https://doi.org/10.1038/s41560-023-01380-y

# Mission Energy Access for a just and sustainable future for all

Ambuj D. Sagar, Ajay Mathur, Fatih Birol, Yacob Mulugetta, Damilola Ogunbiyi, Youba Sokona & Achim Steiner



Access to clean energy is essential to sustainable human development. We thus have a responsibility and an opportunity to meet the global goal of ending energy poverty by 2030. We propose the creation of a new Mission Energy Access programme to support this aim.

Despite efforts to enhance energy access, there were about 675 million people worldwide who had no access to electricity and about 2.3 billion people who had no access to clean cooking facilities in 2021 (ref. 1). Furthermore, in the absence of additional efforts and measures, as many as 660 million people (mostly in the least-developed countries and in sub-Saharan Africa) will remain without access to electricity and 1.9 billion people will still be dependent on polluting fuels and technologies (mostly biomass used in traditional cookstoves) for cooking in 2030 (ref. 1). This is a betrayal of the global commitment to ending energy poverty by 2030.

Access to clean energy, although it is a worthy end in itself, has several knock-on benefits across the development spectrum. The lack of access to clean energy adversely affects human health, the availability of decent work, access to education, gender equity and the ability to move out of poverty. For example, household air pollution, mostly from smoke resulting from the combustion of biomass, kerosene or coal for cooking, is linked to as many as 3.2 million premature deaths a year[2]. Unfortunately, most improved biomass cookstoves do not reduce emissions sufficiently in practice to eliminate these health impacts[3]. Women and children, who are typically responsible for the collection of firewood and cooking, bear the greatest health burden. Therefore, provision of clean household cooking energy has implications for the United Nations Sustainable Development Goals 1, 3, 4 and 5. Similarly, enhancing access to electricity contributes to the achievement of Sustainable Development Goals 1, 2, 3, 4, 5, 6 and 8.

Access to clean and modern energy also enables countries and peoples to reduce – and to eliminate – greenhouse gas emissions. Biomass used for cooking is estimated to contribute 1.9–2.3% of global greenhouse gas emissions[4], and therefore replacing such traditional sources of household cooking energy with modern and clean sources would make a useful contribution to climate mitigation, even if replaced by liquefied petroleum gas[5]. At the same time, the revolution in modern and clean energy technologies, especially the performance gains and cost reductions in renewable energy and energy storage, can also substantially advance electricity access goals while also delivering gains in the form of avoided emissions. For example, of the 21,500 mini-grids that serve 48 million people worldwide, half are solar-photovoltaic-based; and of the almost 30,000 mini-grids that are planned, 99% will be solar photovoltaic[6]. A recent study by the International Solar Alliance indicates that solar-photovoltaic- and battery-based mini-grids provide cheaper electricity than from the grid if the grid has to be extended by more than ten kilometres[7].

This alignment of development and climate benefits through access to energy highlights that action to enable universal access to clean and modern energy needs to be accelerated, so that it is achieved as soon as possible, and certainly by 2030. In fact, enhancing access to clean and modern energy should rightly be seen as an integral part of the efforts to incorporate justice considerations in the ongoing clean-energy transition. This transition is ramping up globally, driven mainly by a recognition of the urgent need to address the climate change problem. But this acceleration has also brought into focus the concept of 'just transitions', resulting from the understanding that in order to continue to receive political support and to be socially acceptable, we must address the needs and concerns of those adversely affected by the transition.

Much of the focus of 'just transition' discussions currently has been on mitigating the impacts of the shift away from fossil fuels. However, a just transition is meant to 'leave no one behind'[8] and therefore cannot ignore the enormous number of people who continue to live without access to electricity or clean cooking energy and who played only a small part in warming our planet, even as the impacts of climate change affect them most severely. Notably, the poorest 30% of the global population is estimated to be responsible for less than 2% of global energy-related carbon emissions[9]. Furthermore, the cost of the infrastructure and equipment needed to achieve universal access to electricity and clean cooking fuels by 2030 is around 1% of the overall clean energy spending that would be required before 2030 to achieve a scenario consistent with limiting global temperature rise to 1.5 °C (ref. 10). In comparison, the estimated costs of the lack of clean cooking energy by itself are US$2.4 trillion a year[11].

