

Clean And Competitive: Opportunities For U.S. Manufacturing Leadership In The Global Low-carbon Economy

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Our Bottom Line

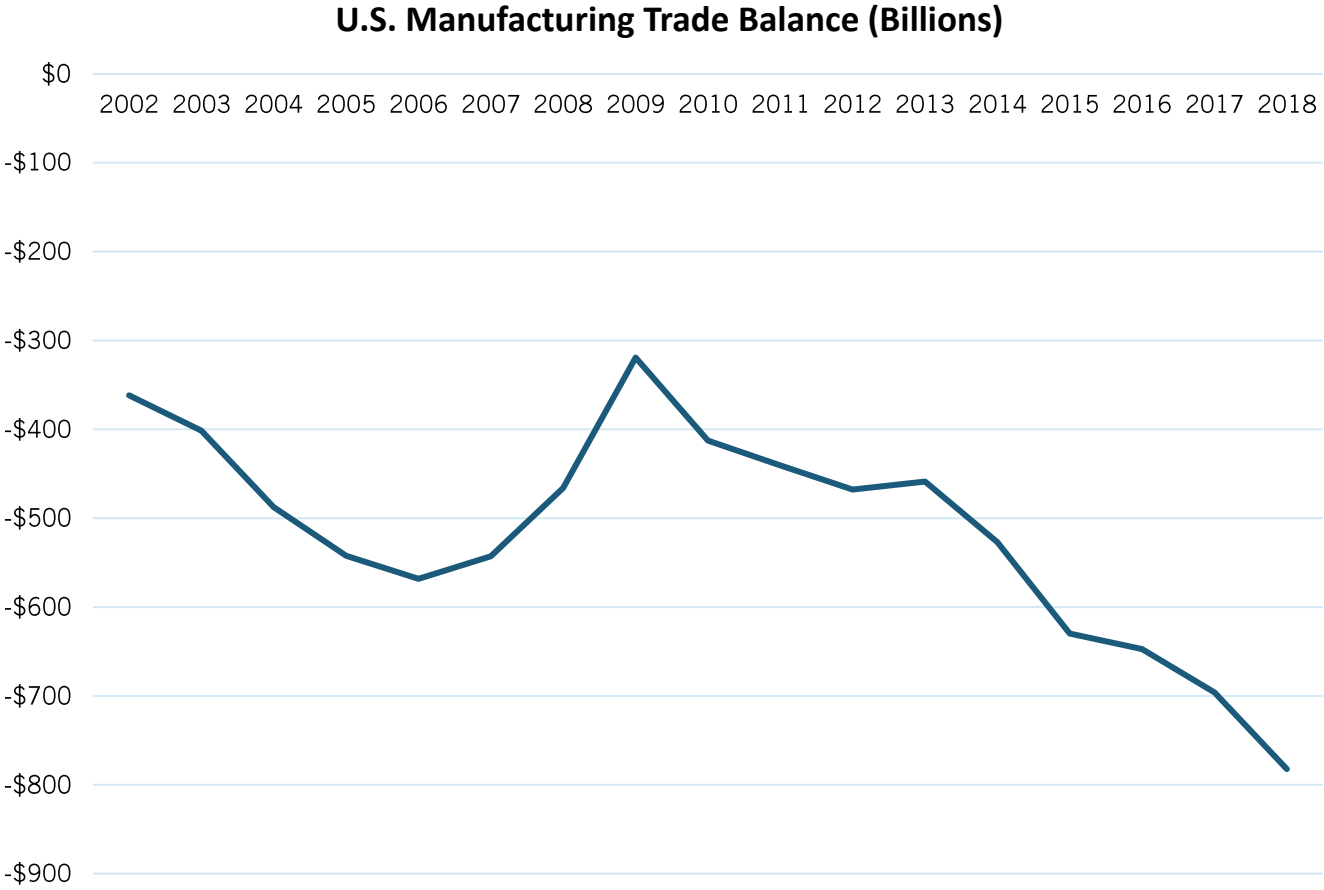
The United States should respond to the **twin challenges** of rebuilding a vibrant, inclusive economy that includes a strong manufacturing sector and accelerating progress toward net-zero emissions

by adopting an **integrated strategy** that features policies that **target specific industries** that have a high potential for **both emissions reduction and high-quality job growth**.



Manufacturing Matters for...

