Can low-carbon options change conditions for expanding energy access in Africa?

An unmet need for energy

Nearly one-fifth of the global population has no access to electricity, and two-fifths rely on traditional solid fuels, including biomass, for cooking. More than 95% of this unmet need is in sub-Saharan Africa or South Asia, and 84% is in rural areas. In sub-Saharan Africa, only 14% of rural residents have electricity.[i]

Energy poverty has serious impacts on human health and living standards. Traditional biomass stoves produce smoke and hazardous chemicals; the World Health Organization estimates that 4.3 million people died in 2012 due to exposure to household air pollution, almost all in low- and middle-income countries.[ii] Fuel collection is also a major burden, especially to women and children, often keeping them from income-earning activities and school. Even having a grid connection does not guarantee a safe, affordable and reliable power supply, or one adequate for productive uses, as outages are common in most African countries.[iii]

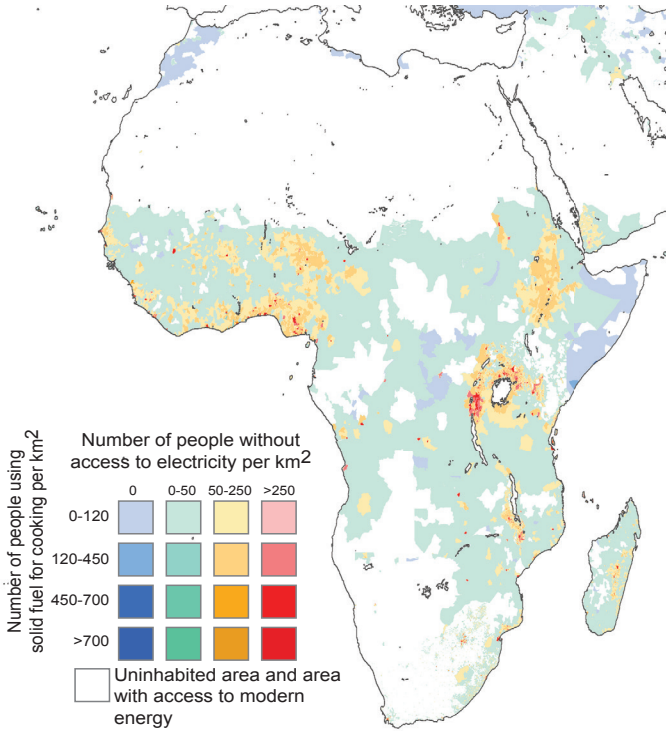
Energy choices have significant local and global environmental and climate impacts, making sustainability a key concern. Yet recent research suggests that achieving universal access to modern energy services using fossil fuels would increase global energy consumption by 7% and contribute, at most, 0.13˚C to global warming.[iv] Hence, many argue that climate concerns should not be a factor in the choice of technologies used to expand modern energy access.[v]

The UN Secretary General's Sustainable Energy for All (SE4ALL) initiative, launched in 2011, is building political momentum for an alternative approach that addresses energy access and climate change together.[vi] SE4ALL's goals are to provide universal access to modern energy services; double the global rate of improvement in energy efficiency; and double the share of renewables in the global energy mix. More than 80 developing countries had signed on as of June 2014, and most had initiated assessments to determine how to achieve the goals.

Yet few countries have pursued climate and energy access goals in tandem before. This is not surprising, given that historically, those facing the biggest energy access challenges also had few emissions to mitigate. That may change as more people in low- and middle-income countries begin to live affluent lifestyles. However, for most developing countries, and in sub-Saharan Africa in particular, it is energy access that remains the priority, to alleviate poverty and support economic development. That raises the question: Can low-carbon options meaningfully contribute to meeting those development goals?

An array of African perspectives

As part of the New Climate Economy project,[vii] SEI and the International Institute for Applied Systems Analysis (IIASA) co-hosted a workshop in Nairobi, Kenya, in April 2014 to examine whether and how low-carbon options are changing conditions for energy access in Africa. The workshop brought together about 40 representatives of academia, government, NGOs, donor organizations, business and development programmes



Energy poverty is widespread in sub-Saharan Africa, where only 14% of rural people have electricity. Map adapted by SEI from Pachauri et al. (2013).[x]

across Africa. Over two days, they explored the extent to which low-carbon options are being used to expand energy access and electrification; what the incentives and barriers to using low-carbon options are; and how low-carbon options fare against other political goals.

The discussion that follows draws on the insights and experiences of workshop participants. The programme followed Chatham House rules, so statements are not attributed to specific individuals. The organizers also prepared a workshop report and shared it with participants, several of whom have continued exchanging knowledge and ideas for future cooperation.[viii]

How can we achieve universal modern energy access?

