

Electrifying PNG: challenges and opportunities for decentralised solar



Rooftop solar in Port Moresby, Papua New Guinea
Photo Credit: Christian Lohberger

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Papua New Guinea is facing an electricity access crisis. Only 14% of its population has access to the grid, and even those connected experience unreliable and costly power. With rugged terrain, scattered rural communities and a financially stressed national utility, extending the central grid to meet the government's 2030 electrification target of 70% will be challenging.

Decentralised solar systems, whether individual home kits or small-scale mini-grids, offer a scalable, cost-effective solution to PNG's electrification challenge. Solar technology is getting cheaper and PNG has abundant sunshine. What is needed is the institutional, financial and technical ecosystem to make decentralised solar work at increased scale.

In a new paper, we explore why PNG's grid has struggled to expand, what role decentralised solar could play and how other countries have overcome similar challenges. We then outline key steps PNG can take to turn decentralised solar from a promising technology into a viable nationwide electrification solution.

PNG Power Ltd (PPL), the national utility, is struggling. It operates an ageing grid, sells power below the cost of production and faces payment arrears from government departments. Outside investors are wary of engaging with PPL due to poor payment security and the lack of sovereign guarantees.

PNG's power sector suffers from fragmented oversight, complex land-tenure arrangements and regulatory uncertainty. Independent power producers are discouraged from investing in grid-based expansion by legal grey areas, foreign exchange shortages that affect equipment imports and profits, and a procurement system that lacks transparency.

Extending the grid to rural areas is expensive. Building power lines through mountainous terrain is difficult and capital costs for power plants in PNG can be two to three times higher than in comparable countries. Research shows that villages located just five kilometres from an existing power line can often be served more

cheaply through solar.

Decentralised solar avoids many of the grid's problems. There is no need for transmission lines, no fuel logistics and no dependence on a struggling utility. With PNG's high solar potential, a basic home system can provide lighting, phone charging and power for small appliances for far less than the lifetime cost of running diesel generators or using kerosene appliances.

Decentralised systems that incorporate batteries also build resilience. When the grid power suffers a "black-out", solar-powered systems keep the lights on. And because systems can be expanded incrementally, villages can start small and scale up as needs and resources grow.

This approach is already in use. About half of PNG's total electricity generation is already off-grid, mostly diesel systems run by mines, agribusinesses and institutions. The challenge is extending this model to the broader population, especially in rural communities with limited cash income and low technical capacity.

Decentralised solar could play a major role in expanding energy access across PNG, particularly in remote areas where grid extension is unlikely. But progress has been slow, held back by a mix of financial, regulatory, technical and community-level challenges. A more coordinated approach that draws on the experience of contemporary countries could help unlock the sector's potential.

Affordability remains one of the biggest barriers. A typical solar home system costs between US\$500 and US\$700, a price that's out of reach for most rural households without financing options. In Kenya and Tanzania, mobile money platforms enabled pay-as-you-go (PAYG) solar systems to reach millions of users, spreading costs over time in manageable amounts. In contrast, PNG's limited mobile money infrastructure and logistical difficulties have made it harder to apply similar models. To improve access, the government could support PAYG providers through targeted incentives, reduce remaining import duties on solar products and encourage local banks and microfinance institutions to offer loans for solar purchases. Payroll savings schemes, where urban workers finance systems for their home villages, could also provide an innovative way to connect city income with rural energy needs.

Finance alone, though, is not enough. Across the Pacific, including in PNG, many donor-funded solar systems have failed within a few years due to a lack of maintenance. Batteries wear out, components break and there are often no trained technicians available to undertake repairs. Tuvalu offers a useful example: long-term sustainability there has depended on regular maintenance and strong

community involvement. PNG needs to follow a similar path by establishing a national maintenance network, supported either by the public or private sector, and ensuring that maintenance plans are built into every installation from the beginning. While PNG has adopted the [Lighting Global standards](#) to ensure product quality, enforcement has been limited and technician training remains underdeveloped.

Clear regulation is another essential piece of the puzzle. At present, PNG's National Energy Authority has drafted an off-grid regulatory framework but it has yet to be approved. This leaves companies unsure whether they're operating legally, how to set tariffs and whether their systems will be protected if the main grid later reaches their service areas. In India, a supportive policy environment has helped scale up rural mini-grids, with rules that specify how these systems will be treated as grid infrastructure expands. PNG could adopt a similar approach, providing legal certainty for investors while protecting community systems from being abandoned or dismantled.

Land access is another important consideration. Even small solar installations need land and with 97% of PNG under customary ownership, developers must negotiate with local landowners — often a complex and time-consuming process. Projects that don't build trust early on risk being delayed or derailed by disputes. Successful initiatives in other countries, such as Bangladesh's Infrastructure Development Company (IDCOL) program, have shown the value of community engagement and local partnerships. IDCOL combined donor funding with microfinance and a strict quality assurance regime to deploy over four million solar home systems, in part because it worked closely with users and treated them as customers, not just beneficiaries.

Ultimately, all of these issues — finance, maintenance, regulation and community involvement — are interconnected. Making systems affordable won't deliver results if they break down within a year. Good quality equipment still needs policy support to operate at scale. And no regulation can succeed if communities aren't engaged and supportive. The experience of other countries shows that with the right mix of financing models, long-term support, clear rules and genuine community involvement, off-grid solar can thrive.

Decentralised solar energy is not a silver bullet. However, it is currently the best solution to push PNG towards widespread electrification in the next decade. If the right enabling environment is created to allow the industry to grow, solar can transform lives in rural PNG. It can improve health outcomes by powering clinics and reducing indoor air pollution (from kerosene lighting), enhance education by enabling evening study with proper lighting, and unlock economic opportunities through phone connectivity and electric tools. For PNG, the challenge now is not to

invent something new but to apply and adapt these proven solutions in ways that fit its unique context.

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Link:

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