

POWER FOR ALL FACT SHEET

Mini-grids costs can be reduced by 60% by 2030

POWER FOR ALL

\$0.55–0.60/kWh

2019 MINI-GRID LEVELIZED COST OF ELECTRICITY

\$0.22/kWh

PROJECTED 2030 MINI-GRID LEVELIZED COST OF ELECTRICITY

30%

POTENTIAL O&M COST SAVING FROM REMOTE MONITORING

Understanding different mini-grid cost metrics supports informed decision-making. For instance, the levelized cost of energy (LCOE) accounts for all costs spread over the lifetime and load profile of a mini-grid, including capital expenses (CAPEX), operating expenses (OPEX) and therefore is an indicator for the cost-reflective tariff. Meanwhile, upfront cost per kW helps drive project investment decisions, and the per connection cost is strongly linked to electrification targets and performance-based grants. This fact sheet synthesizes the latest data points on mini-grid costs based on new reports published by Rocky Mountain Institute (RMI)¹, the World Bank (WB)², AMMP Technologies (AMMP)³, the International Renewable Energy Agency (IRENA)⁴ and Wood Mackenzie Power & Renewables (WM)⁵.

Mini-grids are the least-cost electrification solutions for 490 million people by 2030, however based on studies comparing mini-grids in Africa to diesel alternatives, their LCOE of US\$0.60/kWh needs to be more than halved to allow for an affordable cost-reflective tariff.

- » Upfront cost per connection for mini-grids is around US\$500–2,100, similar to the unsubsidized cost for traditional grid connections. In remote areas, mini-grids are the preferred options for electrification as grid extension costs increase. (WM, p.7; WB, p.8)
- » Similarly, in terms of upfront cost per kW installed, solar-hybrid mini-grids today cost US\$3,908/kW on average. By 2030, this will fall below US\$3,000/kW, already falling within the range of utility-scale solar CAPEX in Africa, which was US\$1,300–4,100/kW in 2015–16. (WB, p.3; IRENA, p.9)
- » Analysis shows that the best-run unsubsidized solar-hybrid mini-grids have a levelized cost of energy (LCOE) of US\$0.55–0.60/kWh. This is indicative of the cost-reflective tariff for a private mini-grid developer without subsidy. (RMI, p.17; WB, p.3)
- » In some countries, unsubsidized mini-grids are already able to compete with gasoline or diesel generators, whose LCOE falls between US\$ 0.35–0.70/kWh. So to be comparable with the grid electricity LCOE of US\$0.27/kWh average for Africa, mini-grids need to cut costs by more than half. (RMI, p.17; WB, p.3)

Batteries, fuel, and operation and maintenance (O&M) are the main technical costs of solar-hybrid mini-grids. Poor asset utilization, costly financing and regulatory barriers also drive up costs.

- » 60% of mini-grid LCOE is due to upfront costs, among which 48% is from capital expense (CAPEX) and 12% from project development and installation. (RMI, p.18)
- » 40% of mini-grid LCOE is ongoing costs, which include fuel cost of 20%, operation and maintenance (O&M) 13%, and losses and utilization 7%. O&M costs consist of 44% labor costs, 30% logistics and 26% component replacements. (RMI, p.18; AMMP, p.5–7)
- » Poor utilization rates drive up the mini-grid cost per unit of electricity sold especially for solar-hybrid mini-grid systems because of the excess power that is neither stored nor consumed. Low electricity consumption is related to rural consumers' lack of access to electrical appliances and loans. (RMI, p.16)
- » Mini-grid companies struggled to secure equity and low-cost debts, with interest rates for commercial debt being 15% or more in sub-Saharan Africa, as compared to 5% or less in OECD countries. (RMI, p.16; World Bank Data)⁶
- » Finally, regulatory and policy barriers slow progress and also increase costs. Unpredictable licensing and tariffs requirements pose threats to mini-grid profitability. (RMI, p.16,17)

Join the conversation:

powerforall.org
twitter.com/power4all2025
facebook.com/pwr4all

POWER FOR ALL FACT SHEET

Mini-grids costs can be reduced by 60% by 2030

By the Numbers:

\$0.55–0.60/kWh

2019 MINI-GRID LEVELIZED COST OF ELECTRICITY

\$0.22/kWh

PROJECTED 2030 MINI-GRID LEVELIZED COST OF ELECTRICITY

30%

POTENTIAL O&M COST SAVING FROM REMOTE MONITORING

Analysis by RMI and AMMP shows that hardware cost decline, system standardization, remote monitoring, demand stimulation, low cost financing and minimizing regulatory barriers can reduce the mini-grid LCOE by 60%.

- » Through a series of hardware, finance and policy interventions, RMI's case study in Nigeria finds the mini-grid LCOE can be reduced by 60%, reaching US\$0.25/kWh by 2020 and the World Bank projects that global mini-grid LCOE can be lower to US\$0.22/kWh by 2030. (RMI, p.22; WB, p.3)
- » More specifically, the mini-grid LCOE can be reduced by 20% by leveraging ongoing hardware cost decline, bulk purchasing and streamlined procurement and standardized design for large-scale deployment. (RMI, p.23,24)
- » Standardized mini-grid system designs and simplified construction methods can lower engineering time by a third and installation time by 80%, and ultimately reduce LCOE by 20%. (RMI, p.24)
- » Remote monitoring of power generation, storage and consumption can cut mini-grid O&M cost by 30% (LCOE by 4%) by reducing the number of site trips and prolonging component lifetime, therefore cutting labor, logistics and component replacement costs. (AMMP, p.7,10,13; RMI, p.18)
- » Demand stimulation, stronger customer engagement and promoting productive use can improve asset utilization and lower LCOE by 23%. (RMI, p.26,28)
- » Enable low cost financing is a possible pathway to reduction of mini-grid costs. Reducing cost of capital by 4% can shave 5% off mini-grid's LCOE. (RMI, p.31)
- » Minimizing regulatory barriers, such as through tax exemption and simplified permitting procedures, can unlock additional investment and reduce mini-grid costs by 5%. (RMI, p.31)

Share the Message

- » The current mini-grid LCOE of US\$0.55–0.60/kWh is competitive to diesel gensets, but needs to be halved to be able to adopt a cost-reflective tariff comparable with national utilities in Africa.
- » Poor asset utilization, costly financing options and regulatory barriers are the main drivers of costs for mini-grids.
- » Solar-hybrid mini-grid LCOE can be reduced by 60% and reach US\$0.22/kWh by 2030 by leveraging hardware cost reduction, remote monitoring technology, system standardization, demand stimulation, low cost financing and minimizing regulatory barrier.

Sources:

1. "Six ways to reduce mini-grid costs by 60% for rural electrification". Rocky Mountain Institute, 2018.
2. "Mini Grids for Half a Billion People". The World Bank, 2019.
3. "Reducing the cost of operations and maintenance for remote off-grid energy systems". AMMP Technologies, 2018.
4. "Solar PV Cost in Africa". International Renewable Energy Agency, 2016.
5. "Strategic investment in off-grid energy access". Wood Mackenzie Power & Renewables, 2019.
6. "World Bank Data [internet]". The World Bank. [accessed: Apr. 23, 2019]