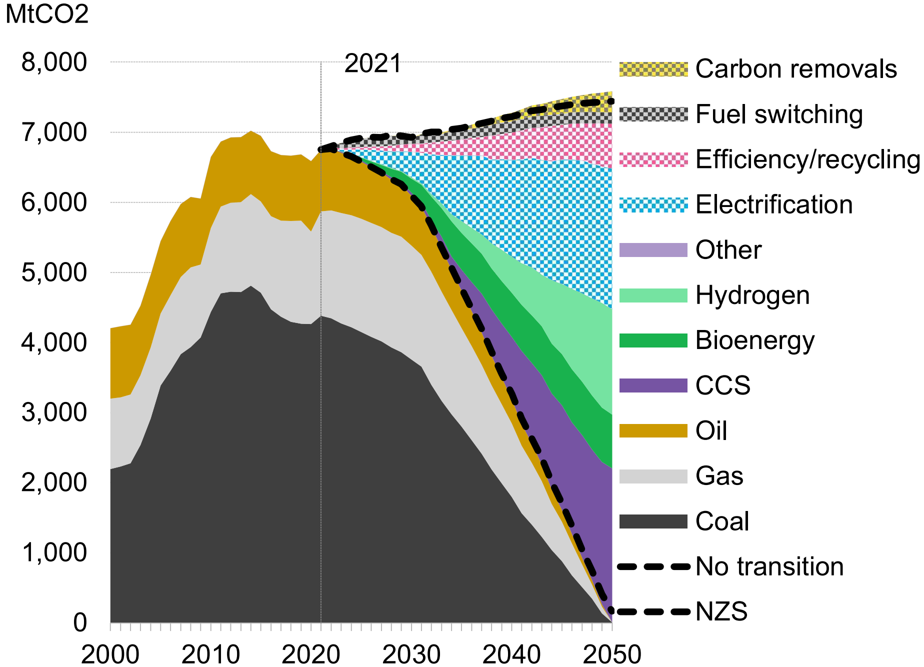
- In BNEF's Economic Transition Scenario, there is almost no emissions abatement from industry. Most materials will require policy support, a green premium, or a technology breakthrough to decarbonize. A net-zero industrial sector needs a contribution from every solution. By 2050, carbon capture and storage (CCS) is providing 29% of industrial emissions abatement, electrification delivers 26%, hydrogen 20%, bioenergy 10% and recycling 8%. Deployment must begin immediately for available technologies.
- **Steel:** Existing coal-fired furnaces are replaced by cheaper direct reduction and electric furnaces. Natural gas is initially used to fuel them, switching to green hydrogen in the late 2030s and 2040s.
- **Aluminum:** Power sector decarbonization does most of the sector's work for it. Furnaces used for recycling and alumina refining must choose the cheapest of electrification, CCS, bioenergy and hydrogen.
- **Petchems:** CCS and electrification deliver most of the emissions reductions, but at a very high cost. Achieving net-zero could double production costs. Demand for petchems grows faster than in any other major materials industry.
- **Cement:** Significant direct chemical emissions mean carbon capture is the primary decarbonization route. The large base of existing furnaces are retrofitted to burn green hydrogen or biomass, or rebuilt to run on electricity.
- **Countries:** In the US, recent climate policy has given industrial decarbonization a boost. Expertise in hydrogen and carbon capture, combined with a mostly electrified steel sector mean the pieces are in place for net-zero. China is the most important market for change. The country has not chosen a path yet, but may give preference to hydrogen given its existing domestic expertise and supply chains. India will see greater growth in industrial production than any other country. To reach net-zero it must build clean capacity from the start. In Europe, production of most materials falls, despite efforts to save it through carbon tariffs. However, the region is a crucible for net-zero technology innovation that is exported globally.
- The charts on slides 13 and 14 were corrected on April 11, 2023 to show the correct units for carbon intensity.

7,642 MtCO2 Total abatement needed from industry in 2050 to reach net-zero

29% Share of emissions abatement in industry from CCS – the largest technology contributor

2x Increase in petrochemicals production globally by 2050

CO2 abatement in industry, by technology



Source: BloombergNEF. Notes: NZS = net zero scenario; CCS = carbon capture and storage. MtCO2 is million tons of CO2.

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Key messages

Timelines matter. Focusing solely on net-zero emissions in 2050, and ignoring near-term, but partial, emissions reductions, risks missing warming targets. In a change to BNEF's previous modelling, these scenarios build the capacity needed to meet yearly emissions targets for less than two degrees of warming. As a result, this year's Net Zero Scenario (NZS) uses much less hydrogen, and much more carbon capture. The carbon capture supply chain is better developed and offers cheaper emissions reductions until hydrogen costs start to drop dramatically in the late 2030s.

The hydrogen era is coming. Even under an economic transition scenario, there is some hydrogen use in industry. It is limited to steel production in Europe, where replacement cycles and falling hydrogen costs line up in the late 2040s to generate some new-build capacity using hydrogen. However, given the industry's potential to scale faster by taking advantage of generous policy incentives in the US, we expect to see more hydrogen creeping into the ETS.

Industry decarbonization in the US and Europe will not make a serious dent in emissions reductions, but it will lower the cost of enabling technologies and lay out a roadmap for developing economies. For this reason, it is incredibly important. However, in absolute terms, China matters the most. It must abate 1,679 MtCO2 from industry by 2050. For the US, this number is 492 MtCO2, for Europe it is 300 MtCO2. Only India comes close to China, needing to abate 1,513 MtCO2.

Direct air capture and carbon removal are necessary for decarbonization. The world's industrial sector is past the point where it could rely purely on abatement to limit warming to less than two degrees and reach net-zero. Direct air capture and other engineered removals are needed for fugitive emissions from chemical processes and to mop up the emissions that 90% effective carbon capture systems miss. That said, they can be used sparingly. The NZS has only 815 MtCO2 of carbon removal in place by 2050.

The Inflation Reduction Act will change these calculations. The US climate bill approved a large increase in the country's carbon capture credits and set up generous subsidies for hydrogen. This pushes industrial applications within reach for the two decarbonization technologies.

New supply chain priorities could upend today's material flows. Materials producers could soon be looking for very different resources when choosing a location for new capacity. Petrochemicals production has been chasing cheap natural gas for ethane crackers, but rising prices and new electric crackers could have chemicals companies searching for firm clean power instead. Integrated steelmaking could fracture, with iron being produced in regions with high quality ore and low-cost hydrogen production before being shipped closer to end users for conversion to steel.

Companies do not always choose the cheapest solution. These outlooks are based on least-cost models. Producers have many other considerations, such as volume of production, supply-chain maturity and location of demand that could take priority instead.

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Our expert coverage assesses pathways for the power, transport, industry, buildings and agriculture sectors to adapt to the energy transition.

We help commodity trading, corporate strategy, finance and policy professionals navigate change and generate opportunities.

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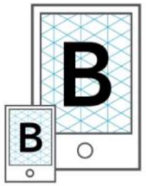

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