100% renewable by 2050: the technology already exists to make it happen

By Dénes Csala and Sgouris Sgouridis

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Most of the world could switch to 100% renewable energy by 2050, creating millions of jobs, saving millions of lives that would otherwise be lost to air pollution, and avoiding 1.5? of warming. That's the bold claim of a major new study by Stanford professor Mark Jacobson and his colleagues, published in the journal Joule.

Image source: www.pixabay.com

Such work can be controversial. Jacobson and his team had previously produced a similar “energy roadmap” for the US alone, which sparked a fierce debate about whether it was feasible or even possible to power the country only with wind, water and solar by mid-century. One rebuttal earlier this summer, by a team of scientists led by Christopher Clack, claimed Jacobson’s plan didn’t have enough energy storage, was unrealistic about hydropower and completely disregarded nuclear power and carbon-capture – it was, they said, a “poorly executed exploration of an interesting hypothesis”.

The original authors responded by saying “there is not a single error in our paper” and highlighting the critics’ links to the fossil and nuclear industries. The debate had quickly turned into a personal feud on the pages of prominent academic journal PNAS and even Twitter.

Jacobson’s work has been politically influential, despite all the bickering. Many cities have joined his 100% renewables movement and public figures such as Bernie Sanders and the actor Mark Ruffalo have pledged their support.

Now Jacobson has upped the ante by publishing this new analysis of 139 countries across the world. However, it is likely that it will also be criticised along similar lines as it uses simplifying assumptions and still evades a detailed modelling of the three largest problems we face in the transition to sustainable energy: storage (especially large scale and long term), intermittency (both generation and demand) and trade (influenced by national security agendas just as much as by economics). Nevertheless, it can still be regarded as an agenda-setting, hypothetical description of the future, rather than a scientific pathway.

But this is just what we need.

Debates over energy modelling rarely make front page news, but this one did. We believe the world needs more discussion and awareness of the sheer complexity of the problem, as well as a positive vision of the future to aim for. And that requires work that is ambitious – and long-term.

Thinking long-term

The energy transition is one of those "wicked problems" – by the time you realise you took the wrong action, it may be already too late.

It's true that 2050 is a whole generation away, but this is exactly the sort of timescale over which we need to think about switching to clean energy. Change doesn't happen overnight. Even if a holy grail technology was invented today, history teaches us that it would still take decades to make it viable on an industrial scale and many more years to deploy worldwide.

Calder Hall: the world's first nuclear power station, shortly after opening in 1956. energy.gov

And let us not forget that radical energy inventions happen perhaps once or twice a century, with no guarantee they will keep occurring. Therefore we must look to the alternatives that are already being deployed on a large scale: wind and solar.

The possibility of continuing to rely on fossil fuels along with carbon capture and storage is fading away, given both the practically nonexistent commercial deployment so far and the associated risks. On the other side, renewables are already the cheapest option for providing (variable) power in many countries, significantly below fossil fuels and nuclear power, while both hydropower and bioenergy are limited to certain regions and cannot easily scale up.

With the cost of wind and solar set to fall even further, the real question is what additional infrastructure we deploy to support it. This certainly includes batteries, which are predicted to become dramatically cheaper.

But there is also something else: inertia. This is partly technical: cheaper renewables and climate policies will leave a legacy of "stranded assets" such as the unnecessary Chinese coal-fired power plants that will probably never be turned on, or the UK's nuclear plant at Hinkley Point C, already twice as expensive as offshore wind. But renewables must also battle against political and social inertia.

Energy doesn't exist in a vacuum

Our societies are becoming ever more complex, and energy (especially electricity) plays an increasingly central part in supporting this complexity. An "energy transition" isn't enough; what's required is a total societal transformation. This societal transition can only be discussed in conjunction with other critical systems like transport or manufacturing and trends such as the rise of big data analytics, artificial intelligence or the internet of things. These are the fields which have the potential to *actually* revolutionise and enable the large-scale transition to renewables. And the large energy companies already know this.

Take transport. Recently, many countries have come up with plans to ditch petrol cars and go electric. These policies will need to join up with plans to store more energy and build more turbines and solar panels (if they don't, emissions may increase). But they'll also rely on developments in artificial intelligence, governance, the concept of car ownership and even insurance. The ideal of replacing all fossil-fuel vehicles with electric, comfortably charging every night, may be impeded by an antiquated grid or by insurers that choose not to cover damage or fires. An optimizing centrally controlled algorithm or a consumer-based dynamic pricing system could resolve this, but there are limited laws and precedents for this – another example of technology already being far ahead of what is politically or socially feasible.

People need to be clear that renewables are the way forward. We may differ with Jacobson and his team over the best type of energy storage, but there is a lot of value in this sort of ambitious roadmap. It emphasises the scale of the challenge, and, if done right, it should bolster general opinion and inspire action. The Paris Agreement was a good example of target-setting but details matter.

We know that the future will not be anything like we imagine – "all models are wrong" after all. But physical limitations suggest there won't be a magical new source of energy; the technologies we need are already here. Like Polynesian navigators, we need to look beyond the horizon to "see" the unknown destination we are heading to.

ABOUT THE AUTHOR

Dénes Csala is a lecturer in energy storage systems dynamics, Lancaster University. Sgouris Sgouridis is associate professor of engineering systems and management, Masdar Institute.