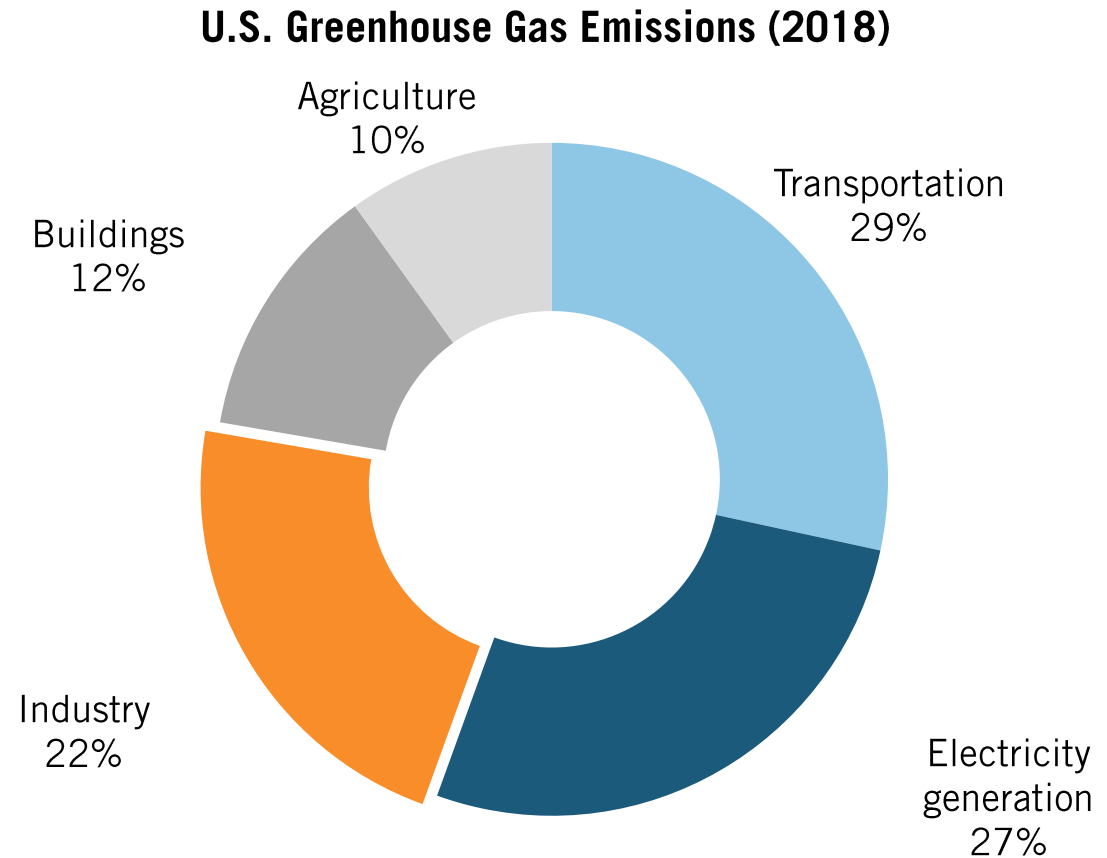
- Resilience
- Equity
- Innovation
- Competitiveness
- National security
- And...



