frontiers | Frontiers in Environmental Science

TYPE Opinion
PUBLISHED 03 March 2023
DOI 10.3389/fenvs.2023.1118987

OPEN ACCESS

EDITED BY
Ana Somoza-Tornos,
Delft University of Technology,
Netherlands

REVIEWED BY
Barry D. Solomon,
Michigan Technological University,
United States

*CORRESPONDENCE
Dominic Rohner,
dominic.rohner@unil.ch

SPECIALTY SECTION
This article was submitted to Environmental Economics and Management, a section of the journal Frontiers in Environmental Science

RECEIVED 08 December 2022
ACCEPTED 16 February 2023
PUBLISHED 03 March 2023

CITATION
Rohner D, Lehning M, Steinberger J, Tetreault N and Trutnevyte E (2023), Decentralized green energy transition promotes peace.
Front. Environ. Sci. 11:1118987.
doi: 10.3389/fenvs.2023.1118987

Decentralized green energy transition promotes peace

Dominic Rohner[1]*, Michael Lehning[2,3,4], Julia Steinberger[4,5], Nicolas Tetreault[4] and Evelina Trutnevyte[6]

[1]Department of Economics, Université de Lausanne, Lausanne, Switzerland, [2]Laboratory of Cryospheric Sciences, Swiss Federal Institute of Technology Lausanne, Lausanne, Switzerland, [3]WSL Institute for Snow and Avalanche Research, Davos, Switzerland, [4]Center for Climate Impact and Action, Swiss Federal Institute of Technology Lausanne, University of Lausanne, Lausanne, Switzerland, [5]Institute of Geosciences and Sustainability, Université de Lausanne, Lausanne, Switzerland, [6]Renewable energy systems group, University of Geneva, Geneva, Switzerland

KEYWORDS

energy, conflict, fossil fuels, green transition, decentralization, climate change, global warming

Introduction

Two of the biggest challenges faced by humanity, climate change and major episodes of political violence, have one thing in common: They are fuelled by oil and gas to which the world has become increasingly dependent over the last century. The upside of this dilemma is that if the green energy transition succeeds, it can "kill two birds with one stone", as there is an environmental and geopolitical double dividend of avoiding fossil fuels. The tragedy in Ukraine unfolding currently in front of our eyes has increased the political urgency to reduce fossil-fuel dependency. Fossil fuel prices that have been relatively high in the past months compared to recent years, especially for fuel types particularly affected by the war, such as, e.g., natural gas prices in Europe (Federal Research Bank of St, 2020, Garicano et al., 2022), and ever-cheaper renewable energy technologies provide powerful economic incentives to finally invest in green energy. Lessons learnt from the COVID-19 pandemic can inform incentives for behaviour change too. Put differently, the current moment is a unique window of opportunity to engage in a radical transition towards green energy.

In what follows, this piece will first highlight through what mechanisms fossil fuels threaten sustainability and peace, and, subsequently, outline in detail how the green energy transition can concretely be achieved, stressing both key factors of reducing energy demand and boosting green energy supply. Several promising green energy policies can be implemented at a local, *decentralized* scale, helping to avoid the fatal concentration of resource rents and political power that has led to oil and gas hollowing out democracy, fuelling corruption and triggering civil and interstate wars.

Fossil-fuelled climate change

Rapid climate change is a generally accepted reality, and it is unequivocal that it is a direct consequence of human-led fossil fuel burning and poor land management. The atmosphere, ocean and land have already warmed an average of 1.1°C compared to pre-industrial time. Today, Greenhouse Gases (GHGs) from coal, gas and oil continue to accumulate and increase global average temperatures at an alarming rate. What does it mean? Human-induced climate change is already affecting many weather and climate extremes in every region across the globe. Sea levels increase as well as heatwaves, floods, droughts, and tropical cyclones are expected to increase in severity and frequency as

temperatures keep rising. Is it too late? It will never be "too late" to avoid some level of impacts and destruction by reducing emissions to zero – but right now, we can still act to avoid the vast bulk of impacts by limiting the global average temperature increase to 1.5°C. To do so, we need to halve our GHGs emissions by 2030 and reach global net zero emissions by 2050. How can we do it? The first and most obvious step to reach this goal is to commit, starting today, to stop extracting, trading, transforming and using fossil fuels (IPCC et al., 2022).

