How can grids/mini-grids and Solar Home Systems be mutually reinforcing for rapid access impact in 5 years?

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See an earlier engineering-focused CEET policy **brief** "Beyond Basic Electricity Access: The Unrealized Promise Of Solar Power For Economic Growth In Africa".

Executive Summary

The upcoming Africa Energy Summit in Tanzania will elevate a new platform, M300, to bring electricity access to 300 million people in 5 years- about half of the 600 million that lack access today, through coordinated action by multi-lateral banks and private capital. It is not the first such summit, nor will it be the last—but it is a great opportunity to take stock and commit all the key partners to achieving rapid access over the next five years.

The technological means of electricity access are unlikely to change, but how can we achieve scale, and through what kind of financing and institutions would help achieve speed and scale? Those living closest to existing grids are easiest to reach with grid extensions. At the other end of the spectrum, rural populations, which make up the bulk of the 600 million, are already adopting solar lanterns and solar home systems, which are designed to provide essential services such as lighting, torches, radios, and even TVs. Despite their low manufacturing cost, private sector pricing is closer to $5/month for a 10W-started package. Hence, even the 20% that do have such systems cannot use them every day. The remaining 80% are even worse off.

How best should we close the access gap in the next five years, especially since solar home systems by themselves cannot catalyze income and livelihoods?

Some thoughts are:

a. *Should we prioritize electricity access for income-generating activities,* with those living near anchor loads benefitting opportunistically? Here, one needs to identify rural growth nodes (and urban settings, e.g., informal settlements where existing service is poor). The idea is that those far from existing grids would have mini-grid access first since large central infrastructure may take a decade to arrive.
b. Indeed, the primary underlying affordability challenge comes from rural poverty. Should governments and other non-energy partners place far more emphasis on identifying regionally competitive commercialization clusters and then deploy coordinated programs to address poverty while ensuring that the energy sector prevents electricity from becoming a limiting factor?
c. Should *public investments ensure some basic minimum access* levels through solar home systems for those without grid or mini-grid access?

Operationally, we need to shift from upfront capital-cost incentives for household connections towards a combination of capital and operating cost grants while not exceeding the current public costs per household connection through mini-grids or grids. This will bring in more derisked private finance, especially if the operating cost grants are administered through a trusted actor. If the programs are highly successful and the share of private investment increases alongside the growth of the public component, there will be an opportunity to course-correct in five years.

For solar home systems, the high cost of deploying personnel in rural areas to manage customer acquisition and product maintenance poses a challenge. Additionally, uncertain revenues arise due to poor system

utilization and high financing costs, which result in higher monthly payments needed to break even. This, in turn, reduces adoption rates, which currently remain below 20% for reliably providing Tier 1 energy access. We propose that for this bottom-of-the-pyramid segment, an annual grant of $20 per household for assured reliable lighting and cell charging, at minimum, be provided for five years. A good way to start would be to leverage the wider catchment areas of new mini-grids since such operators are already investing in personnel and technical support and, hence, are well-placed to serve solar home systems. Hence, they can ensure maintenance at a low cost. Most importantly, operators will be able to track who is adopting SHS, how much they are using, and who is upgrading, allowing them to determine who to target for more services and appliances and assess viability for possible future mini-grid connections. This will also create synergy with existing and new productive and irrigation loads in the catchment area- perhaps through captive power.

The recurrent costs of serving rural mini-grid customers are also high for similar reasons, and since electricity is sold by kWh, household revenue can be even lower than that for an SHS customer. Moreover, there are limited incentives for mini-grid developers to grow electricity demand—a key metric that would otherwise signal the profitability of mini-grid operations (beyond just connecting customers) and support progress toward broader development goals.

Hence, we propose a simplified strategy.

