



Integrated Emissions Reduction Planning includes Carbon Capture Options



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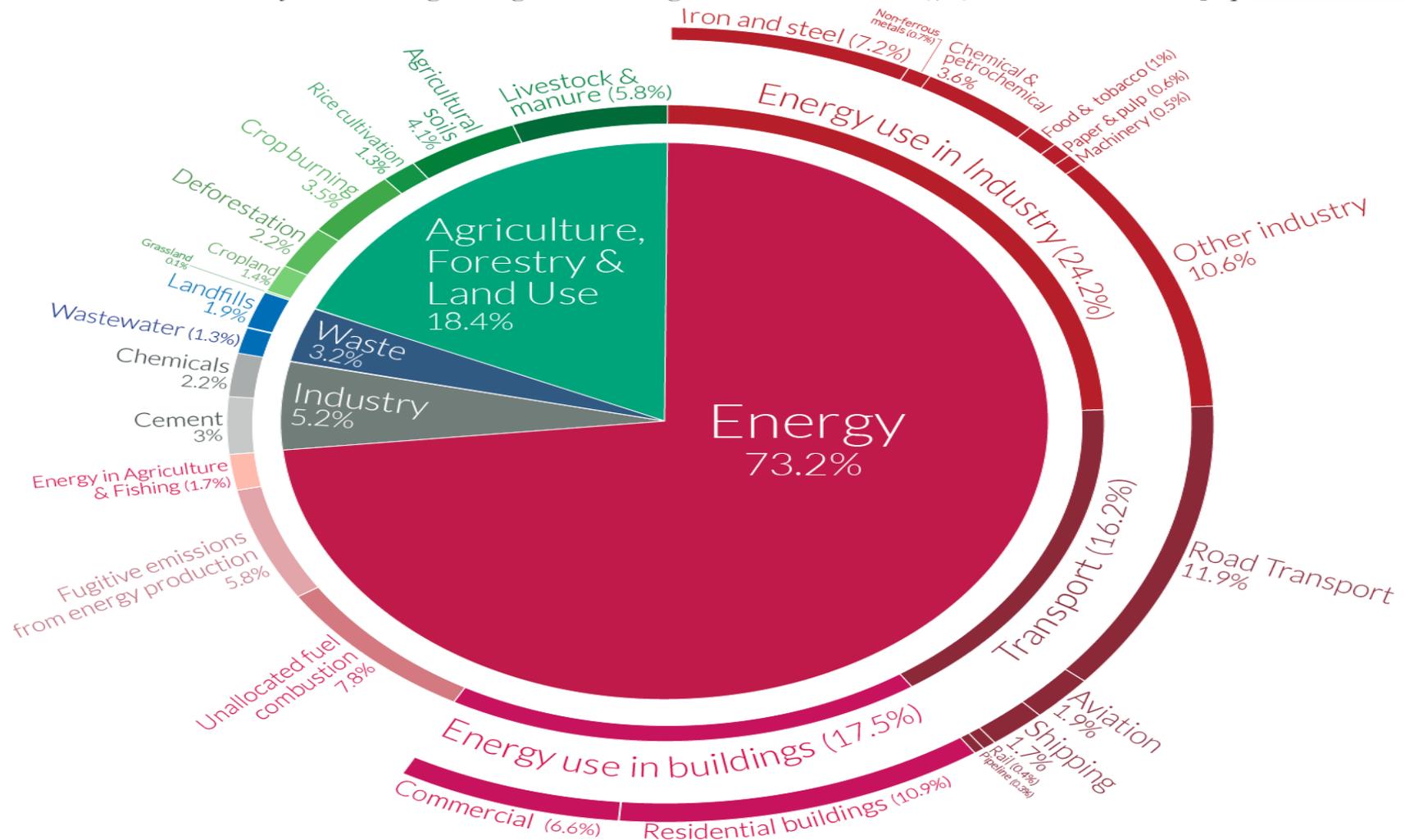
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The Nature of the Challenge

Global greenhouse gas emissions by sector

Our World in Data

This is shown for the year 2016 – global greenhouse gas emissions were 49.4 billion tonnes CO₂eq.



Challenges to be overcome to minimize cost

- Not just the energy sector – includes all areas of a jurisdiction’s economy
 - waste, forestry, agriculture, manufacturing, trade
- Not just reducing emissions – includes other environmental, economic and social
 - Industrial policy, trade balances, security, employment, social justice
- Not just one jurisdiction – includes overlapping jurisdictions within a nation (federal systems) and international relations
 - Political alliances, trade agreements, government or market driven economic activities
- Government involvement in the market will be unprecedented

- Fragmentation by discipline
 - Energy, industry, agriculture, waste
 - Supply or demand, production or consumption
- Fragmentation by jurisdiction
 - Intranational, international, Paris Agreement focus
 - Limited inter-jurisdictional agreements
- Simplistic solutions for complex problems
- Lack of comprehensive consideration of sectors of the economy facing the negative impacts

Least-Cost Planning or Integrated Planning

Moving past the debate about needing to reduce emissions to a focus on reducing emissions at the lowest cost. Build up the integrated plan via nested steps

1. **Cost of options** along the supply and demand for energy
 - Low emissions energy sources – fuel switching
 - Energy efficiency in systems with significant average CO₂ emissions
 - Carbon Capture Utilization and
2. **Add in:** cost of options in other areas including industry, agriculture, forestry, and land use
 - Process efficiency options
 - Resource and product efficiency (e.g. reducing food waste)
3. **Add in:** how options in other jurisdictions may be cheaper than the home jurisdiction
4. **Then:** what levers need to be used to realize implementation
 - Government policies and taxes
 - Market mechanisms
 - International agreements

- Emissions Reduction Costs \$/tonne CO₂e
 - CCUS - \$50 to \$200 (does not yet include the revenues from a working carbon utilization market)
 - Electrification - \$100 to \$150
 - Methane capture - \$negative to \$50
 - Energy Efficiency - \$negative to \$75
 - Improved Agriculture, Industry, Forestry, land use, waste management processes - ????
- What could be the other economic benefits?
 - Reduced transaction costs (\$, jobs)
 - Match investment to the local jurisdiction
 - Avoid sunk costs and unnecessary reinvestment

THANK YOU

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