Source: U.S. Census Bureau, Exports & Imports by NAICS Commodities

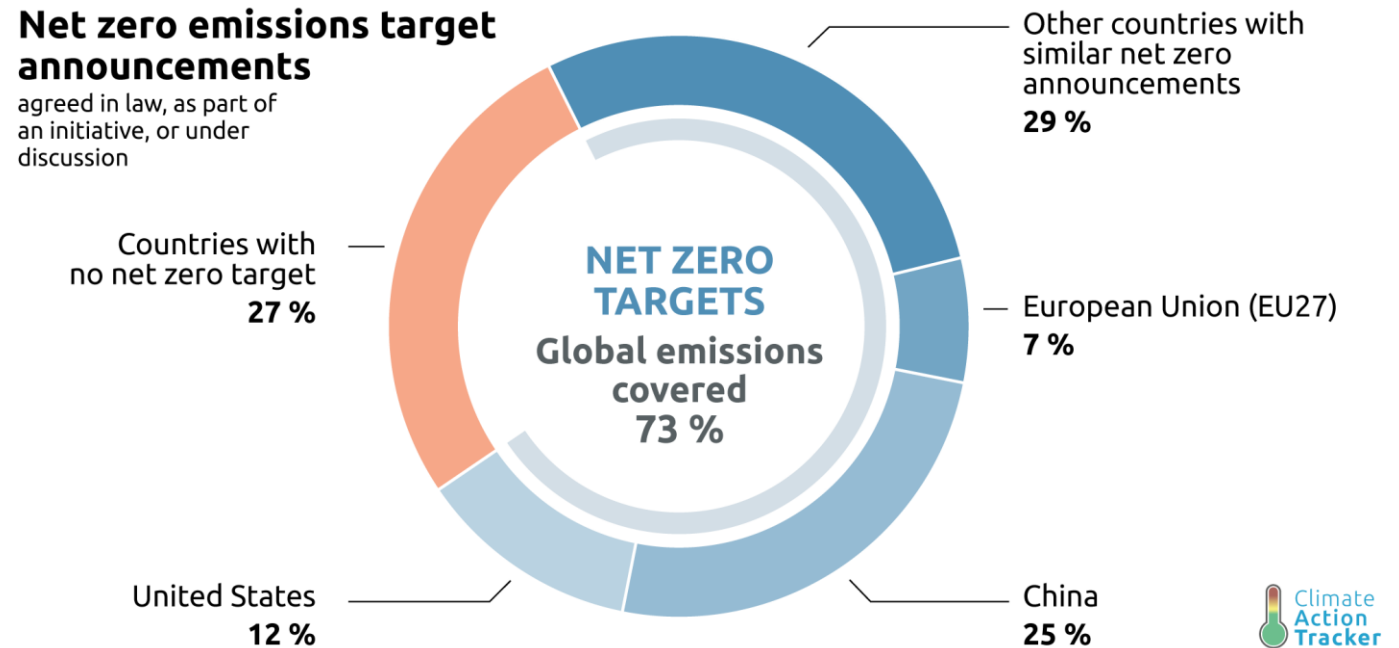
And...Climate

- Causes over 30% of GHG emissions (direct and indirect, US and global)
- Required for new low-carbon and negative emissions technologies
- Could displace emissions from other sectors (e.g. agriculture)



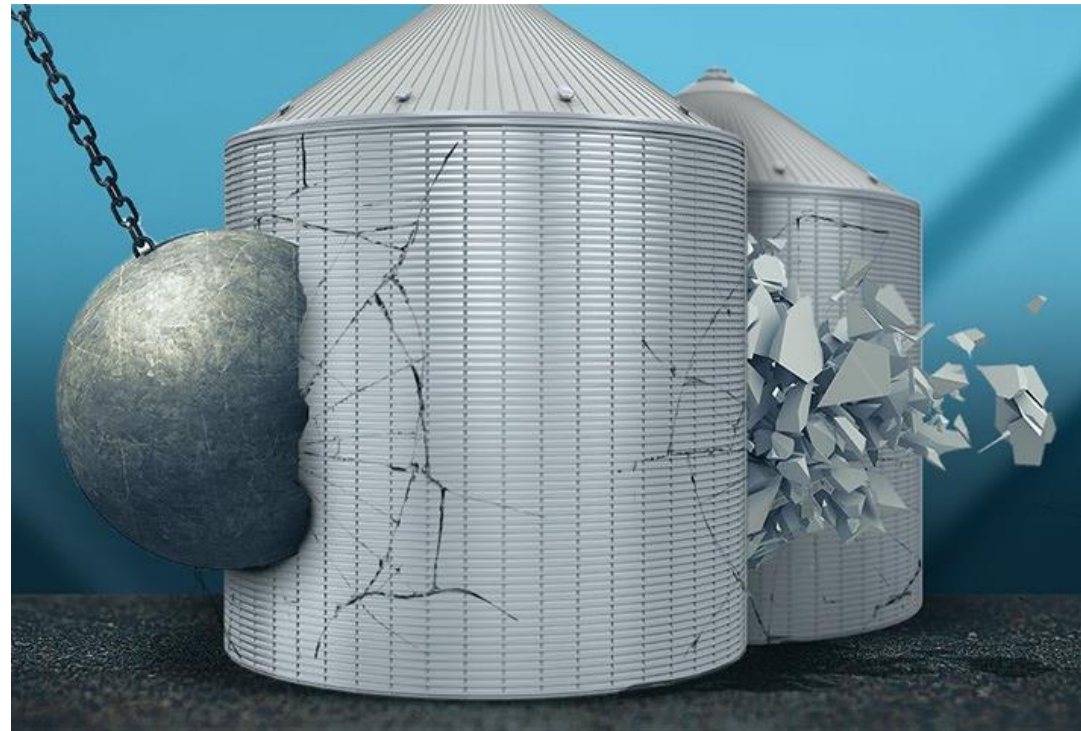
The Opportunity

- Global retooling toward clean manufacturing
- History lesson: Transformations can radically alter international competitive positions



An Integrated Clean Manufacturing Strategy

- Leverage U.S. strength in science and technology
- Target industries and technologies in which domestic producers are most likely to succeed against international competitors
- Act forcefully via R&D, demonstration, and early deployment policies



“Until very recently, these two national challenges have been treated largely within their own policy silos.”

Preliminary Screening Questions

- Drawn from Atkinson (2021):
 - Can the industry contribute to national goals?
 - Can it leverage existing strengths?
 - Would federal policy strengthen industry performance?
 - Is industry willing and would it share costs?
- Plus: has it been overlooked?