## A transformative approach

We believe that a Mission Energy Access programme is urgently required now to accelerate our efforts to ensure universal energy access by 2030. To achieve this objective, Mission Energy Access would need both to greatly enhance the development of innovative and affordable solutions for enabling access to clean and modern energy and its productive uses, and to drive the accelerated large-scale deployment of these solutions. This, in turn, will require not just strengthening innovation relating to clean energy access but also other activities that support these clean-energy-access programmes. This will require paying attention to the interplay of the technology, finance, policy and socio-economic sectors. A successful Mission Energy Access would help to deliver a triple dividend of increasing energy access, enhancing social and economic benefits, and advancing climate goals.

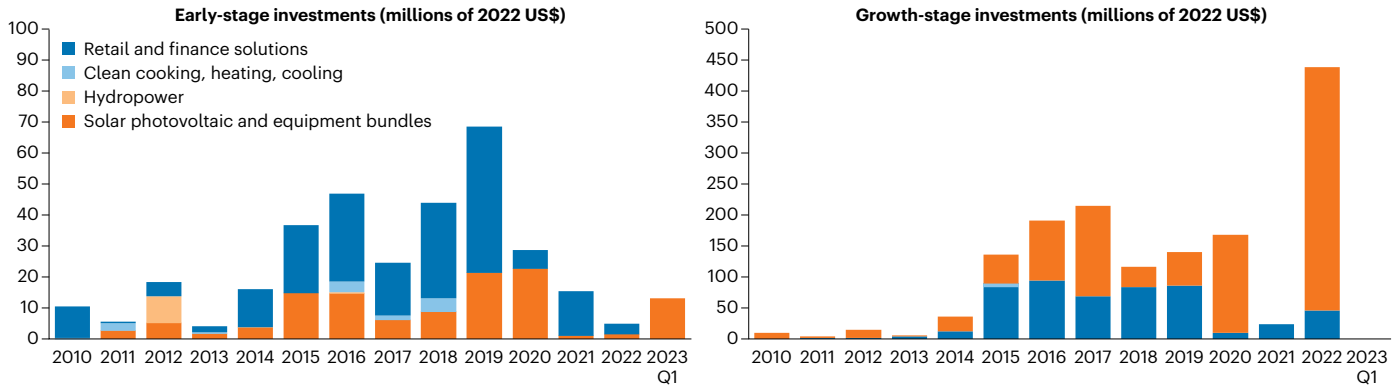


**Fig. 1 | Venture capital investment in energy start-ups in energy-access-related areas.** Early-stage deals (left) and growth-stage deals (right) are shown for 2010–2023. Data are taken from ref. 20.

Mission Energy Access would continue to build on the innovation and performance enhancement of solar photovoltaic, wind energy and energy storage technologies to drive innovations in mini-grids and solar home systems. Equally importantly, it would also help to support and enhance research into and development of suitable technologies and products, not only for enhancing a clean energy supply but also for enabling more efficient and productive uses of this energy that could improve human development and contribute to the achievement of the United Nations' Sustainable Development Goals.

In fact, it has become increasingly clear that while access to clean energy can directly provide high-quality energy services (such as lighting and cooking), it can also enable the provision of other basic services (such as health, by expanding the availability of health diagnostic technologies, for example) as well as livelihoods (through, for example, solar-powered cold storage and other food-processing technologies, textile technologies and so on)[12]. At the same time, it is also important for innovation to be driven by an understanding of the energy requirements for decent living standards[13] as well as socio-cultural contexts. Therefore Mission Energy Access must take a broad perspective on innovation by supporting efforts that enhance broader well-being enabled by the provision of clean energy as well as access to clean energy itself.

Suitable public policy support is required to stimulate the scale of private investments needed to enhance innovation. This can be achieved through the provision of public research and development that stimulates private research and development[14] and robust entrepreneurship[15], alongside policies that send a clear signal to investors about market opportunities. As Fig. 1 shows, venture capital funding for energy-access start-ups has been uneven and broadly stagnant, with notable activity related mostly to solar photovoltaic and associated equipment bundles. Almost no investment has been directed towards start-ups developing clean cooking technologies around the world. These data indicate clearly that increasing public policy support for energy-access-related innovation and entrepreneurship would be an important role for Mission Energy Access.

