Renewable energy targets may undermine their sustainability

As the world's economies seek to use new renewable energy developments to address climate change and reinvigorate economies post-COVID-19, avoiding a fixation on targets in decision-making will ensure positive social and environmental outcomes.

Scott Spillias, Peter Kareiva, Mary Ruckelshaus and Eve McDonald-Madden

The development of renewable energy is essential for tackling climate change. Because of the growing appreciation for global warming as an urgent crisis, many jurisdictions around the world have adopted renewable energy targets (RETs; for example, India[1], USA[2], Europe[3] and Australia[4]) that dictate dates by which threshold percentages of total energy must be derived from renewable sources. The point of these targets is to accelerate the expansion of renewables and thereby address climate change in a timely manner. Few would argue with this intent. The complexity arises because achieving these targets requires transforming our energy systems at a rate and scale that is unprecedented in human history[5]. This presents numerous technical and logistical challenges, and is complicated by the fact that the future energy infrastructure we build, and the way in which we build it, could have significant consequences — both good and bad — for all aspects of human society and the environment (Fig. 1). Frameworks more nuanced than RETs may be needed to synthesize both the benefits and the costs of rapid renewable energy expansion, with the realization that as important as climate change is, the world faces a number of global issues in need of solutions.

On the positive side, renewables generally yield climate benefits, can help promote energy security and can lead to improvements in local air quality and human health[6]. Specific types of renewables can deliver their own unique co-benefits. For example, floating solar panels on reservoirs can reduce evaporative freshwater losses in water-stressed regions in the developing world, erecting solar panels over agricultural fields can provide additional revenue to farmers while simultaneously increasing harvests of shade-tolerant crops, installing wave energy devices in key areas can protect coastlines from erosion and flooding, and producing biofuel from algae grown in wastewater effluent can clean polluted waterways[7].

Expanding renewables can also cause problems, especially if poorly planned. They typically demand large amounts of land, and that demand can put renewable energy in conflict with indigenous rights, with public access to wild lands, and sometimes with ranching and farming[8]. In addition, increased deforestation rates and biodiversity loss can arise from land clearing to make way for renewable energy installations[9], and in some cases, renewable energy incentives have actually caused increases in global emissions due to forests being cut down for 'renewable' wood-fired generators[10].

The problem with RETs as goals

The key insight is that expanding renewable energy is an activity that addresses one global goal, but not all global goals. And in some cases, there are unintended consequences with explosive growth in renewable energy that hinder the ability to address other global challenges such as reduced inequality and ridding the world of poverty. Policy and decisions regarding the transformation of our energy system cannot focus myopically on RETs but must also consider interactions with other targets for a sustainable future. Most notably, the Sustainable Development Goals (SDGs), which have been adopted by 196 countries and the United Nations, lay out a comprehensive global vision for humanity's future in the form of a broad list of 17 related objectives[11]. While energy is only mentioned explicitly by SDG 7 ('Affordable and Clean Energy'), the energy systems built to power the future will play a critical role in determining the extent to which we are able to achieve most, if not all, the prescribed development goals[12].

As an implementation strategy, it is easy to see how RETs can support the SDGs, but like life-saving medical treatments, the way in which they are implemented is critical for minimizing and avoiding harmful side effects. Although targets can be valuable as policy tools by virtue of their quantitative nature[13], they also have significant practical drawbacks that could make them ill-suited for guiding energy policy. For example, setting a target (a quantitative threshold to be attained; for example, 80% wind energy), rather than an objective (a qualitative direction in which to go; for example, maximize wind energy) can blind us to trade-offs when evaluating different policy actions[14]. They can also create psychological incentives to act quickly to implement them[13,15], causing decision makers to lose sight of the more fundamental objectives that motivated the target in the first place[15,16]. Europe's Renewable Energy Directive, for example, instead of reducing carbon emissions and protecting the environment, threatens to increase net carbon emissions and deforestation[17]. Similarly, while calls have been made to invest heavily in renewables to alleviate the strains of COVID-19 (ref. [18]), these new pressures may further blind us to unwise trade-offs. RETs are also inflexible, which might seem initially appealing as a signal of resolve, but may be a liability if the underlying techno-economic capacity, environmental context and/or societal values in place at the outset change over the time it takes to achieve them.