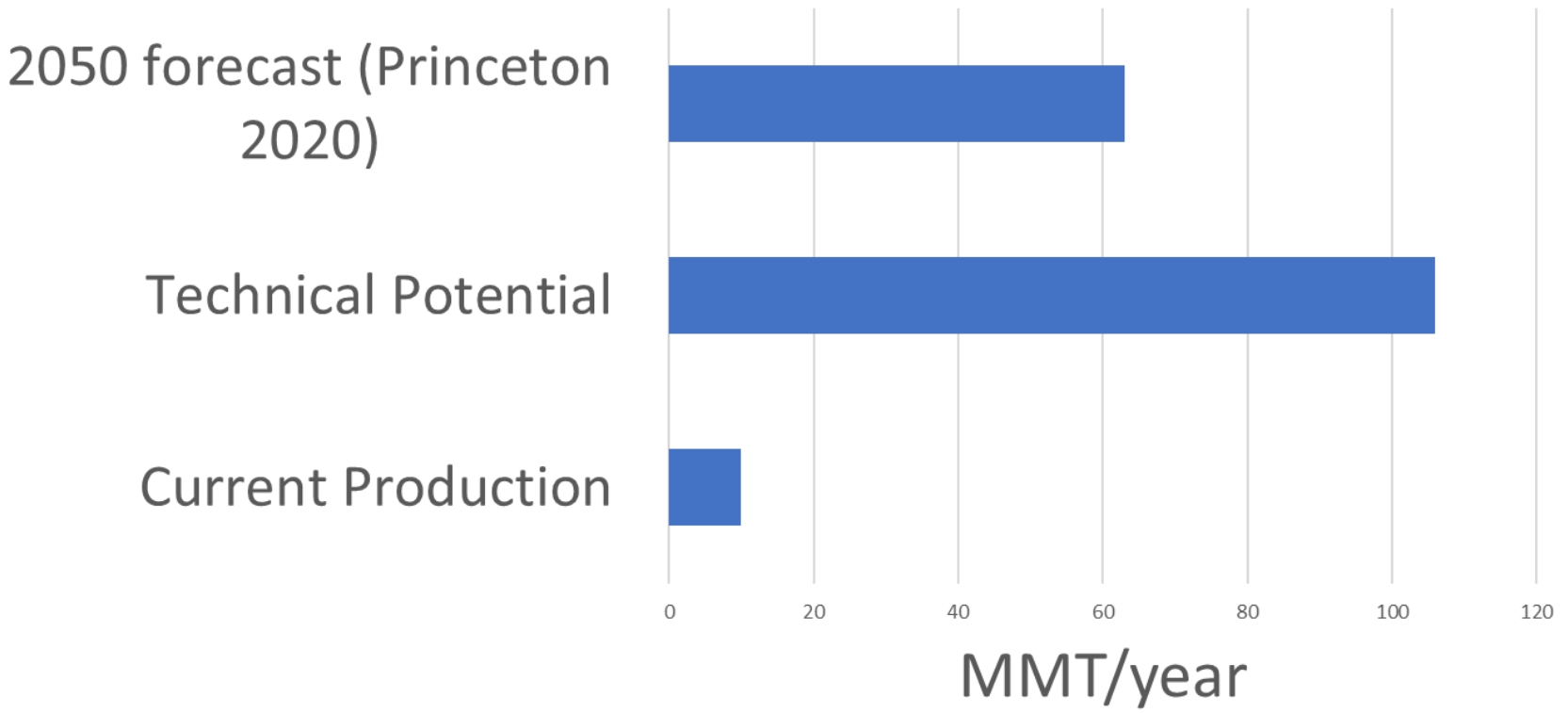
Four Opportunities

- A joint research team from ITIF, Boston University, and Fraunhofer USA conducted interviews and expert workshops.
- We identified four opportunities to strengthen U.S. competitive advantage that have largely been overlooked:
 - Hydrogen production
 - Heating, cooling, and drying equipment
 - Chemicals production and recycling
 - Biotech-based alternatives to meat and dairy products

