

Using materials efficiently can substantially cut greenhouse gas emissions

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How much can society gain by cutting consumption of materials—via smarter use, using less, or recycling materials? A new report from the International Resource Panel for the United Nations Environmental Program (UNEP) says the gains are substantial and can be key to enabling countries to meet their emissions targets.

The International Resource Panel (IRP) Report, *Resource Efficiency and Climate Change: Material Efficiency Strategies for a Low-Carbon Future* is the first comprehensive scientific analysis of potential GHG

emission savings from material efficiency. The report, for which Edgar Hertwich, International Chair in Industrial Ecology at the Norwegian University of Science and Technology was a lead author, focused on two carbon-intensive sectors: [residential buildings](#) and passenger vehicles.

"Materials are ignored by [climate policy](#), yet emissions from the production of materials production have grown fast!" says Hertwich. "If you are concerned about eating meat or flying on airplanes because of your carbon footprint, you should also be even more worried about cement and steel."

The researchers found that 80% of emissions from the production of materials come from the construction and manufacturing sectors, in particular from our homes and cars.

Applying material efficiency strategies can reduce GHG emissions from the life-cycle of construction, operation, and deconstruction of homes by an average of 40% in seven major developed countries—Canada, France, Germany, Italy, Japan, the United Kingdom and the United States (G7 countries) and by 70% in China and India, the researchers found.

It can also reduce GHG emissions from the manufacturing, operations and end-of-life management of cars by 40% in the G7 and by 35% in China and India.

"This report makes it clear that natural resources are vital for our well-being, our housing, our transportation and our food. Their efficient use is central to a future with universal access to sustainable and affordable energy sources, emissions-neutral infrastructure and buildings, zero-emission transport systems, energy-efficient industries and low-waste societies. The strategies highlighted in this report can play a big part in making this future a reality," said Inger Andersen, Executive Director of

the UNEP, in a press release.

The Intergovernmental Panel on Climate Change, the IPCC, has proposed a carbon budget under which the G7 would need to limit their remaining CO₂ emissions to 50 gigatons for global average temperature increases to stay at 1.5°C.

The IRP estimates that 23 gigatons of emissions could be saved in the G7 through material efficiency strategies in 2016-2060. The IRP report found that the most promising strategy comes from the consumption side—which would involve more intensive use.

"We were not sure society could live with less materials. Our study show it can: we can easily reduce the amount of primary materials required for a reasonably comfortable living through a combination of less materialistic lifestyles and smarter technologies," says Hertwich.

For cars, this means ride-sharing, car-sharing and a shift towards smaller vehicle sizes. If one in four journeys in the G7, China or India was a shared ride, then the carbon footprint of the use and production of cars would decline by as much as 20%.

For homes, more intensive use means increasing use rates through, for example, peer-lodging, or smaller and more efficiently designed homes. IRP modeling shows that reducing demand for floor space by up to 20% could lower GHG emissions from the production of materials by up to 73% in 2050.

"Limiting the growth in the size of our homes, and sharing rides and vehicles turned out to be the most effective ways to reduce emissions," says Hertwich.

Other material efficiency strategies to be considered include the

recycling of building materials, less material by design in both cars and homes, and the use of alternative low-carbon materials (for example, sustainably sourced wood instead of reinforced concrete in homes).

"Climate mitigation efforts have traditionally focused on enhancing energy efficiency and accelerating the transition to renewables. While this is still key, this report shows that material efficiency can also deliver big gains," Andersen, UNEP's Executive Director, said.

The cuts revealed by the report are on top of [emission](#) savings generated by the decarbonization of electricity supply, the electrification of home energy use, and the shift towards electric and hybrid vehicles. If the world focuses on energy efficiency without boosting material efficiency, it will be almost impossible and substantially more expensive to meet the Paris climate targets, the report warns.

The report notes that the only way to make many of these kinds of emissions reductions is if countries themselves create enabling policy environments and incentives.

The strongest effect comes from policies that apply across sectors, such as building certification, green public procurement, virgin material taxes, and removal of virgin material subsidies.

The IRP report urges policymakers to consider resource efficiency and materials in the next generation of their Nationally Determined Contributions (NDCs), broadening the scope of targets and increasing the magnitude of the intended mitigation ambition.

Some countries have started doing this, as described in the Resource Efficiency and Climate report. For example, China's NDC specifically mentions a commitment to the efficient use of materials. It includes measures aimed at improving the efficiency and lifespan of existing and

new buildings and promoting recycled construction materials.

Japan's NDC includes a commitment to use blended cement, while India's NDC refers to recycling, "enhanced resources efficiency and pollution control" (in addition to energy efficiency) and the general need to "use natural resources wisely."

"There will be no progress until policy makers turn their attention to this issue," says Hertwich. "Unfortunately, many countries have policies in place that inadvertently increase the use of materials, such as through tax breaks for home ownership. Such policies favor the wealthy and increase material use, so revising them creates a win-win situation."

More information: Hertwich et al., Resource Efficiency and Climate Change: Material Efficiency Strategies for a Low-Carbon Future. A Report of the International Resource Panel. United Nations Environment Program, Nairobi, Kenya. *International Resource Panel* (2020). [DOI: 10.5281/zenodo.3542680](https://doi.org/10.5281/zenodo.3542680)

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