Towards more holistic energy planning

By making RETs the centrepiece of an energy transition strategy, societies are leaving themselves unnecessarily vulnerable to poor sustainable development outcomes. Here we advocate for a reorientation of stated priorities, from a narrow focus on renewables to a broad focus on sustainable development. Within this approach, RETs may still be useful as a policy option, but this determination can only be made after a comprehensive assessment of other options and a full exploration of the costs and trade-offs associated with the rush to large wind and solar installations. California is currently suffering extensive rolling

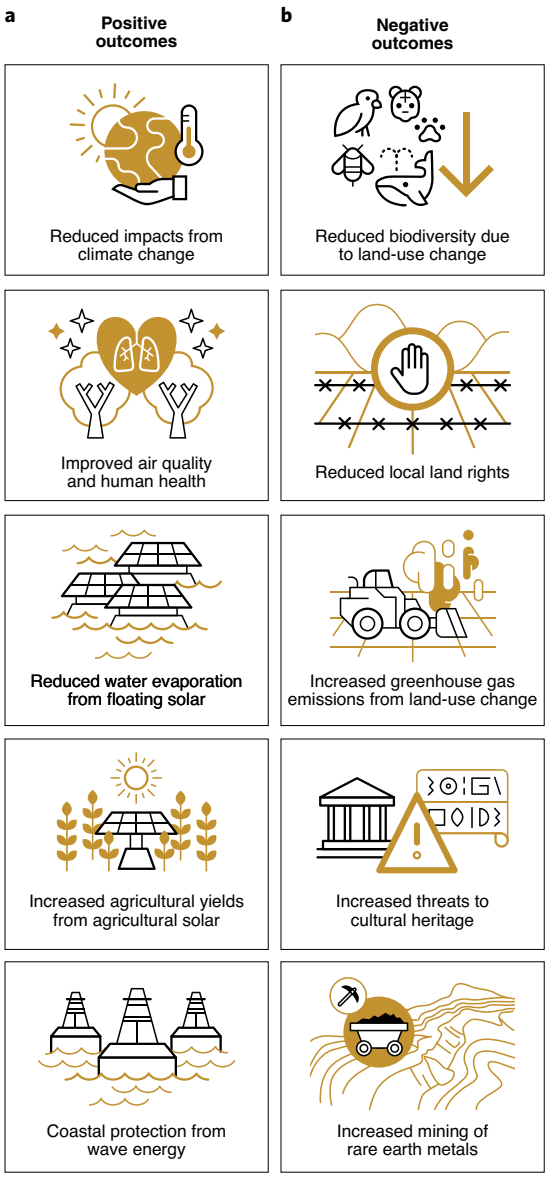

Fig. 1 | The potential positive and negative outcomes of renewable energy development. a,**b**, With smart, rigorous decision-making, renewable energy developments may be able to contribute positively (**a**) to non-energy related objectives, but without it, they may lead to negative outcomes (**b**) in others.

energy blackouts that some attribute to an overzealous pursuit of state-wide targets for renewables without solving the associated problem of what to do when energy demands are high and there is no sun or wind, and affordable battery storage is not yet a reality[19].