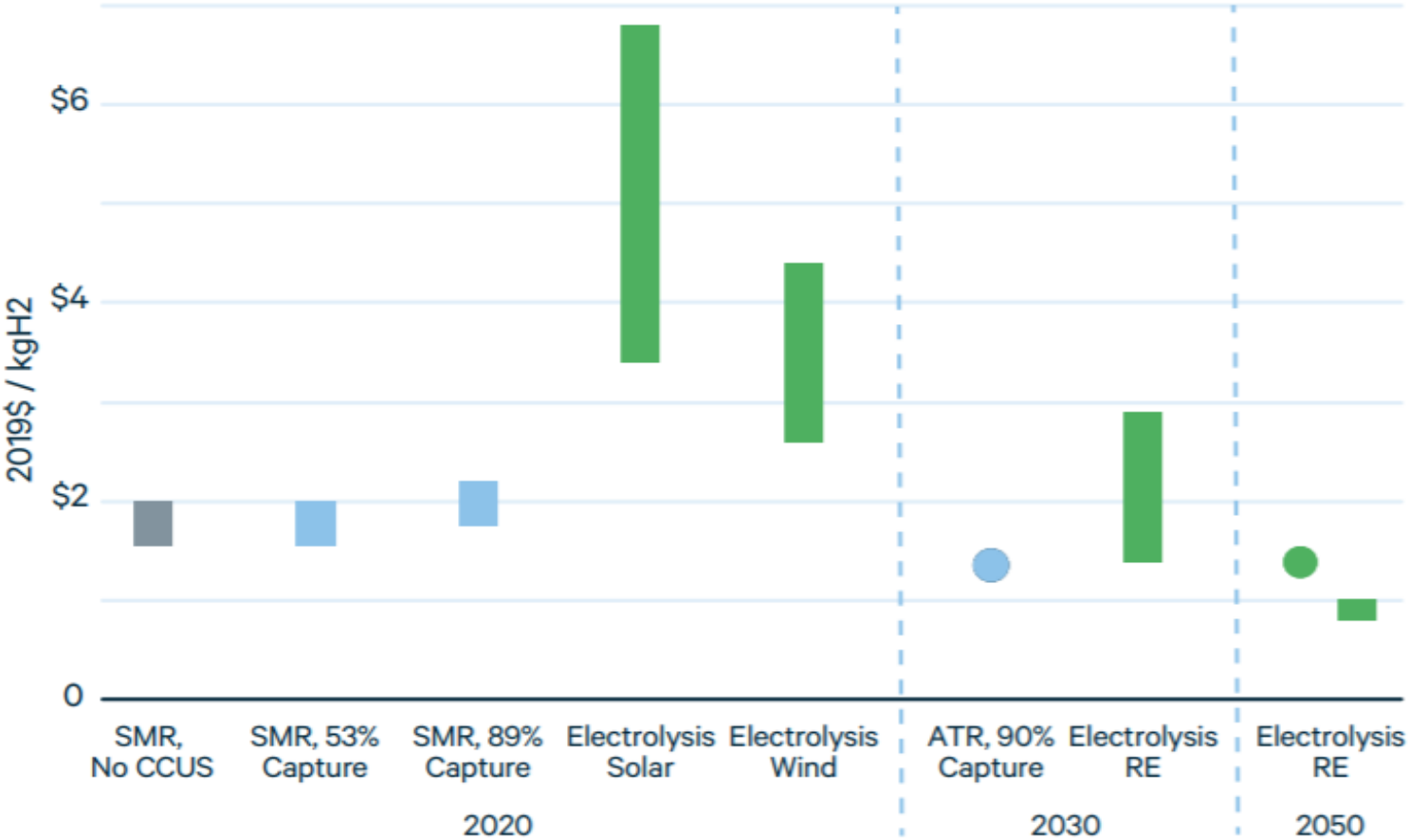


Hydrogen Production: The Opportunity

US Hydrogen Production

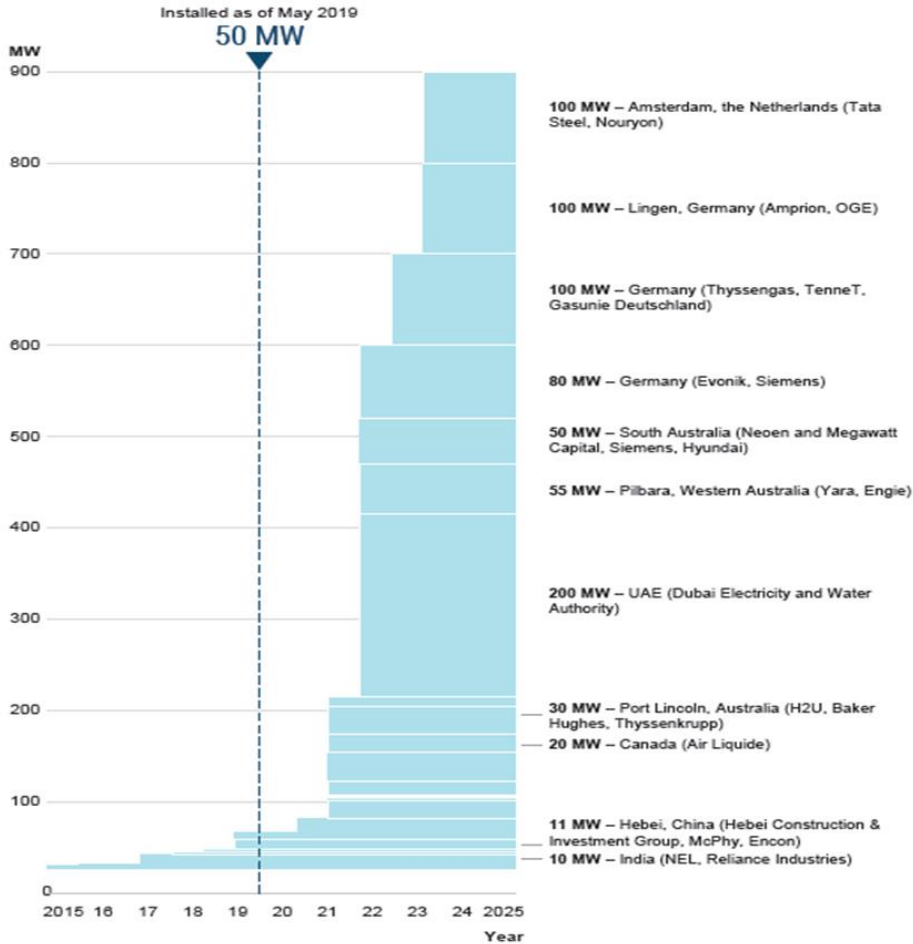


Hydrogen Production: Technical Potential



Hydrogen Production: Global Positioning

- European Union: 40 GW of green hydrogen electrolyzers by 2030
- Australia: world's largest green ammonia plant