At the same time, since the eventual goal is deployment at scale, Mission Energy Access would also need to draw on other tools from the scaling toolkit, such as standardization and advanced market commitments that could enable widespread deployment through cost reductions. This would be very helpful since the cost of distributed renewable energy technologies (such as mini-grids) in developing countries remains much higher than in the global north, even though such technologies have the transformative potential to offer clean energy to millions of people without reliable grid access. Similarly, Mission Energy Access could leverage the potential of the expansion of the availability of clean electricity to enable clean cooking through induction and modern electric cookstoves[16]. There is also an opportunity for collaboration between countries on issues such as technology and expertise sharing; twinning of practitioners; and consolidation of demand so that developing countries become price makers rather than price takers.

This will also require us to address the imbalance in global investments in the deployment of renewables: over 50% of the world's population (mostly in developing and emerging economies) received only 15% of these investments in 2022 (down from 27% in 2017); furthermore, the least-developed countries received less than 1% of the global renewable energy investments between 2013 and 2020 (ref. 17).

Since innovation would be a central pillar of Mission Energy Access, many of its elements should be included in the portfolio of Mission Innovation. Being part of Mission Innovation would enable a systematic and coordinated approach to the development and deployment of appropriate technologies and products for clean energy access, drawing on the strength of the Mission Innovation approach. At the same time, it also allows Mission Innovation to be true to the mission statement of Mission Innovation 2.0: 'to accelerate the implementation of the Paris Agreement including pathways to net zero by making clean energy affordable, attractive and accessible to all'[18]. Finally, linking Mission Energy Access to Mission Innovation also allows Mission Innovation to ensure that its activities contribute to the advancement of multiple clean-energy-related global public goods, thereby enhancing its relevance to the broader landscape of the United Nations' Sustainable Development Goals.

In addition to making technologies available with suitable configurations and performance specifications, Mission Energy Access would also need to undertake additional activities to underpin the acceleration and effectiveness of clean-energy-access programmes. These include at least five aspects. First, ensuring access to capital through enhancing the availability of, and delivery networks for, appropriate, sufficient and low-cost finance; the development of fit-for-purpose business models and innovative financing mechanisms (such as blended finance) to support the deployment of these technologies; and training and capacity building of financiers. Second, the formulation

and implementation of policies and regulatory frameworks to support deployment through financial derisking, improved investor confidence and greater mobilization of public and private finance. Third, the development of knowledge networks that promote sharing of effective practices across contexts and strengthening of synergies between different kinds of actors. Fourth, the development of the appropriate capacity to develop, guide and implement programmes as well as to coordinate activities at the national level; training of the next generation of innovators and leaders to drive energy-access efforts, especially in regions, such as Africa, where most of the world's youngest people live. Fifth and finally, further strengthening of coordination between international actors interested in addressing the energy-access problem as well as between these and national and private entities.

However, programmes for enhancing energy access have to be implemented in national contexts and therefore must be tailored to the specific circumstances, needs and capabilities of those countries[19]. Such large-scale customization is tricky to achieve, yet absolutely necessary for success. A Mission Energy Access programme of the kind we are suggesting, by taking a bird's eye view, can help to enable such customization not only in the design but also the resourcing of national programmes.

## All together now

A number of international agencies – such as the United Nations Development Programme, the International Energy Agency, Sustainable Energy for All, The World Bank (through its Energy Sector Management Assistance Program), the International Solar Alliance and the International Renewable Energy Agency – are already involved in enhancing energy access in a multiplicity of ways. Mission Energy Access could start with each of them strengthening their plans to enable energy access and enhancing coordination to support country initiatives and efforts. Such coordination among agencies regarding their respective roles, their activities in specific countries, and their own comparative advantages will help energy-access goals to be met in each country, with each agency carrying out the activities that it does best. The United Nations-led Energy Compact Action Network (https://www.un.org/en/energycompacts) provides the framework to do so under the aegis of the United Nations and its General Assembly-mandated High Level Dialogue on Energy.

This coordinated approach would also further raise the profile of Mission Energy Access and hopefully lead to the sustained political commitment that is absolutely necessary to enable the policy and financial support needed, and therefore should allow these agencies and others to expand their efforts further and deepen their impact through enhanced coordination and harmonization. If Mission Energy Access is to succeed, developing-country institutions also have a key part to play in leading these efforts domestically, which means enhancing their own agency and breaking down silos.

