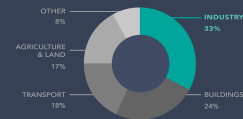


DECARBONIZING GLOBAL INDUSTRY

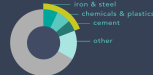
INDUSTRY IS RESPONSIBLE FOR 1/3 OF GLOBAL GREENHOUSE GAS EMISSIONS



The top 10 industries account for 90% of global industry emissions

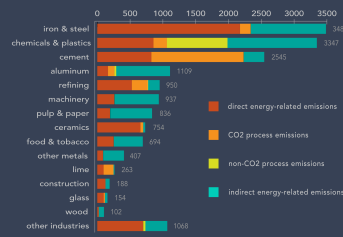


The top 3 industries account for over 55% of global industry emissions



Each sector's wedge includes emissions associated with electricity and heat purchased by that sector.

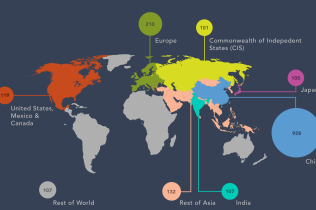
GLOBAL GREENHOUSE GAS EMISSIONS BY INDUSTRY* IN 2014



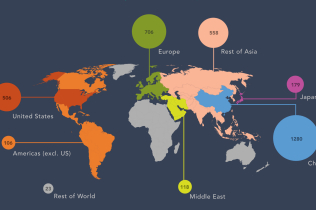
* "Industry" is defined as including all manufacturing activities, petroleum refining, and construction. It does not include extraction of raw materials (e.g. mining, drilling, forestry), agriculture, waste management (waste treatment, landfill), nor fugitive emissions. Nor does it include emissions from transporting input materials or output products (as those are part of the "transportation" sector).

WHERE PRODUCTION OCCURS

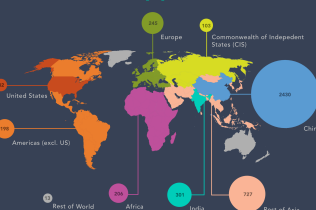
WORLD STEEL PRODUCTION IN 2018 (Mt)



WORLD CHEMICAL PRODUCTION IN 2017 (Billion €)



WORLD CEMENT PRODUCTION IN 2014 (Mt)



THERE ARE 3 MAIN STRATEGIES TO REDUCE INDUSTRY EMISSIONS

1 REDUCE MATERIAL CONSUMPTION

USE MATERIALS EFFICIENTLY

Computer-aided design and precision application creates products that work at least as well as traditional products while consuming less material.



3D printing can create complex parts with less material. Additive manufacturing techniques can be used to create parts that are lighter and stronger.

DESIGN FOR LONGEVITY & QUALITY

When products and buildings need to be replaced less often, less new material needs to be created.



Concrete buildings in China typically have a lifespan of 50 years. Some buildings are designed to last for 100 years or more. The average building built in 1950 is still standing today.

MAKE BETTER USE OF EXISTING PRODUCTS

When the use of existing products is maximized, more people get the services they demand and less products are needed overall.



The average car in the United States is used for 12 years and travels 120,000 miles. For every 1.4 people in a city, one car is needed. The average car can be used for 15 years or more.

REPLACE WITH LOW-CARBON MATERIALS

Some sustainable industrial materials already exist, and even more are in development.



New technologies, such as those based on carbon capture and storage (CCS), can help reduce emissions from existing buildings.

2 REDUCE INDUSTRY ENERGY CONSUMPTION & SHIFT TO CLEAN ENERGY



Design industrial systems as an integrated whole by optimizing materials and energy flows between components and right-sizing equipment to suit the loads.



transition to zero-carbon electricity



use hydrogen produced from zero-carbon electricity for difficult-to-electrify processes

3 IMPROVE THE TOP-EMITTING INDUSTRIES

IRON & STEEL

Industry-specific technology emissions-reducing that can be used



electric arc furnaces can recycle scrap metal into new steel



CEMENT



efficient equipment with heat recovery and mineral additives can lower temperatures required for making cement



CHEMICALS



novel catalysts lower temperature requirements for chemical reactions



carbon capture and storage (CCS)

hydrogen fuel

chemical additives

POLICIES

THE MOST IMPORTANT POLICIES TO HELP ACCELERATE THE TRANSITION TO ZERO-CARBON ENERGY



CARBON PRICING
that covers all industrial greenhouse gas emissions



R & D
for national labs, public-private partnerships, and financial incentives for corporate R&D



STANDARDS
for energy efficiency and emissions for industry

OTHER HELPFUL POLICIES



material-efficient building codes



emissions data collection & disclosure requirements



labeling low-carbon materials



government green procurement programs

BROUGHT TO YOU BY:

This graphic summarizes "Technologies and Policies to Decarbonize Global Industry: Review and Assessment of Mitigation Drivers Through 2070" by Rissman et al., published in Applied Energy (2020).



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