Bad politics

Decades of research in political science and economics have assembled a long list of detrimental effects of fossil fuel and mineral extraction. Petrostates are characterised by lower levels of democracy, more corruption, and more economic instability (Ross, 2012). One of the underlying mechanisms at work is that the appeal of grabbing the windfalls of mother nature's riches attracts a type of rent-seeking politician and leads to lower state accountability and a rentier state (as much of the fiscal budget is financed by royalties of natural resources rather than by income taxes, the regime in place has lower incentives to content citizens and invest in public services, infrastructure, education and sectors beyond the extractive one). The lucrative fossil-fuel rents also represent an attractive "prize" to be appropriated by rebel leaders aiming to get their hands on the precious resources. This has led to a strong statistical relationship of oil or mineral discoveries or prize spikes fuelling the risk of civil wars (Ross, 2012), (Watts, 2004), (Heinberg, 2005), (Berman et al., 2017). In many circumstances multinationals also contribute to the institutionalised theft of a country's riches by kleptocrats. In particular, mineral extraction has a specially strong detrimental impact on peace when mines are owned by companies with low corporate social responsibility and when the sector escapes traceability and transparency initiatives (Berman et al., 2017).

Further, dictatorships built on petrodollars also have a greater tendency to commit mass atrocities targeted against their citizens. As shown in the game-theoretic setting and empirical analysis of (Esteban et al., 2015), when a cynical dictator draws riches mainly from lucrative oil contracts that do not require much local labour, her/his incentives to physically eliminate opposition groups are larger than when the economy hinges on complex, human-capital intensive production outside the commodity sector.

Finally, there is also strong statistical evidence that interstate wars are fuelled by the "black gold" (Caselli et al., 2015). First of all, petrostates over-proportionally give birth to dictatorships, which are more likely to start wars against democracies and autocracies alike. Indeed, as shown by the famous "democratic peace" result, democracies are extremely unlikely to attack other democracies militarily. Put differently, a decisive way in which fossil fuels push our world towards Armageddon is by increasing the share of non-democracies in the international system. Beyond this mechanism, fossil fuels are drivers of interstate wars by providing countries with incentives for trying to capture a neighbouring country's resources (Caselli et al., 2015).

More with less: Curbing energy demand

One argument against abandoning (or, more actively, banning) fossil fuels is the outdated assumption that more energy is equivalent to higher wellbeing: in this view, growth in energy use is tautological with human progress. This assumption is widespread, but does not hold up to empirical scrutiny. Several important facts have emerged in recent research:

First, at any given point in time, the international energy use *per capita* associated with human development exhibits saturation behaviour. Beyond that point, there are diminishing or no returns observed (Martinez and Ebenhack, 2008), (Steinberger and Timmons Roberts, 2010).

Second, the level of international energy use *per capita* associated with high levels of human development has been decreasing drastically over time (Steinberger and Timmons Roberts, 2010).

Third, growth in primary energy use can statistically account for only one-quarter of the improvement in life expectancy observed internationally since the 1970s (Steinberger et al., 2020). In contrast, residential electricity can account for almost two-thirds (Steinberger et al., 2020). This means that it is not the *quantity* of energy which matters, so much as its *quality* and the *purpose* of its use. This is especially important for fossil fuels, since up to 2/3 of fossil energy is lost between extraction and use (in transport and electricity generation especially), while in space heating, where conversion could be expected to be more efficient, technological alternatives such as heat pumps exist which are energy positive (supply more than they consume thanks to use of temperature differentials in the environment): for the vast majority of uses, electrification and renewable supply would be far, far more efficient.

Fourth, even within developing countries, households with low energy footprints and high levels of wellbeing can be observed. Wellbeing for these households depends far more on access to clean and modern energy vectors (especially electricity), and proximity to public services and infrastructure (markets, transport, health, etc.) than on total energy use (Baltruszewicz et al., 2021).

Fifth, the importance of the socio-economic context of energy provision and use can be observed at the international level. Several factors have been identified as beneficial to achieving high levels of human need satisfaction at lower energy use: high quality public services and infrastructure, democratic governance, electricity access, economic equality (Vogel et al., 2021). At the same time, extractivism (the dependence of an economy on resource extraction, such as fossil fuels) is identified as a highly negative factor in achieving human needs at lower energy use (Vogel et al., 2021).

Sixth, new research directions include modelling based on "decent living energy" (a concept pioneered by Narasimha Rao of Yale), with several regional and two global models indicating that universal decent living standards (with no under- or over-consumption) could be achieved at an annual final energy demand level less than half of what we current use, despite forecasted population growth (Kikstra et al., 2021). Moreover, the infrastructure build-out required for enabling low-energy decent living standards would be equivalent, globally, to less than 1 year of

current energy use. Such models are clearly idealized, but at the same time the lack of investment in mass deployment of demand-oriented solutions means that we are still at the infancy of many areas of technological and social learning. It is quite probable that even more could be achieved with even less.