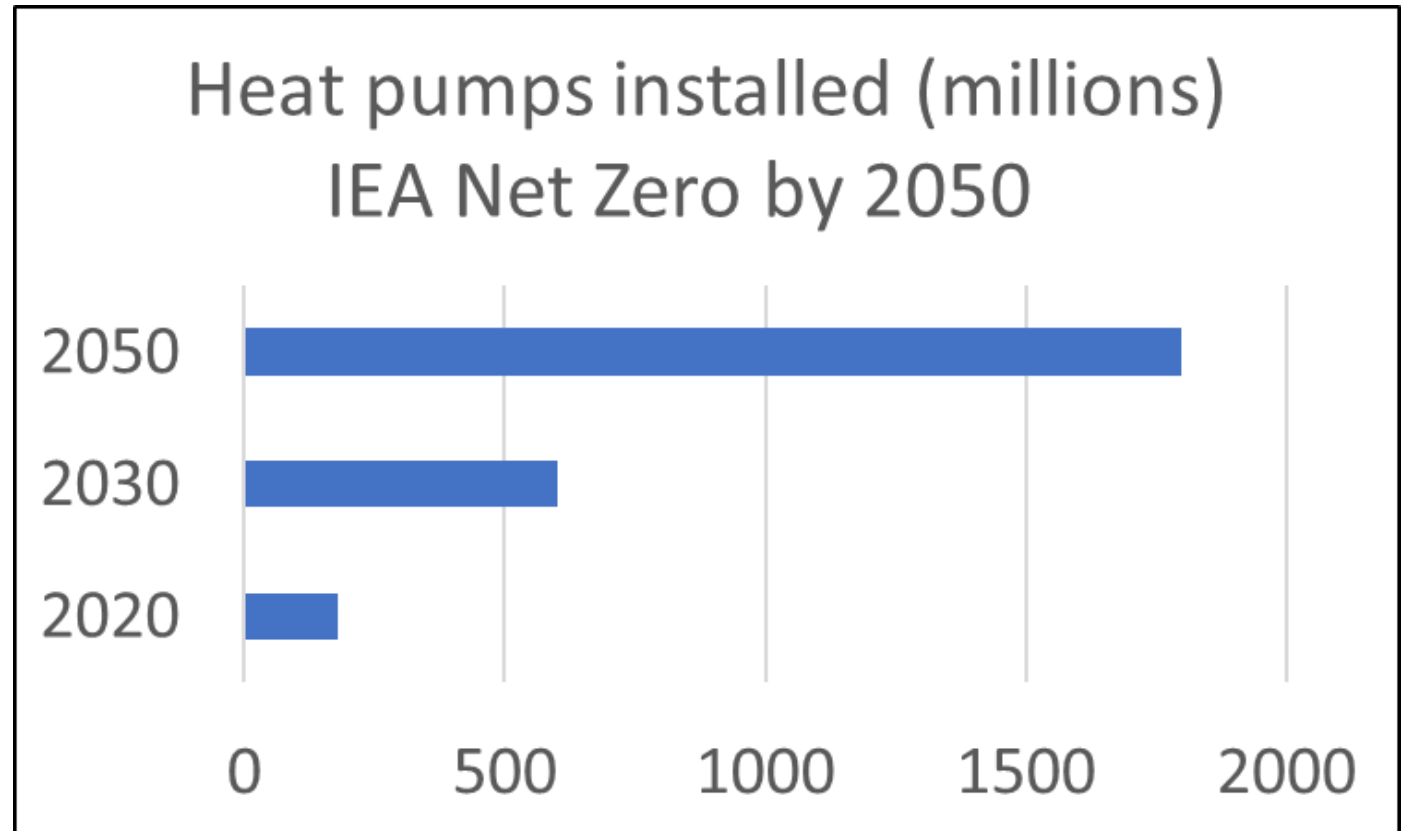


Hydrogen Production: Policy Imperatives

- Moonshot goal of \$1/kg goal for hydrogen production
- R&D for industrial applications, heavy-duty transportation
- Manufacturing USA institute on electrolyzer manufacturing
- Pilot and commercial scale demonstration
- DOD & GSA purchasing
- Standards & safety

Heating, Cooling, and Drying: The Opportunity

- Electrification of buildings means replacing fossil appliances & many industrial processes
- Potential for enormous growth in demand



Heating, Cooling, and Drying: Technical Potential

- Theoretical efficiency of heat pumps ~3x typical performance
- Many promising paths to efficiency gains:
 - Novel refrigerants
 - Solid state refrigerants
 - Geothermal, including community systems
 - Membranes and mechanical drying

Heating, Cooling, and Drying: Global Positioning

- Weak incentives for U.S. manufacturing research
- European roadmap goal: 36 heat pump megafactories by 2030
- Japan world leader in heat pumps

