European Commission

Science for Environment Policy

‘Carbon law’ could lead to zero global emissions by 2050

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Source: Rockström, J., Gaffney, O., Rogelj, J., Meinshausen, M., Nakicenovic, N. & Schellnhuber, H.J. (2017). A roadmap for rapid decarbonization. *Science*. 355 (6331): 1269-1271. DOI: 10.1126/science.aah3443.

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Researchers have proposed a global roadmap for decarbonisation over the coming decades. The roadmap is based on the idea of a simple heuristic, described by the researchers as ‘carbon law’, of halving carbon dioxide (CO_2) emissions every decade from 2020 to 2050. The researchers say that, if combined with the development of new technologies and efforts to reduce CO_2 emissions from land use, this target could lead to a carbon-neutral global economy by 2050.

The Paris Agreement is the current international commitment to reduce greenhouse gas (GHG) emissions and aims to limit global warming to below 2 degrees Celsius (°C). However, international commitments are often at odds with national priorities and political realities. In this study, researchers develop a global roadmap, or planning instrument, for decarbonisation over the coming decades, which links short-term targets with long-term goals.

The roadmap is based on a simple heuristic, called ‘carbon law’ by the researchers, of halving human CO_2 emissions every decade. The carbon law, which would apply to all sectors of industry and countries, would need to be accompanied by the development of carbon capture and storage (CCS) technologies and the reduction of CO_2 emissions from land use. The roadmap was developed by reviewing scientific research as well as gathering expert opinion from discussions among The Earth League, a network of scientists and institutions. The researchers focused on four dimensions — innovation, institutions, infrastructure and investment — that qualitatively identifiy crucial steps needed for the transformation to be realised, outlining a number of actions over the periods 2017–2020, 2020–2030, 2030–2040 and 2040–2050.

By 2020: initially the researchers suggest that fossil-fuel emissions must start falling by 2020 through measures such as carbon-tax schemes, feed-in tariffs and quota approaches. For example, fossil-fuel subsidies, currently between US $500 and $600 billion (€406 and €487 billion) per year, should be ended by 2020, as opposed to 2025, as agreed by the G7 (countries with the seven largest advanced economies in the world[1]) in 2016. All major cities and corporations should also have decarbonisation strategies in place. Emerging economies, such as South Africa, are identified as a risk to the roadmap and the researchers say that international efforts should incentivise low-carbon development. Food production also accounts for 10% of GHG emissions, so carbon management in the food system should be a major focus of investment in order to move towards more sustainable, low-meat diets, which would benefit ecosystems and human health, while reducing pollution.

2020–2030: large changes need to be made to the global economy in this decade**.** Carbon pricing must cover all GHG emissions starting at US $50 (€41) per ton increasing to $400 (€324) per ton by mid-century (it is now around US $12 (€10) per ton). By 2030 coal use should be almost phased out and cities such as Copenhagen and Hamburg, should be fossil-fuel free. There should be robust taxes on air transport and shipping and countries should phase out the internal combustion engine in new cars by 2030. These measures should hasten the development of non fossil-fuel technologies as well as investment in the development of technologies to mitigate climate change (e.g. energy-storage systems, CCS and smart-power grids). Major investment should also be made in afforestation to remove CO_2 from the atmosphere.

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1. The Group of Seven or G7 consists of Canada, France, Germany, Italy, Japan, the United Kingdom and the United States. The European Union is also represented at the G7 summit.

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2030–2050: this decade is characterised by key breakthroughs in the roadmap. For example, oil would be phased out for energy, and petrol and diesel cars rarely used on the roads worldwide. Aircraft should also be running on alternative fuels, such as hydrogen and, therefore, should be carbon neutral. The construction industry would also become carbon neutral and CCS technologies would be able to remove large amounts (5 gigatonnes a year by 2050) of CO_2 from the atmosphere. After 2040, all major European countries should be close to net-zero carbon states with North America, South America and most of Africa and Asia reaching this stage by 2050. The global economy would be powered by carbon-free energy and fed by sustainable agriculture, which sequesters carbon.

It should be noted that the study is a hypothetical exercise in order to explore how to achieve rapid decarbonisation and it is unknown how emission-reductions strategies will play out in the real world. For example, CCS technologies are still in the early stage of development — technology is not yet ready or affordable — and it is unknown whether the future sequestration amounts described in the roadmap are achievable. The roadmap would also require a considerable degree of cooperation between different countries in order to be achieved (it was beyond the scope of the study to look at whether the roadmap is implementable and acceptable by Member States). However, the researchers say their roadmap could contribute to national and international strategies to deal with climate change. They also point out that the nature of a roadmap means that it should be revisited regularly to update targets and actions. They suggest that a carbon law could lead to decisive action on climate change in the short term.

The researchers say that the key to a carbon law would be to encourage renewable energy and other zero-emission technologies while simultaneously removing fossil-fuel-based technologies from use. They say this can encourage radical change which will make possible a zero-emissions future. The researchers concede that this approach will be extremely challenging in the current global political climate. However, they argue that, without rapid transitions and the need for drastic regulatory and financial reform that puts a cost on carbon, it will be difficult to keep climate warming below 2 °C.

The researchers note that there are positive signs that the world is on track to transform to a net zero-emissions economy. They emphasise, furthermore, that decarbonisation can also be a pro-growth strategy and that climate efforts need to be given equal importance on the international stage with economic development, human rights, democracy and peace.