We suggest that this Mission Energy Access be inclusive – any agency or country would be welcome to join. The G20 could be a suitable platform for both reporting on and providing political support for Mission Energy Access, since the G20 is a connector between the rich countries and emerging and developing economies (even more so given the recent addition of the African Union to this group). We reaffirm our commitment to meeting the United Nations' Sustainable Development Goal of universal energy access by 2030. We urge other key actors – national governments, donor agencies, civil society and private firms – to do the same.

**Ambuj D. Sagar[1] ✉, Ajay Mathur[2], Fatih Birol[3], Yacob Mulugetta[4], Damilola Ogunbiyi[5], Youba Sokona[4] & Achim Steiner[6]**

[1]School of Public Policy, Indian Institute of Technology Delhi, New Delhi, India. [2]International Solar Alliance, Gurugram, India. [3]International Energy Agency, Paris, France. [4]University College London, London, UK. [5]Sustainable Energy for All, Vienna, Austria. [6]United National Development Programme, New York, USA.
✉e-mail: asagar@iitd.ac.in

Published online: 26 October 2023

## References

1. IEA, IRENA, UNSD, World Bank, WHO *Tracking SDG 7: The Energy Progress Report* (World Bank, 2023).
2. Household air pollution. *WHO* https://www.who.int/news-room/fact-sheets/detail/household-air-pollution-and-health (2022).
3. Goldemberg, J., Martinez-Gomez, J., Sagar, A. & Smith, K. R. *Environ. Res. Lett.* **13**, 030201 (2018).
4. Bailis, R. et al. *Nat. Clim. Change* **5**, 266–272 (2015).
5. A vision for clean cooking access for all. *IEA* https://www.iea.org/reports/a-vision-for-clean-cooking-access-for-all (2023).
6. Mini grids for half a billion people: market outlook and handbook for decision makers. *ESMAP* https://www.esmap.org/mini_grids_for_half_a_billion_people_the_report (2022).
7. Report on roadmap of solar energy for universal energy access. *International Solar Alliance/Ministry of New And Renewable Energy* https://isolaralliance.org/uploads/docs/540dc1da191598c88320bf07b42e8d.pdf (2023).
8. UN DESA Policy Brief No. 141: a just green transition: concepts and practice so far. *United Nations* https://www.un.org/development/desa/dpad/publication/un-desa-policy-brief-no-141-a-just-green-transition-concepts-and-practice-so-far/ (2022).
9. Cozzi L., Chen O. & Kim, H. The world's top 1% of emitters produce over 1000 times more CO2 than the bottom 1%. *IEA* https://www.iea.org/commentaries/the-world-s-top-1-of-emitters-produce-over-1000-times-more-co2-than-the-bottom-1 (2023).
10. World energy investment 2023. *IEA* https://www.iea.org/reports/world-energy-investment-2023 (2023).
11. ESMAP. The state of access to modern energy cooking services. *World Bank* http://documents.worldbank.org/curated/en/937141600195758792/The-State-of-Access-to-Modern-Energy-Cooking-Services (2020).
12. Hartvigsson, E., Ehnberg, J., Ahlgren, E. O. & Molander, S. *Energy Sustain. Dev.* **60**, 82–89 (2021).
13. Kikstra, J. S., Mastrucci, A., Min, J., Riahi, K. & Rao, N. D. *Environ. Res. Lett.* **16**, 095006 (2021).
14. Becker, B. *J. Econ. Surv.* **29**, 917–942 (2015).
15. Fudickar, R. & Hottenrott, H. *J. Technol. Transf.* **44**, 326–358 (2019).
16. Smith, K. R. *Science* **345**, 603–603 (2014).
17. Global landscape of renewable energy finance 2023. *IRENA/CPI* https://www.irena.org/Publications/2023/Feb/Global-landscape-of-renewable-energy-finance-2023 (2023).
18. Sagar, A. D. *Nature Energy* **7**, 782–784 (2022).
19. Mulugetta, Y. et al. *Nature Energy* **7**, 1015–1022 (2022).
20. Energy innovation investment remained resilient to shocks in a turbulent 2022. *IEA* https://www.iea.org/commentaries/energy-innovation-investment-remained-resilient-to-shocks-in-a-turbulent-2022 (2023).

## Acknowledgements

The authors thank K. Chawla and S. Singh for helpful comments.

## Competing interests

The authors declare no competing interests.

## Additional information

**Supplementary information** The online version contains supplementary material available at https://doi.org/10.1038/s41560-023-01380-y.