As the COVID pandemic has so clearly revealed, one cannot effectively solve one global crisis — the pandemic — without also factoring in that our responses to the pandemic might trigger crises in employment, economic development and social justice. In the context of climate change and RETs, this means the SDGs should be taken as our collectively agreed-upon fundamental objectives, and we should evaluate any possible RET under consideration against a suite of relevant SDGs. That evaluation would consider several other alternative actions: RETs with various portfolios, percentages or timeframes, or different tools altogether, like a carbon tax or establishment of carbon markets. Each alternative action would undergo rigorous analysis to quantify the projected consequences for a suite of relevant SDGs under consideration, and once established, these consequences would be subject to stake-holder scrutiny and input. In the end, we might find that some form of RET is the best way to achieve diverse sustainability objectives, but importantly, this decision will be strengthened by a rigorous and methodical evaluation process that considered important societal trade-offs among actions. Following a multi-objective process will better prepare us to anticipate and manage the unavoidable trade-offs of renewable energy. Such a process is akin to a decision analysis approach[20], which aims to find tools and methodologies to help people and organizations structure decision problems, analyse consequences, tease out trade-offs and make more informed decisions.

Structured approaches to decision-making, such as decision analysis, have become more numerous recently in the energy planning literature[21], but in the public sector they are still rare[22]. If governments are not using decision analysis or a similar structured approach to contemplate objectives, actions, consequences and trade-offs, then how are they deciding at what level to set RETs? Are these targets that (1) can be technically achieved and/or (2) should be achieved? Are they merely the result of political machinations with an eye towards messaging and laying claim to 'we are taking action'[23]? The answers to these questions are not clear, and very few studies or reports have been published on the process underpinning RET-setting. It is impossible to find any documentation of why a RET might be 50% as opposed to 45% or 55%. But what we do know is that these targets are driving policy and our energy transition, for better or worse.

Reconsidering RETs within a decision analysis or similar framework will require significant financial, technical and political investment[22]. Institutional capacity already shows potential with multi-lateral institutions such as the International Finance Corporation (IFC) evaluating investment opportunities using a series of sustainability performance standards[24]. With investment in renewable energy booming and business leaders and financial institutions around the world pledging to decarbonize their portfolios, now is the time to elevate our sophistication in thinking about RETs and related incentives or targets aimed at the climate crisis[25].

We know how to do this[26]. Public and private sector decision makers and other stakeholders, supported by decision scientists and/or facilitators, frame the problem, identify objectives to be included and help balance trade-offs. This linking of public and private perspectives will also help to explore trade-offs and synergies between sectors and will increase the speed at which individuals and institutions can respond to rapidly changing conditions. In an uncertain

future, governments and institutions with the greatest impact on global sustainability, and on their own viability, will be those that use and heed the results of a structured approach to decision-making to navigate and adapt to energy challenges.

RETs are an important step in propelling the transition towards a clean energy future. However, a narrow focus on RETs may hinder progress towards sustainable development objectives; RETs are not ends in and of themselves but a means of achieving broader fundamental social goals. Such goals must undergird any setting of RETs. In a post-COVID world filled with uncertainty, simple goals like RETs bely the complexity of the interlocking challenges and risk being campaign slogans as opposed to thoughtful policy interventions. It is worth remembering that we are not trying to build a world full of solar panels and wind turbines for their own sake, we are trying to build a world that is more prosperous, healthy and just. Renewable energy and RETs are just one means to that end. ❐

Scott Spillias[1,2]✉, Peter Kareiva[3], Mary Ruckelshaus[4] and Eve McDonald-Madden[1,2]

[1]School of Earth and Environmental Sciences, University of Queensland, St Lucia, Queensland, Australia. [2]Centre for Biodiversity and Conservation Science, University of Queensland, St Lucia, Queensland, Australia. [3]Aquarium of the Pacific, Long Beach, CA, USA. [4]Natural Capital Project, Stanford Woods Institute for the Environment, Stanford University, Stanford, CA, USA.
✉*e-mail: s.spillias@uq.edu.au*

