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Off-Grid Solar's Poverty Premium

PAYGo Solar Models Leave the Poorest Behind

BLUF: Government programs and development partners typically assume off-grid solar solutions are inherently "pro-poor" — and an optimal fit for electrifying poor, rural areas. Yet, because the off-grid solar market depends on expensive commercial capital, **we are asking the poorest Africans to pay the highest unit price for basic electricity**. A wealthy urban household in Nairobi or Lagos pays grid tariffs subsidized by the government. Yet, a rural household in northern Zambia or Nigeria using off-grid solar pays higher per-kWh costs, financing charges, and bears a higher total cost of ownership. Without a mindset shift toward public-good financing, off-grid solutions will continue serving only the "almost poor", while excluding those most in need.

Context

Across sub-Saharan Africa, off-grid solar is widely seen as the cheapest and fastest route to electrifying rural communities.[1,2] Many rural households now get first-time electricity access from solar appliances, solar home systems, and minigrids sold by private off-grid solar providers. These companies typically rely on grants and concessional support from the development ecosystem to demonstrate commercial viability.[3,4] However, as they expand, they often turn to venture capital and commercial debt because development finance cannot support long-term scale.

This creates two fundamental and interconnected tensions. Commercial capital demands high returns, which rural customers with low incomes are ill-suited to meet. And typical payment models designed to recover those returns intensify the burden on low-income users. The mismatch between the financing model and the customer base shapes the cost of capital, business models, and repayment structures in the off-grid solar industry, and, ultimately, who gets served and who gets left behind.

The Capital Behind Off-Grid Solar is Priced for Commercial Returns — Not Poverty Alleviation

The companies dominating Africa's off-grid solar landscape include Sun King, Bboxx, d.light, Zola Electric, and M-KOPA. Their growth relies on a blend of financing sources:

[1] Between 2020 and 2022, off-grid solar accounted for 55% of all new connections.
[2] ESMAP, GOGLA, Dalberg. 2024. *Off-Grid Solar Market Trend Report 2024*. Washington, DC: The World Bank. License: Creative Commons Attribution CC BY 3.0 IGO
[3] Multilaterals, bilateral donors, philanthropies, impact investors
[4] Lighting Global/ESMAP, GOGLA, Efficiency For Access, Open Capital Advisors (2022), *Off-Grid Solar Market Trends Report 2022: State of the Sector*. Washington, DC: World Bank.

- **Equity (especially venture capital or growth equity).** Equity raises by Sun King, Bboxx, d.light, and M-KOPA are fuelling their expansion. The investors providing these funds typically target 20-40% returns, which are high by global standards.
- **Debt (secured, receivables-backed, and local-currency facilities).**[5] Debt facilities such as Standard Bank Group's $200M loan to M-KOPA and Sun King's $156M receivables-backed securitization in Kenya are also supporting the companies' growth. Average lending rates are 10-20+% across many African markets, especially where significant energy access gaps exist, like Nigeria (27%), Congo (17.5%), and Ethiopia (15%).
- **Catalytic and concessional capital (grants, results-based financing, and first-loss).** This is cheap financing that supports early market entry and pro-poor projects. Examples include the World Bank-funded Nigeria Electrification Project and Rwanda's Results Based Financing programs.

What this means for customers: High financing costs get passed on to customers through pay-as-you-go (PAYGo) and lease-to-own pricing models. Customers pay a deposit to acquire a system and pay the remainder over 12 to 24 months. By the end of a repayment cycle, a household may pay over twice the system's retail price. For example, Sun King's 50W Home 500X system costs NGN 165,000 upfront in Nigeria, but under its 74-week PAYGo plan, a customer pays a total of ₦319,300 — a 94% increase.

This is not because off-grid solar providers are predatory — it is because the capital funding their operations is priced for commercial returns, not poverty alleviation.

The PAYGo Model Doesn't Match the Market

The PAYGo business model was designed to make off-grid solar affordable by spreading costs over time. And in some African markets, such as Rwanda, Kenya, and parts of West Africa, it has dramatically expanded electricity access. PAYGo is typically used for Tier 1 and Tier 2 off-grid solar products that power basic lighting and small household appliances.[6] But three structural challenges undermine its suitability for rural, low-income customers.

1. **Monthly payments exceed rural household budgets.** For PAYGo to be considered affordable, repayments should be less than 5% of monthly income.[7] Most Tier 1 and 2 products cost US$100-300, and under standard PAYGo terms, monthly repayments are ~$10-30.[8] Many rural households live on less than $2 a day (or $60 a month), making PAYGo installments unaffordable.[9] One study found that half of households without electricity access cannot afford a basic Tier 1 system, and 97% cannot afford Tier 2. Faced with this, companies move upmarket to peri-urban or wealthier customers.

