Comment

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Pop-up cycle lanes were installed across Germany during the COVID-19 pandemic to aid social distancing.

Fuel crisis: slash demand in three sectors to protect economies and climate

Felix Creutzig

Global dependence on Russian gas, oil and coal can be cut by 20–60% and greenhouse-gas emissions by 2.9% within one year, with the right policy support.

The war in Ukraine has triggered an energy and resource crisis. Russian exports account for 3.6% of coal, 7.0% of natural gas and 5.8% of oil consumption globally (see Supplementary information). Much of those exports goes to Europe. Russia provides about 40% of the European Union's gas, nearly 50% of its coal and one-quarter of its oil. Russia is cutting gas exports to countries that will not pay in roubles. Prices are soaring and gas and oil are running short.

In the light of this and the economic sanctions against Russia, how can countries reduce their Russian energy imports? And, crucially, how can they do so while addressing climate change? Both require immediate action. Fortunately, the two agendas overlap.

In short, the solution is to slash energy demand: grow more food and less fodder, drive and fly less, turn down the thermostat. Demand-led solutions are efficient, quick and cheap, as Cape Town showed in 2018 when the city drastically curbed water use during extreme drought in South Africa. Designed and implemented with care, and backed by policy, such measures can lower future greenhouse-gas emissions and climate risks, as well as reducing reliance on Russian exports today.

Without such steps, governments seeking to increase or subsidize domestic supplies of gas and oil, or to burn coal or ship in liquid

natural gas (LNG), might slow the fuel-price spiral in the near term. But in the long run, they — along with everyone else — will face even greater economic damage from climate change. Russia's invasion of Ukraine makes clear that propping up the old world economy will result only in more resource bottlenecks, empowered authoritarian regimes, wars and climate-related devastation.

Here I outline a set of structural, social and lifestyle changes that could reduce European reliance on fossil-fuel imports from Russia by 20–60% within one year. If this approach were adopted by member states of the Organisation for Economic Co-operation and Development (OECD) and in east Asia, it would lower global greenhouse-gas emissions by up to 2.9% over 12 months (assuming 4–9% emissions savings in end-use sectors; further savings in industry and the power sector are possible). And, by 2050, it would cut global emissions by 40–70% relative to existing policy commitments[1].

These figures are based on reports released this year by the Intergovernmental Panel on Climate Change (IPCC)[1] and the International Energy Agency[2,3]. Similarly, the IPCC's latest summary for policymakers[4] sets out how a combination of structural shifts, social choices and changes in behaviour can cut emissions from sectors that use fossil fuels: by 5% rapidly in high-income countries, and by 40–70% by mid-century.

Three sectors are central: transport, buildings and food production (see 'Cut reliance, curb emissions'). Challenges include overcoming economic inertia, changing behaviours and social norms, and ensuring policies are equitable. Some measures can be implemented straight away, such as banning cars from city centres. Others will take longer, such as overhauling food systems. The benefits of adopting new technologies and retrofitting will stack up year on year.

Such solutions aren't new, but the war in Ukraine has made implementing them more urgent and palatable, politically and socially. It will require more than personal choice — regulation and market interventions will be needed to make low-carbon the obvious option.

Transport

The following 5 measures (see SI for details) might, within one year, replace 60% of global oil imports from Russia (4.7 million barrels per day in 2021) and cut the transport sector's greenhouse-gas emissions by 4%. They would be most effective in OECD countries and China, nations that emit the highest share of greenhouse gases globally and have most capacity to act. They can be implemented quickly and fairly. And they support political and economic stability.

One, encourage telecommuting. During COVID-19 lockdowns, when those who could work from home did so, greenhouse-gas emissions from land-based transport fell by 40% globally[5]. Other benefits include time saved through not being stuck in traffic, a better work–life balance, fewer sick days and more freedom. In my view, governments should mandate that companies allow employees to work remotely at least half of the time, if tasks allow, with some social contact at the office.

Two, reduce speed limits. Energy consumption increases with the square of speed. On German roads where speed is unregulated, a limit of 120 kilometres per hour or 100 km h^{-1} would save up to 13% of greenhouse-gas emissions from light vehicles on highways (2.6 megatonnes of carbon dioxide equivalent or 5.4 $MtCO_2e$, respectively, per year; see SI). Globally, lowering speed limits for cars and heavy trucks by 10 km h^{-1} would save 430 thousand barrels of oil products per day[2], equivalent to Pakistan's oil consumption. It would also improve traffic safety. For example, after Seattle, Washington, reduced speed limits to 40 km h^{-1} citywide, crashes fell by 22%.