Together, these results form part of the reason that the 3rd working group of IPCC's 6th assessment report concluded that "demand-side measures and new ways of end-use service provision can reduce global GHG emissions in end use sectors by 40%–70% by 2050 compared to baseline scenarios" (IPCC et al., 2022). The possibility of universal wellbeing while significantly reducing energy use is another reason it is not only necessary, but beneficial, to fully abandon fossil fuels.

Boosting green energy supply

Climate mitigation for 1.5°C requires high quality energy, in particular, electricity (Davis et al., 2018). The sustainable and low-impact generation of electricity is therefore a major challenge to be addressed. Renewable resources include wind, solar, geothermal, modern biomass and hydropower plants. Wind energy installations have seen a major technological advancement and cost reductions in the last 2 decades and this is even more true for solar photovoltaics (PV). The urgency of the required transition makes it mandatory that we deploy existing technologies, which are quite advanced in the field of wind energy generation and solar photovoltaics. While solar energy is well accepted for deployment on existing infrastructures (e.g., rooftop), larger-scale solar and wind installations face acceptance problems in many countries (Cousse, 2021), where the aspects of landscape protection are prominent or installations are costly because of high labour costs.

Most of renewable generation is decentralized in nature - and hence can "kill two birds with one stone": First, the local to regional communities profit from installations and therefore have a motivation to move installations forward; Second, the concentration of power, control and revenue, which has led to environmental, geopolitical and security problems, is avoided. The political task is therefore to facilitate the build-up of such local to regional units. PV and wind have a particularly high potential in that context, especially if they are combined (Dujardin et al., 2021).

Once produced, renewable electricity can be used for other energy services too, through electrification of transport, heating, and production of renewable fuels for other sectors. Multiple studies showed that 100% renewable electricity systems are feasible and economically viable, even at global or national scales (Brown et al., 2018). When combined with demand reduction and energy efficiency improvements, fully renewable whole energy systems could be designed in a longer term too (Grubler et al., 2018). Additional bridging technologies that do not use fossil fuels are in principle available (Davis et al., 2018) and need firm policies to ensure market uptake.

Escaping mad max: Conclusion

As discussed above, fossil fuels jeopardise not only the environment but also prospects for peace. Thankfully, there are various promising avenues to free humanity from this perilous addiction. As detailed above, these include curbing energy demand by focusing on less, but better suited and more efficient energy types and boosting green energy supply through innovation and incentives for adoption.

A first key challenge is political willingness, but the geopolitical implications of the current war in Ukraine lead to a window of opportunity to finally seriously engage in the green transition. Times of (energy) crises are also times for building back better: If not now, then when?

A second critical challenge is that several low-carbon technologies require metals and minerals, such as lithium, cobalt, copper, and rare earths, some of them being concentrated in geopolitically vulnerable countries (Berman et al., 2017). Transition from fossil fuels to green energy supply should aim to forego a new geopolitical trap by decentralising and diversifying mining sources and locations and improving traceability schemes (Sovacool et al., 2020).

In a nutshell, in any energy transition, we believe that power of control should remain with the local society and this is a very important component to help the longevity of democracy, which is under pressure at many places now. We find that decentralised renewable energy offers great opportunities in this respect.

Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

Funding

Open access funding by University of Lausanne.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

References

Baltruszewicz, Marta, Steinberger, Julia K., Ivanova, Diana, Brand-Correa, Lina I., Paavola, Jouni, and Owen, Anne (2021). Household final energy footprints in Nepal, vietnam and Zambia: Composition, inequality and links to well-being. *Environ. Res. Lett.* 16 (2)–025011. doi:10.1088/1748-9326/abd588

Berman, Nicolas, Couttenier, Mathieu, Rohner, Dominic, and Thoenig, Mathias (2017). This mine is mine! How minerals fuel conflicts in Africa. *Am. Econ. Rev.* 107 (6), 1564–1610. doi:10.1257/aer.20150774

Brown, Tom W., Bischof-Niemz, Tobias, Blok, Kornelis, Breyer, Christian, Lund, Henrik, and Vad Mathiesen, Brian (2018). Response to 'burden of proof: A comprehensive review of the feasibility of 100% renewable-electricity systems. *Renew. Sustain. energy Rev.* 92, 834–847. doi:10.1016/j.rser.2018.04.113