Heating, Cooling, and Drying: Policy Imperatives

- Integrated RD&D roadmap with adequate funding
- Loans and other incentives for advanced heat pump manufacturing
- Standards based on performance of integrated systems (including grid integration)
- Building retrofits include electrification
- Include advanced heat pumps in federal retrofits

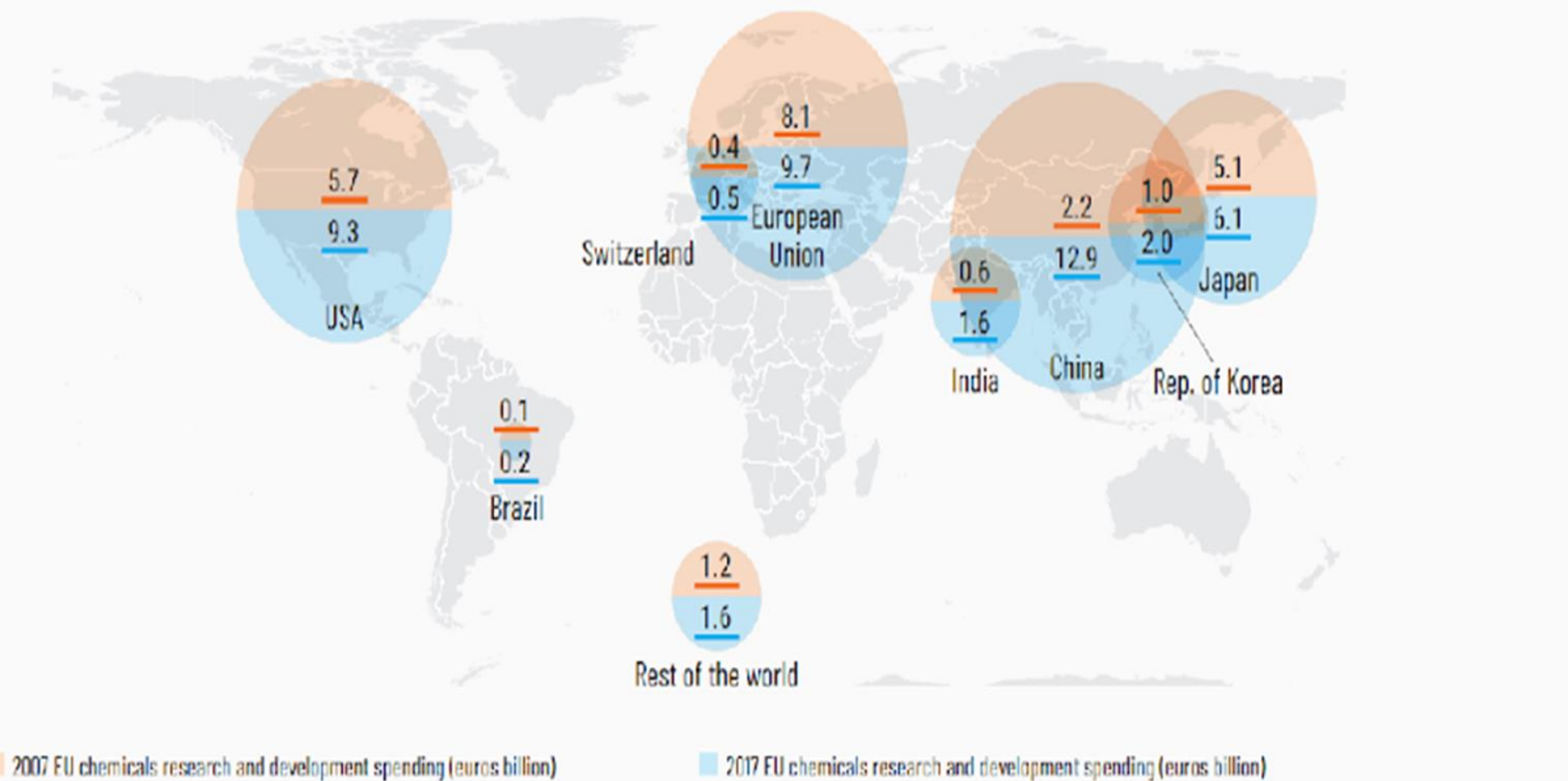
Chemical Production and Recycling: The Opportunity

- 18% of GHG emissions from industry
- Major U.S. employer
- Disruptions expected in fuels for electric generation and transportation: 2/3 of U.S. oil and gas market
- Rapid growth in demand for plastics and other chemical products

Chemical Production and Recycling: Technical Potential

- Chemical manufacturing now uses fossil fuels for processing and as a feedstock
- Technical opportunities include products:
 - designed for recycling
 - produced from biological materials
 - produced directly with artificial photosynthesis