Three, ban cars from inner cities. Pontevedra in Spain and Ghent in Belgium have done so; Paris plans to; Berlin is considering it. Such a ban also lowers air pollution and noise, and revives the social nature of streets as meeting places. Restrictions, such as car-free Sundays, encourage residents to try living without cars. Implementing such measures across advanced economies could save another 82 $MtCO_2e$ per year (see SI).

Four, adapt streets for safe cycling. In Germany, nearly 65% of all car trips, responsible for 20% of the total distance travelled by cars, are less than 10 km. Safe bicycle lanes, separated from traffic, should be expanded. Some cities tried this during the pandemic. For example, Bogotá created 84 km of temporary bicycle lanes using traffic cones. This increased the city's share of trips made by bicycle from 9% in 2020 to 13% in early 2021. One analysis of pop-up bicycle infrastructure in 2020 in 106 European cities found that extending bike lanes by 12 km per city, on average, increased the number of cycling trips by 11–48% (ref. 6). Emissions from urban transport fell by between 0.34% and 1.87% as a result.

Five, replace short-haul flights with teleconferencing or train travel. During COVID-19 lockdowns, daily flight numbers fell by up to three-quarters[5]. France has banned domestic flights on routes that can be travelled by train in less than 2.5 hours, amounting to 12% of services. Some airlines might not object; Air France was making losses on some of those routes. In advanced economies, avoiding business air travel or replacing it with trains would save about 41 $MtCO_2e$ per year, or about 300,000 barrels of oil per day[2]. In academia, relocating conferences, increasing virtual participation and holding meetings every two years rather than annually could slash travel emissions by more than 90% (ref. 7).

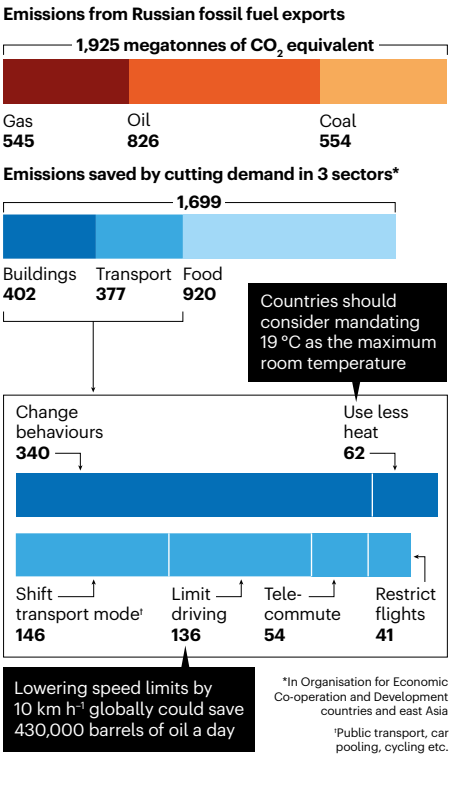
Social equity is an essential consideration — transport is the sector with the highest inequality in greenhouse-gas emissions. Low-income households, most of which neither have a car nor fly regularly, would hardly be impacted by bans. However, a small proportion (5–9%) of citizens in high-income countries rely on cars yet have low incomes. Policies to support them include targeted subsidies, zero-carbon shared-car and e-bike schemes, and paying climate dividends to all (see below).

Buildings

Heating accounts for one-quarter of total energy demand in buildings (see SI). Turning thermostats down by 2 °C in countries that

CUT RELIANCE, CURB EMISSIONS

Gas, oil and coal exports from Russia account for 7%, 5.8% and 3.6% of of global consumption, respectively. Slashing energy demand would cut global emissions by 2.9% in 12 months and avert fuel shortages.



SOURCE: SEE SUPPLEMENTARY INFORMATION

are major importers of Russian gas, such as Germany, could save 32 billion cubic metres of gas annually (20 b.c.m. of which would be in Europe[3]) – about 13% of Russia's global gas exports. Lowering demand for heating should eventually reduce energy prices, helping low-income households. Governments in OECD countries should consider mandating 19 °C as the maximum room temperature next winter. Although this would be hard to enforce, and some people might need warmer rooms for health reasons, for example, such a mandate would set a social norm that makes overheating unacceptable.

Behavioural interventions, such as visual prompts from 'smart' electricity meters, can encourage households to use less energy. Programmable devices can help them 'game' their energy use, by washing clothes off-peak, for instance. Social prestige should be attached to energy saving rather than large cars and housing. Utilities should roll out devices that display electricity and gas consumption, send out bills that compare customers' energy use with neighbourhood averages, and advise on energy saving. A combination of such approaches might deliver energy savings of 4% (see SI). Making renewable-electricity providers the default for households when they move in to a property is another effective measure – 80% of households stay with this option[8].