[5] Secured debt is backed by collateral; receivables-backed debt is secured with future customer payments; and local currency debt is issued in the same currency that the company earns revenues.
[6] Based on the World Bank's Multi-Tier Framework for measuring energy access. Tier 1 and Tier 2 refers to systems with capacities of 3-50 Wp and 50-200 Wp, respectively. This equates to a maximum annual consumption of about 72 kWh per household at Tier 1 and 364 kWh at Tier 2.
[7] ESMAP, GOGLA, Dalberg. 2024. *Off-Grid Solar Market Trend Report 2024*. Washington, DC: The World Bank. License: Creative Commons Attribution CC BY 3.0 IGO.
[8] Assumptions from ESMAP report: 20% down payment, 40% financing charge, and 12-36 months repayment timeframe.
[9] GOGLA, Hystra. 2020. *Pricing Quality Cost Drivers and Value-add in the Off-Grid Solar Sector*.

2. **High default rates weaken business viability.** Rural customers often have irregular or seasonal incomes, which makes it difficult to follow fixed repayment schedules. Since COVID, many off-grid solar companies have reported rising default rates, which have worsened unit economics and caused some firms to lose money on each system sold. In 2023, about half of PAYGo customers were either written off or had delayed payments by more than 30 days. Companies adapt to this reality by hiking prices, shortening repayment windows, requiring higher deposits, or avoiding rural areas altogether. This defeats PAYGo's role as a pathway toward universal energy access.
3. **PAYGo requires a rapid cost recovery.** Because companies heavily rely on commercial capital, they must recover costs quickly to recycle capital for growth. This keeps repayment cycles short, financing charges high, and products unaffordable for the poorest households.

For these reasons, PAYGo works better in peri-urban and emerging middle-income customers (the "almost poor"). It fails the poorest.

History Shows that Universal Electrification Depends on Public Capital

Universal electrification has rarely been achieved through commercial capital alone — in Africa or elsewhere. In most countries, the state led rural electrification efforts, often paying most of the costs. For example:

- **Kenya** dramatically expanded rural electrification through government-led, donor-supported last-mile programs that subsidized connection fees.[10]
- **Rwanda** accelerated electrification through strong public planning, subsidies for solar kits, and donor-supported Results Based Financing subsidies.[11]
- **Ethiopia** electrified millions through grid expansion funded by concessional loans and grants.
- **Globally**, Vietnam,[12] China,[13] and the USA[14] electrified rural areas with state investment programs.

The same pattern emerges everywhere: Successful rural electrification is a state-led, publicly financed effort. Private companies play an important role, but they complement public investment rather than replace it. Relying on commercial capital to deliver universal access is historically unprecedented and fundamentally misaligned with the income realities of rural Africans. We need to reassess the expectation that commercial actors and venture capital-backed models will electrify the poorest communities.

[10] Kenya's Last Mile Connectivity Project was led by the Kenya Power and Lighting Company, and supported by the World Bank, African Development Bank, Agence Française de Développement, and European Union
[11] State-owned Rwanda Energy Group led RBFs supported by Asian Infrastructure Investment Bank and African Development Bank
[12] Electrified 97% of rural areas by 2010 through direct government investment, supported by multilateral donors.
[13] Used central government planning and investment to electrify 900 million rural people in under 30 years.
[14] The 1936 Rural Electrification Act allowed the federal government to give cheap loans to rural cooperatives for electrification. Rural electrification rose from about 10% in the 1930s to over 90% within 20 years.

The Energy-Development Ecosystem Needs a Mindset Shift

1. **Recognize the limits of PAYGo off-grid solar.** It can be transformative for certain segments, but it is not a solution for universal access. It works for customer segments with higher income levels, such as productive-use appliances, commercial and industrial solar, and peri-urban markets. Funders should stop treating it as the default strategy for last-mile electrification of the poorest households.
2. **Treat electricity access as a public good, not a commercial product.** Energy access for the poorest should be akin to primary healthcare or education, which require planning, subsidies, and long-term public financing.
3. **Scale subsidies that directly reduce retail prices:** Results Based Financing subsidies like those used in Rwanda and Kenya work. They lower connection costs without distorting markets or inflating prices.
4. **Use catalytic capital to reduce the cost of capital:** Blended finance should focus on first-loss capital, concessional debt, foreign exchange hedges and guarantees, and local-currency facilities. This reduces repayment pressure and makes PAYGo or mini-grids more affordable.

Conclusion

The off-grid solar sector has delivered electricity to millions, but its financing model remains fundamentally commercial and therefore incompatible with Africa's poorest rural households. Reaching those left behind will require philanthropies, development funders, and governments to shift from a "commercialization first" mindset to a "public good first" approach. Universal access requires subsidies, public leadership, catalytic finance, and an honest acknowledgment of what commercial capital can and cannot deliver. Commercial capital has an important role — but it cannot be the backbone of rural electrification. Without this shift, access for the poorest will remain slow, expensive, and inequitable.