Caselli, Francesco, Morelli, Massimo, and Rohner, Dominic (2015). The geography of interstate resource wars. *Q. J. Econ.* 130 (1), 267–315. doi:10.1093/qje/qju038

Cousse, J. (2021). Still in love with solar energy? Installation size, affect, and the social acceptance of renewable energy technologies. *Renew. Sustain. Energy Rev.* 145 (May)–111107. doi:10.1016/j.rser.2021.111107

Davis, Steven J., Lewis, Nathan S., Shaner, Matthew, Aggarwal, Sonia, Arent, Doug, Azevedo, Inês L., et al. (2018). Net-zero emissions energy systems. *Science* 360, 6396–eaas9793. doi:10.1126/science.aas9793

Dujardin, J., Kahl, A., and Lehning, M. (2021), Synergistic optimization of renewable energy installations through evolution strategy, *Environ. Res. Lett.*, 16(6), ARTN 064016. doi:10.1088/1748-9326/abfc75

Esteban, Joan, Morelli, Massimo, and Rohner, Dominic (2015). Strategic mass killings. *J. Political Econ.* 123 (5), 1087–1132. doi:10.1086/682584

Federal Research Bank of St. *Louis economic data (FRED)*, https://fred.stlouisfed.org/, Gabriola Island, BC Canada, 2020.

Garicano, Luis, Rohner, Dominic, and Weder di Mauro, Beatrice (Editors) (2022). *Global economic consequences of the war in Ukraine: Sanctions, supply chains and sustainability* (London EC1V 0DX, UK: Centre for Economic Policy Research).

Grubler, Arnulf, Wilson, Charlie, Bento, Nuno, Boza-Kiss, Benigna, Krey, Volker, McCollum, David L., et al. (2018). A low energy demand scenario for meeting the 1.5 C target and sustainable development goals without negative emission technologies. *Nat. energy* 3 (6), 515–527. doi:10.1038/s41560-018-0172-6

Heinberg, Richard. (2005). *The party's over: Oil, war and the fate of industrial societies*. Gabriola, BC, Canada: New Society Publishers.

Ipcc, 2022: *Climate change 2022: Impacts, adaptation, and vulnerability. Contribution of working group II to the sixth assessment report of the intergovernmental panel on climate change*, H.-O. Pörtner, D. C. Roberts, M. Tignor, E. S. Poloczanska, K. Mintenbeck, A. Alegría, et al. (eds.)]. Cambridge University Press. In Press. Cambridge, England.

Kikstra, Jarmo S., Mastrucci, Alessio, Min, Jihoon, Riahi, Keywan, and Rao, Narasimha D. (2021). Decent living gaps and energy needs around the world. *Environ. Res. Lett.* 16 (9)–095006. doi:10.1088/1748-9326/ac1c27

Martinez, Daniel M., and Ebenhack, Ben W. (2008). Understanding the role of energy consumption in human development through the use of saturation phenomena. *Energy Policy* 36 (4), 1430–1435. doi:10.1016/j.enpol.2007.12.016

Ross, Michael L. (2012). *The oil curse*. Princeton, New Jersey: Princeton University Press.

Sovacool, Benjamin K., Ali, Saleem H., Morgan, Bazilian, Radley, Ben, Benoit, Nemery, Julia, Okatz, et al. (2020). Sustainable minerals and metals for a low-carbon future. *Science* 367 (6473), 30–33. doi:10.1126/science.aaz6003

Steinberger, Julia K., Lamb, William F., and Sakai, Marco (2020). Your money or your life? The carbon-development paradox. *Environ. Res. Lett.* 15 (4)–044016. doi:10.1088/1748-9326/ab7461

Steinberger, Julia K., and Timmons Roberts, J. (2010). From constraint to sufficiency: The decoupling of energy and carbon from human needs, 1975–2005. *Ecol. Econ.* 70 (2), 425–433. doi:10.1016/j.ecolecon.2010.09.014

Vogel, Jefim, Steinberger, Julia K., DanielO'Neill, W., Lamb, William F., and Krishnakumar, Jaya (2021). Socio-economic conditions for satisfying human needs at low energy use: An international analysis of social provisioning. *Glob. Environ. Change* 69 (2021)–102287. doi:10.1016/j.gloenvcha.2021.102287

Watts, Michael. (2004). Resource curse? Governmentality, oil and power in the Niger delta, Nigeria. *Geopolitics* 9 (1), 50–80. doi:10.1080/14650040412331307832