Saving electricity has an immediate impact on fossil-fuel emissions and imports. The power plants that deliver peak energy loads and are switched off when demand drops often run on gas or coal.

More efficient use of industrial products can also reduce dependency on gas. For example, more than 4% of German gas imports from Russia are used to produce steel. Changing building codes can reduce the need for steel in construction by one-quarter[9]. Refurbishing old buildings or reusing parts of them is better than demolishing them to construct new ones[10]. Allocating floor space more efficiently can also save on materials and gas.

Food

A global food crisis is also unfolding. Russia and Ukraine are responsible for more than one-third of the world's cereal exports, mostly barley, wheat and maize. And Belarus and Russia are major exporters of fertilizer. Production of ammonia, which is used to make nitrogen-based fertilizer, consumes 120–200 b.c.m. (3–5%) of global gas output annually, comparable with Russian gas exports to the EU. Prices of cereals and fertilizer are rocketing.

What to do? Europe alone could replace lost Ukrainian grain by substituting one-third of the EU's fodder production (or the world could substitute 5% globally) with cultivation of wheat and other grains[11]. Fodder accounts for more than half of agricultural production in the United States and the EU, and more than one-third globally[12]. Yet only 12% of the calories in feed ends up as human-food calories. Such a step would reduce the pressure to deforest in other parts of the world. Rearing fewer animals would also lower emissions of methane, a potent greenhouse gas.

Another option, taxing greenhouse emissions in the food sector, could be more effective but is harder to implement. Some analysts project[13] that taxing food at US$52 per tonne of CO_2 emitted would reduce emissions from the agricultural sector by 9% by incentivizing farmers to use less nitrogen fertilizer, for example.

"Social prestige should be attached to energy saving rather than large cars and housing."

Prices for emissions-intensive food, mostly meat, could increase by 15–40%. Those for fruits and vegetables would rise less, by less than 3%. Yet, even small price rises risk lowering access to nutrition in some parts of the world[1]. The impacts of carbon taxes could be reduced by lowering value-added taxes on plant-based foods. In the long run, dietary shifts from animal protein to vegan food, and cutting food waste would, by 2050, reduce fertilizer input and emissions from agriculture by 40% compared with current national policies[1].

Overcoming obstacles

All the above actions would save up to 1,700 $MtCO_2e$, or 2.9% of global greenhouse gas emissions. That includes: 380 $MtCO_2e$ from transport, 350–400 $MtCO_2e$ from buildings and 920 $MtCO_2e$ from food (see SI). Other measures can be deployed on top, such as the use of heat pumps, solar power and electric cars. Hurdles will need to be overcome, however.

Social equity must be addressed. One per cent of the world's population is responsible for 15% of its greenhouse-gas emissions, and yet hundreds of millions of people have inadequate access to basic services[1]. In my view, climate dividends – a lump-sum transfer of several hundred dollars per year for each citizen to alleviate the burden of higher energy costs – would align climate action with social equity better than a patchwork of subsidies. Such a dividend could be financed by carbon prices, taxes or trading[14]. It would also protect low-income households that cannot easily shift away from fossil fuels.

Inertia and economic and political interests are the greatest barriers to change. For decades, companies and governments have spent billions on fossil-fuel infrastructure – gas pipelines, LNG terminals, petrol stations, oil platforms, diesel and petrol vehicles, and power plants. Switching them off means losing capital, expertise and investment.

Governments and others must send firm signals that the fossil-fuel industry is in decline. New oil, gas and coal infrastructure should not be built. For example, Germany will be better off saving energy than installing LNG terminals. Pension funds, banks and others should divest from oil and gas companies that still plan to expand. Commitments should be made to increase carbon pricing, and dates set for phasing out gas and oil heating and internal-combustion and diesel engines.

Revenue can be redirected to finance energy and mobility transitions, for example by taxing windfall profits of fossil-fuel companies. Taxing Russian gas imports by about 30–60% would cut the revenues of Gazprom – the giant state-owned energy firm – by 50–75%, and the tax revenues would more than compensate for surcharges incurred by consumers[15]. Alternatively, governments should mandate fossil-fuel companies to reinvest all income in renewable energy and other substitutes.

The barriers seem huge. But surveys show considerable public support for demand-led measures. Energy saving can create jobs and reduce energy inequity. As fossil-fuel prices keep climbing, a swift, sharp cut in energy demand is achievable and affordable, and will lead more quickly to a better future for all.

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