Significant investments are required to achieve universal modern energy access, though they are only a fraction of total projected investments in the energy sector. The International Energy Agency (IEA) has estimated that achieving universal access to electricity by 2030 will require an average annual investment of US$45 billion, and another US$4.4 billion should be invested annually in clean cooking. About 60% of the electricity investments and 25% of the clean cooking investments, the IEA says, need to be made in sub-Saharan Africa.[ix] IIASA's own analysis suggests US$65–86 billion per year is needed, combined with dedicated policies to lower costs for modern cooking stoves and fuels and accelerate electrification.[x]

Extending access to energy to rural and remote areas can be achieved in three ways: 1) at the household level, using stand-alone "off-grid" technical devices for heating, cooking and

power generation; 2) through community-level "mini-grids"; or 3) through large-scale grid-based electrification. Most past efforts to expand energy access have focused on the latter, with great success, for instance in China.[xi] However, continued grid expansion has been slow in much of the developing world, and faces many barriers, especially in rural areas.

The IEA finds that a grid extension is the most suitable option for all urban zones and about 30% of rural areas, but is not cost-effective in remote areas, where mini-grids, or off-grid solutions would work better.[xii] So while grid-based energy systems – low-carbon or fossil-fuelled power – have a major role to play in increasing energy access, they are not the only solution. Falling costs for renewables, new business models and increasing experience with low-carbon technologies are also making these options more viable, particularly in rural areas. Moreover, low-carbon alternatives offer potential benefits beyond energy access, such as lower air pollution impacts, lower fuel import bills, and decentralized management.[xiii] Thus, it is well worth exploring how they could fit into energy access programmes.

Are low-carbon options being used to expand energy access?

Almost half of African countries have assessed the potential of one or more renewable energy sources.[xiv] Renewable energy technologies are increasingly proving to be the most economical solution for mini-grid and off-grid electrification in remote areas, and are expected to play a major role to meet the SE4ALL objectives.[xv] Africa has one of the world's highest solar PV potentials, and the dramatic price reductions of the past few years have rendered solar PV more affordable.[xvi]

There is also a growing recognition among governments that national policies, regulations, and targets play a very important role in determining the investments and financing models needed to make low-carbon options viable. Morocco's 1996–2012 rural electrification programme (see box) is a prime example of a national government putting in place the necessary policy support, including financing options and regulatory frameworks, to support the deployment of renewables for extending energy access.[xvii]

Governments are also recognizing the wide array of economic, environmental and health benefits that can accrue from low-carbon technologies and services, and many have adopted long-term development strategies that include renewables and energy efficiency improvements. Workshop participants said vision documents such as Ethiopia's Climate Resilient Green Economy[xviii] and the Kenya Vision 2030[xix] have opened up the space for discussing renewable energy options in terms of broader co-benefits such as energy security, income and employment generation, and foreign exchange savings. This has also begun to create a more favourable policy environment for energy access programmes using low-carbon options; this was noted, for example, by developers of improved-cookstove projects in Kenya.

Photo courtesy SOLARKIOSK GmbH

The SOLARKIOSK, developed by a German firm, is topped with solar panels that generate enough energy for solar lighting, mobile phone charging, even a solar fridge. Above, a unit in Botswana.

Making low-carbon options the most suitable choice

Between 1996 and 2012, the government of Morocco implemented a rural electrification programme that increased the rural electrification rate from 18% to 98%. Today, about 15% of the population has access to energy through low-carbon options. Notable success factors in the programme, as highlighted at the SEI-IIASA workshop, include:

1) an operationalized political commitment to universal energy access that involved appropriate institutions and incentive schemes for participation and clear ownership across government levels;

2) a clearly articulated funding scheme that drew on various sources of funds, including a well-defined programme that attracted international funds, targeted subsidies from the national utilities, and a solidarity tax of 2% paid by all households connected to the grid;

3) a strong public-private implementation partnership that offset the high costs of maintaining off-grid home solar systems, thereby offering rural customers electricity at costs comparable to what grid connected households pay;

4) extensive piloting programmes that gathered extensive technical, social and economic data to fully understand the preferences and needs of the end-users, including their willingness to accept the new technology.

Persistent barriers

Along with government-led programmes such as Morocco's, niche markets for renewables are emerging, such as for mobile phone charging stations, but challenges remain. For instance, despite the tremendous potential for solar PV, the market remains largely untapped. South Africa remains the only large-scale commercial market for renewables other than hydropower, with the only large procurement plan for grid-connected renewables.[xx]

Workshop participants also highlighted access to finance as a key impediment to private-sector engagement. Upfront capital costs are often higher than for conventional energy options, investments are riskier, and banks are typically reluctant to offer loans. Overcoming this barrier will require targeted, long-term funding schemes and guarantees, including a robust and supportive institutional framework at the national level.

Renewable-energy entrepreneurs also need strong and reliable business partners and qualified service providers. If governments or international partners want to build strong markets for low-carbon technologies, workshop participants said, they need to build local capabilities to install, maintain and adapt technologies; ensure that spare parts and after-sales support are available; and help build local partners' business and marketing skills as well. This could also have positive spillover effects by increasing public awareness of the benefits of using low-carbon options, which is lacking in many places.

Another barrier cited is that several African countries have fossil-fuel reserves that they consider a key economic resource, which might deter them from pursuing alternatives. Oil has recently been discovered off the coast of Kenya, for example. Although in many places around the world, both renewable energy and fossil fuel development are thriving, workshop participants expressed concern about conflicting priorities, and whether it is politically possible to seriously pursue investments in renewables when fossil fuels remain the default option in most countries.