Published online: 26 October 2020
https://doi.org/10.1038/s41558-020-00939-x

References

1. Lakshman, S. PM Modi vows to more than double India's non-fossil fuel target to 450 GW by 2022. *The Hindu* https://www.thehindu.com/sci-tech/energy-and-environment/prime-minister-narendra-modi-addresses-the-un-climate-summit-in-new-york/article29492091.ece (2019).
2. Barbose, G. et al. *Energ. Policy* **96**, 645–660 (2016).
3. Howes, T. *The New Climate Policies of the European Union: Internal Legislation and Climate Diplomacy* (Acad & Scientific Pub, 2010).
4. Warburton, D., Zema, M., Fisher, B. & In't Veld, S. *Department of the Prime Minister and Cabinet* (RET Review Expert Panel, 2014).
5. Solomon, B. D. & Krishna, K. *Energ. Policy* **39**, 7422–7431 (2011).
6. Buonocore, J. J. et al. *Nat. Clim. Change* **6**, 100–105 (2016).
7. Burke, M. *Relations* **6**, 87–116 (2018).
8. Yenneti, K., Day, R. & Golubchikov, O. *Geoforum* **76**, 90–99 (2016).
9. Rehbein, J. A. et al. *Glob. Change Biol.* **26**, 3040–3051 (2020).
10. Kiesecker, J. et al. *Front. Environ. Sci.* **7**, 151 (2019).
11. *Transforming Our World: The 2030 Agenda for Sustainable Development in A New Era in Global Health* (ed. Rosa, W.) (Springer Publishing Company, 2017).
12. Santika, W. G. et al. *Energy Res. Soc. Sci.* **50**, 201–214 (2019).
13. Merry, S. E. *Curr. Anthropol.* **52**, S83–S95 (2011).
14. Gregory, R. et al. *Structured Decision Making: A Practical Guide to Environmental Management Choices* (Wiley-Blackwell, 2012).
15. Fukuda-Parr, S. *J. Hum. Dev. Capabil.* **15**, 118–131 (2014).
16. Barnes, M. D., Glew, L., Wyborn, C. & Craigie, I. D. *Nat. Ecol. Evol.* **2**, 759–762 (2018).
17. Searchinger, T. D. et al. *Nat. Commun.* **9**, 3741 (2018).
18. Ambrose, J. How renewable energy could power Britain's economic recovery. *The Guardian* https://www.theguardian.com/environment/2020/may/19/how-renewable-energy-could-power-britains-economic-recovery (2020).
19. Smith, R. & Blunt, K. Why California keeps having blackouts. *Wall Street Journal* https://www.wsj.com/articles/why-california-keeps-having-blackouts-11598198401 (2020).
20. Howard, R. A. *IEEE Trans. Syst. Sci. Cyber.* **4**, 211–219 (1968).
21. von Stechow, C. et al. *Annu. Rev. Env. Resour.* **40**, 363–394 (2015).
22. Bhardwaj, A., Joshi, M., Khosla, R. & Dubash, N. K. *Energy Res. Soc. Sci.* **49**, 143–157 (2019).
23. Nathan, H. S. K. *Econ. Political Wkly* **1**, 10–14 (2015).
24. *Performance Standards on Environmental and Social Sustainability* (International Finance Corporation, 2012); https://www.ifc.org/wps/wcm/connect/Topics_Ext_Content/IFC_External_Corporate_Site/Sustainability-At-IFC/Policies-Standards/Performance-Standards/Performance-Standards
25. *Investors Make Unprecedented Commitment to Net Zero Emissions* (UN Environment Programme, 2019); https://www.unenvironment.org/news-and-stories/press-release/investors-make-unprecedented-commitment-net-zero-emissions
26. Rincón-Ruiz, A. et al. *Ecosyst. Serv.* **36**, 100901 (2019).

Acknowledgements

We thank W. Turner, J. Powell and J. Calvert for their comments on early versions of this manuscript and S. Houghton for producing the figure. S.S. was funded by an Australian Government Research Training Program Scholarship. E.M.M. was supported by an ARC Future Fellowship.

Author contributions

E.M.M. and P.K. conceived the initial idea for the manuscript, and S.S. and E.M.M. developed the concepts and structure of the Comment. S.S. wrote the manuscript. All authors contributed equally to content development and revisions of the manuscript.

Competing interests

The authors declare no competing interests.