Chemical Production and Recycling: Global Positioning

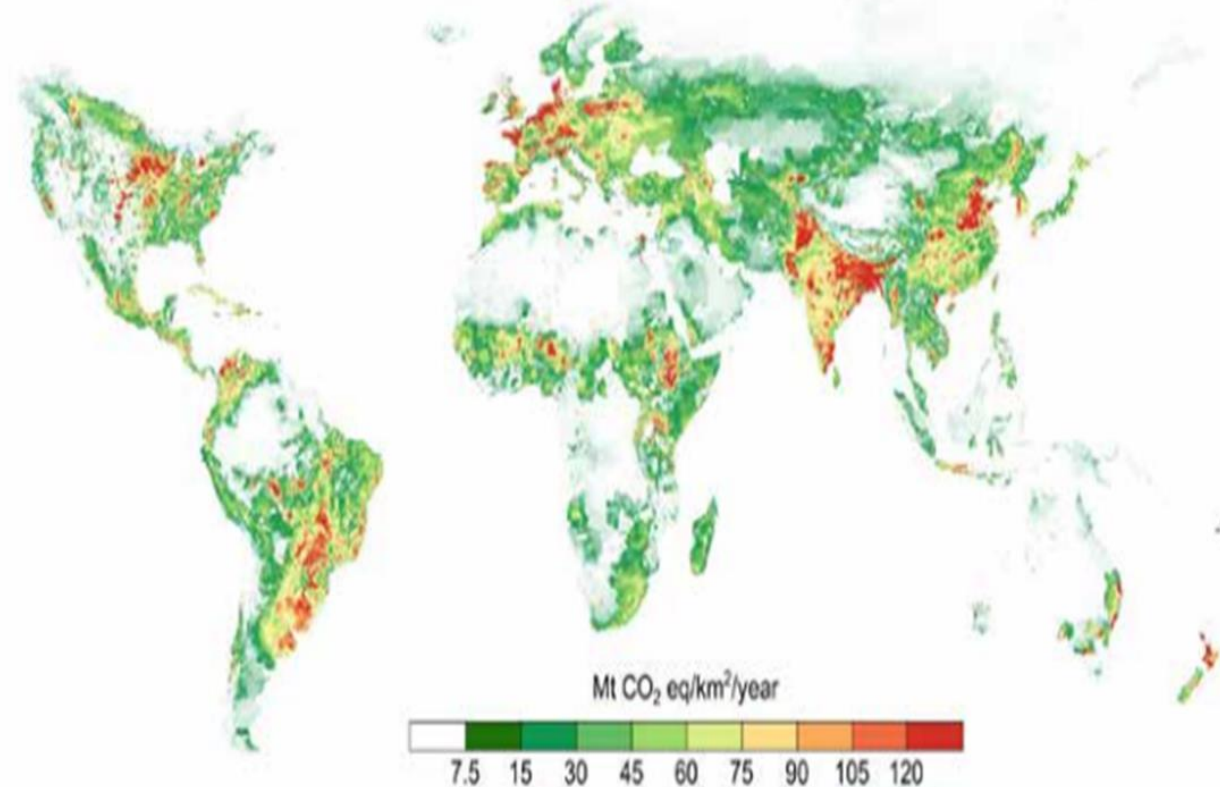


Chemical Production and Recycling: Policy Imperatives

- Integrated RD&D roadmap backed by adequate funding
- Strong interagency management drawing on DOE, USDA, DOD, NSF
- Expanded use of USDA rural economic development programs including BioPreferred
- Labeling to show climate impact of products
- DOD and other public procurement

Biotech-based Meat and Dairy Products: The Opportunity

- 12% or more of global GHGs
- Meat, poultry, and dairy industries employ more than half a million people in the U.S.



Biotech-based Meat and Dairy Products : Technical Potential

- Rapid decline in the cost of gene sequencing and synthesis
- Fermentation using new technologies produce virtually any chemical product
- Cell cultivation to produce meat substitutes less developed but attracting major investment
- Cost reduction is a major challenge, one study expects price parity in early 2030s

Biotech-based Meat and Dairy Products : Global Positioning

- U.S. leads global biotechnology revolution
- Major venture funding available in U.S. (half of new fermentation companies)
- Comparatively high U.S. consumer acceptance
- Worldwide competition growing in Europe and Asia
- Large testing facilities available in Europe

Biotech-based Meat and Dairy Products: Policy Imperatives

- Research focused on feedstocks, production systems, and scale-up
- Fund authorized Agriculture Advanced R&D Authority
- Public funding for large testing facilities
- Modernize FDA oversight of cultivated meat
- Review incentives so that innovative and traditional meat and dairy producers can compete fairly
- Ensure equal treatment of innovative proteins in federal food procurement and nutrition support

More Information

- [“Clean and Competitive” report](#)
- [“Clean and Competitive” webinar](#)
- [“Widening the Lens” workshops](#)
- [ITIF Clean Energy Innovation Policy Program](#)
- [Boston University Institute for Sustainable Energy](#)
- [Fraunhofer USA Center for Manufacturing Innovation](#)
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