A key point that arose from the discussion is that low-carbon options are most often judged by how they compete in terms of price and established project implementation capacity, with conventional options, suggesting that the broader socio-economic benefits of renewables, such as lower air pollution and job creation, are seldom considered in the decision-making process.

Understanding the political economy of energy decision-making

Policy decisions are typically made in a context of vested interests, and when energy supply options are introduced, they are backed by different actors, with different approaches and motivations. If decision-making is going to avoid capture by powerful interests and take alternative options seriously, it needs to be based on a democratic deliberation process that weighs multiple factors, including overall development goals and the interests of the marginalized. The process and overall goals will vary across countries, and so will the wider context and constraints within which energy access initiatives are pursued.

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A solar speciality shop in Gulu, Uganda, does brisk business selling panels, batteries, inverters and other items.

A systematic data collection effort on the various co-benefits of low-carbon options would be an important and necessary first step to provide the evidence needed to help decision-makers find the options that yield the most comprehensive benefits for economic development and achieve other political goals. Workshop participants noted three areas where such evidence could be particularly compelling:

1. Reducing health impacts from household air pollution
Evidence of economic losses due to the health impacts of household air pollution would make it easier to broaden "ownership" of energy access issues, to include, for example, ministries of finance and health. Household-level data is already gathered regularly in many countries, to track health and living conditions, among other things; the same channels could be used to gather data on the socio-economic impacts of renewable energy initiatives.

2. Employment opportunities and jobs creation
One of the biggest challenges facing many African and other developing countries is how to generate employment opportunities for young people. Africa's population is the youngest in the world, with 200 million people ages 15–24. Youth also account for 60% of Africa's unemployed.[xxi] To the extent that evidence can be gathered on the job creation potential of low-carbon energy access initiatives, this would be a powerful tool to build political support. This information should be collected across Africa, and should also be considered in context of the potential jobs lost if fossil fuel reserves are not exploited.

3) Linking energy with political goals of national sovereignty and self-sufficiency
The soaring cost of petroleum products is a significant burden for African countries and can seriously hinder their economic growth. In 2010, African countries imported US$18 billion worth of oil – more than what they received in foreign aid.[xxii] To the extent that renewables can make these countries more self-sufficient on energy, it would reduce their exposure to the price and supply volatility of oil imports. Countries are already investing in biofuels production to reduce their need for oil; in Ethiopia, for example, where oil imports are equivalent to 87% of Ethiopia's export earnings, biofuel production is being expanded, and ethanol is being blended into vehicle fuels. To date this has saved more than US$33 million. More evidence of this kind should be collected and shared across countries.

A more ambitious view of 'energy access'

Given existing energy options, costs, and the rapidly growing demand for energy, low-carbon technologies cannot be seen as the only path to modern energy access, but should be given serious consideration. Low-carbon options can only scale-up and play a substantial role, however, if they are cost-competitive and make sense in the context of countries' broader development objectives.

To that end, it matters how we define "energy access". Often the focus is only on basic household access, but that is really just the first step: the ultimate goal is to supply energy at a scale that can support community development and income-earning activities. But planning for a scale-up raises the bar for conventional energy sources as well – what works for small-scale needs, such as a diesel generator or an unreliable power line, may not be acceptable in the long run. The better we understand the benefits and constraints, on the ground, of different technologies, the better-equipped we will be to achieve modern energy access for all.

The context also matters – what other political goals might be attained through measures to increase energy access, such as energy self-sufficiency. It is only by taking such a broad and systemic understanding of energy access that we can begin to understand whether and how low-carbon technologies can meaningfully contribute to achieving modern energy access for development.

Another important take-away from the workshop was that it is crucial to build local knowledge and capacity; the more experience countries have with low-carbon options, the more benefits they will be able to reap from the technologies. Most African nations are just getting started, but they can accelerate progress by collaborating and learning from one another.

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Key action points

• **There is a strong need for robust evidence on synergies and trade-offs between climate change mitigation, energy access, and broader development goals.** Data needs to be collected in a comprehensive, consistent, and systematic way, and should be shared across countries. Studies must examine whether and how low-carbon options are competitive in the longer term, both in terms of cost, and in terms of broader socio-economic impacts.

• **Governments that wish to build successful low-carbon energy markets must play a central leadership role,** to encourage private-sector initiative and entrepreneurship. This will include coherent and consistent strategies, policies, incentives and funding schemes to facilitate investment and help new low-carbon energy businesses get off the ground.

• **The support of other actors, such as donors and international organizations, is also crucial.** In particular, there is a need to focus more on the receiving end of technology transfer, to create the best possible conditions for long-term uptake of new technologies by tailoring them to local needs, engaging local workers and business partners, and building technical and market development capacity.

• **Public awareness of the benefits of using low-carbon options must be built.** The formal school system could be used to help achieve this. It is also vital for government agencies to work with local civil society organizations.

Endnotes

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