Comment

Supplementary information to:

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

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Table A1. Russian export of fossil fuels and their GHG emission content.

Russia	Exports in 2019 in TJ	Equivalent $MtCO_2$ emissions	% of exports to OECD Europe	% of global consumption
Gas exports	9934000	545	74%	7.0%
Oil exports	11270000	826	49%	5.8%
Coal exports	5756000	554	32%	3.6%

Export numbers are from IEA (https://www.iea.org/data-and-statistics/data-browser?country=RUSSIA&fuel=Imports%2Fexports&indicator=NatGasImportsExports). Factors for computing CO_2 content of unit of energy for fossil fuels used: gas: 55.8 tCO_2/MJ; oil: 73.3 tCO_2/MJ; coal (hard coal): 94.6 tCO_2/MJ.

Table A2. Short-term GHG emission reduction potentials. For demand-side GHG emission reduction potential until 2050 see[1,2].

Sector	Option	Resource and Energy saving	Annualized mitigation potential	Improved wellbeing
Transport (8.85 $GtCO_2$ in 2019)[3]	Telecommuting	0.4 mb/day (oil)[4]	54 $MtCO_2$	home working provides social and individual benefits, such as time saved in traffic, better work-life balance, fewer sick days, more freedom, and improved inclusivity[5]
	Speed limits	0.4 mb/day (oil)[4]	54 $MtCO_2$ (In unregulated Germany, a speed limit of 120 km/h or 100 km/h would save up to 13% of greenhouse gas emissions of light vehicles on highways (2.6 $MtCO_2$ or 5.4 $MtCO_2$ per year)[6].)	improves traffic safety and safe lives, e.g., the city of Seattle reduced speed limits to 40 km/h and thus also reduced crashes by 22%[7]
	Ban cars from inner cities (car free Sundays, alternative car access)	0.6 mb/day (oil)[4]	82 $MtCO_2$	brings environmental benefits, such as reduced air pollution and less noise, and revives the social

				functionality of streets by turning parking spaces into spaces for people to interact[8]
	Make cycling safe	0.007–0.07 mb/day (oil)[9]	1–10 $MtCO_2$[9] (see calculation note below)	For individuals who shift from car to bicycle, beneficial effects of increased physical activity are substantially larger (3–14 months gained) than the potential mortality effect of increased inhaled air pollution doses (0.8–40 days lost) and the increase in traffic accidents (5–9 days lost); additional large social benefits are realized by a modest reduction in air pollution and traffic accidents[10]
	Replace flights with teleconferencing and train	0.3 mb/day (oil)[4]	41 $MtCO_2$ (also: relocating conference venues, increasing virtual participation and holding meetings every two years could slash GHG emissions of academic travel by more than 90%[11])	flying less increased quality of life of business travellers[12]
	Other measures (public transit, car pooling, accelerate EV roll out …)	1.0 mb/day (oil)[4]	136 $MtCO_2$	improves air quality and reduces congestion[13,14]
	Sum of mobility options	**2.8 mb/day (oil)[4,9] (60% of Russia's oil exports in 2021[15])**	**380 $MtCO_2$ (4.3% of 2019 transport sector GHG emissions)**	a better life
Buildings (9.44 $GtCO_2$ in 2019)**[3]** Heating accounts for about one quarter of the total energy demand in buildings**[16]**.	Turn down thermostat by 2°C in countries that import Russian gas	32 bcm gas[17]; 13% of Russia's gas exports in 2021[15]	62 $MtCO_2$	Saved expenses
	Gaming, information, motivation and other behavioral interventions (not mutually exclusive		350 $MtCO_2$ [18] (presenting renewable energy to existing customers as the	Saved expenses

	to thermostat regulation); setting green defaults		standard option led to around 80% of the household and business sector customers staying with the green default[19])	
	Sum of buildings options		**350–400 $MtCO_2$ (3.7–4.2% of 2019 building sector GHG emissions)**	
Food (10.69 $GtCO_2$ in 2019)[3]	Replace Ukraine's grain exports by substituting one third of EU's fodder production (equivalent to 5% of global fodder production) with wheat and other grains for food production[20]	Ukraine's 42 million ha of agricultural land partially compromised (2.8% of global cropland)	would prevent pressure for land use change and deforestation for food production and ensuing GHG emissions; magnitude unclear; reducing enteric fermentation, responsible for 2.95 $GtCO_2$ in 2019[3], by 5% would reduce global GHG emissions by about 150 $MtCO_2$.	Improved health (see below)
	Tax food commodities at \$52 per tonne of CO_2 emitted		920 $MtCO_2$ [21]	results in 107,000 avoided deaths two-thirds of which were due to changes in dietary risk factors, and one-third due to changes in weight-related risk factors[21]
			920 $MtCO_2$ (9% of 2019 food sector GHG emissions)	

In total, short-term GHG emission reduction potential is about 1700 $MtCO_2$, or 2.9% of global GHG emissions of 2019.

Computing GHG emission savings of new bicycle lanes

The following calculation is adapted from ref. 9.

Cycles and electric bikes have untapped potential to replace petroleum-fueled transport; nearly 65% of all car trips, responsible for 20% of all car distance covered, are less than 10 km[22]. Assuming conservatively a 8% modal share baseline of cycling (2014 data for EU)[23] and a 8% increase in cycling due to COVID-19 in EU cities[24]; and given that 270 million Europeans older than 14 years live in cities, in average making 3.47 trips per day[25]; and observing that one additional bicycle trip reduces GHG emissions compared to baseline (in average 3.2kg/day) by 14%[25], then the 8% additional bike trips (2.2 billion), translate into 0.98 $MtCO_2$ saving per year, which is 0.31% of annual land transport GHG emissions of the 270 million European urbanities. In cities, where in average 11,5km pop-up bicycle lanes were provided[26], GHG emission savings were between 0.43% and 1.87%. Extrapolating this indicates that if cities built >100km bicycle networks, GHG emission savings at the order of 4–19% are feasible, or about 10 $MtCO_2$ saving per year.

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