1. Efficient use of scarce capital and leveraging precious skilled human capital in rural settings through larger concession or franchise areas to operators. Especially in parts of the continent where populations are dispersed and transport infrastructure can vary, a serviceable distance of five to ten km in all directions from one or smaller mini-grid sites can be managed by a single concessionaire. This larger service territory would embed mini-grids that are sited closer to anchor loads, but they are also home to as many as four to eight-fold the number of households compared to those within immediate reach of mini-grids. The concessionaire would be required to ensure that at least half of the households in the larger area are reached by some minimum access standard, e.g., a 10-watt SHS with two LED bulbs and a mobile charging capability. This allows a franchisee to exploit scale economies in procuring, selling, and servicing solar home systems within reach of a mini-grid service center. To meet affordability and adoption constraints, the operator would be assured a grant of about $20/year for five years per household reached. Deep access can be achieved with lower household payments, perhaps closer to $1-$2/month instead of $5. The main benefits would come from leveraging the scarcest commodity of all-skilled personnel, local customer knowledge and consumption data, and a service territory within bicycle or motorcycle reach. This service center would be able to sell efficient appliances, deploy captive systems- e.g., farm-level irrigation on behalf of other programs, maintain power for, say, health centers on behalf of the health ministry, or power water pumps for drinking or livestock, and become a hub for deploying e-mobility and e-cooking solutions.
2. Current incentives and subsidies for the mini-grid operator vary, but a fixed per-connection subsidy and a payment for hard pole/wire infrastructure are common. Current mini grid tariffs, however, are either at par or above grid tariffs. A “public investment neutral” approach would be to lower the upfront connection subsidy from $600 to $400, perhaps even $300. A new load-based subsidy would be provided to the developer, e.g., 20 c/kWh for the first five years. For example, for a 125-household connection, 40 kW peak solar capacity solar minigrid that sells 25,000 kWh/year, the load incentive would generate an additional $5,000/year. If capped at five years, this would generate a total of $25,000, the same amount as the reduction in the upfront connection incentive. But instead of incentivizing a number of low-demand household connections, the new approach would encourage the operator to identify/finance end-use equipment and ancillary services (such as wells) that, in turn, will prioritize load growth. Note that the kWh incentive would not make electricity free; it would just enable the operator to pay for development-oriented growth and lower recurrent costs in rural areas for some time. The developer would identify efficient equipment (not unlike what SHS providers do), provide finance, and leverage greater daytime use of their generation plant during times of solar surplus.

3. Last but not least, the role of government leadership is crucial in identifying what value chains are best suited and in creating commercialization clusters where gaps other than electricity (e.g., water, transport, fertilizer, agronomy, and markets) are underappreciated. This was how the Green Revolution was orchestrated, and this was how the success with wheat or barley was achieved in Ethiopia. This allows the government to direct multiple entities, whether it is agriculture, transport, water, or procurement, to coordinate efforts towards a specific value chain. This way, no one bottleneck will impede the impact that electricity can have. One immediate way to begin is by identifying who is already leveraging their local agroecological and market advantage and is using expensive manual or diesel power- providing a clear indication that, indeed, energy is a constraint. Minigrid operators, to incentivize load growth, could enlist third-party providers specializing in ancillary services and sales/financing of value-addition equipment. Note that mini-grid developers, for the most part, are in the business of electricity provision and not necessarily in the business of turning electricity into economic development.
4. Grid access. There are some well-regulated, financially viable electricity utilities, even though this seems to be a rarity. A central grid is suited to serve agricultural, commercial, and industrial loads as well as smaller household loads if economic activity is vibrant and electricity demand levels can grow. It is worth keeping in mind that these grids will continue to be needed to integrate diverse larger-scale supply options and possibly to even allow deeper integration of decentralized renewables and newer demands from e-mobility, e-cooking, and cooling. It is technically feasible now to boost distribution network capacities and reliability with feeder-scale decentralized supply and strategically placed storage. These ideas mesh with decarbonization and least-cost approaches in the long run. The good news is that many countries in Sub-Saharan Africa can implement such innovations much faster without legacy institutions.

In summary, to reach the M300 goals, we would have provided multiple-fold households with access in the same 5-year time frame and incentivized the operator to meet vibrant economic growth.

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