A. Sector Road Map

1. Sector Performance, Problems, and Opportunities

a. Overview

1. Papua New Guinea (PNG) has one of the lowest electrification rates in the Pacific, with only 13% of the population having access to electricity. In PNG, grid-connected power is still primarily restricted to the main urban areas. Supply is often unreliable when power is available (generally in the main urban centers). Access to electricity is very limited in off-grid rural areas. Lack of access to affordable, reliable power limits economic growth in urban areas, constrains growth in smaller urban centers and contributes to poverty in rural areas. Most provincial centers are supplied entirely through diesel generation, resulting in high generation costs and low power supply quality. Hence, PNG’s per capita electricity consumption is among the lowest globally.

2. PNG has a total of 600 megawatts (MW) installed generation capacity. PNG Power Limited (PPL), the national state-owned corporatized power utility, manages the generation, transmission, and distribution of about 320 MW, including three main grids (Gazelle, Port Moresby and Ramu) servicing the main urban centers. PPL also manages 19 geographically isolated 'mini' distribution medium- or low-voltage power grids (mini-grids) servicing 26 smaller provincial centers. These isolated provincial mini-grids are powered entirely on diesel, resulting in high generation costs. The remaining capacity of about 280 MW comprises (i) self-generation systems owned and operated by industrial facilities, including mining companies, and (ii) private generators supplying the main grids or rural communities. PNG’s mountainous terrain and geographically dispersed population compound the challenge of developing town/rural electrification infrastructure. High network losses (technical and non-technical losses are about 24%), high household connection charges, lack of coordination and leadership in the energy sector, and weak governance and financial management within PPL increase the challenge of implementing the government’s power sector road map.

b. Sector Issues

3. The energy sector faces several key development challenges, as described below.

(i) Gazelle, Port Moresby, and Ramu power grids. Robust economic growth translates into rapid growth in demand for power in the main urban areas. The unreliable and low-quality power supply may limit economic growth to the main urban areas. Moreover, considerable self-generation and backup generation are still occurring in urban areas. Maintenance and operation costs of power generation are high and efficiencies low. Therefore, large

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1. Grid penetration in rural areas is less than 4%.
2. PNG’s 600 MW of installed capacity is generated by hydropower (40%), diesel (38%), gas fired (14%), and geothermal (8%).
3. PPL is a state-owned power authority responsible for the generation, transmission, distribution, and retailing of electricity throughout PNG. It serves a diverse range of industrial, commercial, government, and domestic customers in urban centers and rural communities across the country. PPL was established under the Electricity Commission (Privatization) Act (2000) and is also governed by the Electricity (Amendment) Act (2021) and the Companies Act (1997). Kumul Consolidated Holdings Limited acts as the sole shareholder on behalf of the government. The minister for public enterprise and state investments appoints the PPL board, which comprises eight directors and provides regular financial and operational reports and a 5-year business plan to Kumul Consolidated Holdings Limited.
4. These grids are not interconnected.
investments from both the public and private sectors are required in power generation and transmission (both expansion and upgrade) and in the distribution grids of Gazelle, Port Moresby, and Ramu, which serve the major demand centers of PNG.

(ii) **Town and rural electrification.** The difficult geographic conditions mean that extending existing power grids to more than a small percentage of the rural population is not technically or financially feasible. Power demand is relatively low in isolated rural areas, and operation and maintenance costs for diesel-based mini-grid systems in these areas are considerably higher. These factors create disincentives for PPL to expand its grids into provincial centers and rural regions.5

4. Governance and financial management within PPL have historically been weak. Maintaining the independence of the company's board and management is a critical risk, as the entity is susceptible to political influence. Poor asset management and PPL's inadequate ability to control costs and collect revenue are key contributors to the issues. These constraints, combined with a high turnover of key management personnel and low capacity because of a shortage of skilled workers, make it difficult for PPL to implement an operational and financial improvement strategy and adversely impact government plans to expand electricity access.

5. PPL's electricity tariff is regulated based on the Building Block Model consisting of the weighted cost of capital, capital expenditures and operational expenditure, and depreciation. This model is applied across PPL's generation, transmission, and distribution businesses, allowing full cost-recovery for PPL. Since 2022, the responsibility of regulating the energy sector has moved from the Independent Consumer and Competition Commission to the newly founded National Energy Authority. Under the concessional agreement between the regulator and PPL, a uniform energy tariff shall apply to all service areas (irrespective of local generation costs) covered by PPL, depending on consumer category. The electricity tariff has been constant since the second quarter of 2013. Although the regulatory contract allows PPL with the regulator's approval to adjust tariff rates quarterly solely based on fuel price fluctuations, PPL has been unable to exercise this option since 2013 because of political interventions.

2. **Government's Sector Strategy**

6. The PPL's Fifteen-Year Power Development Plan (FYPDP), 2016–2030, was updated in 2016 and again in February 2019 with a new time frame of 2018–2032. The plan includes a road map for priority power infrastructure development to meet future growth targets established under the Papua New Guinea Development Strategic Plan, 2010–2030 and the electricity industry policy (EIP). In May 2016, with support from the Asian Development Bank (ADB), the government developed its 15-year National Distribution Grid Expansion Plan (2017–2031), covering the technical, financial, and economic aspects of distribution expansion in 28 of 35 PPL demand centers. According to the National Electrification Roll Out Plan (NEROP) developed by the

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5 Provincial governments are responsible for managing village power systems; however, because of insufficient operating budgets and maintenance capacity constraints, most village power systems have ceased to operate. Barriers to upscaling village and household-based generation systems include (a) lack of community service obligation funding to install power systems; (b) lack of viable operation and maintenance models; and (c) low cash generation in the villages, which results in household power systems not being affordable.

6 Clause 3.2(a)(i) of the Contract on Tariff Formulation.

7 The EIP, which was enacted in 2011, (i) encourages private investment in the power sector by facilitating competition and developing a clearly defined access regime, (ii) transfers a range of regulation functions from PPL to the government, and (iii) upscales rural electrification through government assistance. The EIP will support state financing of civil society organizations through establishment of an electricity trust fund.

World Bank in cooperation with the government, PNG's power sector requires $1.7 billion to achieve the government's 70% electrification target by 2030. The Power Sector Development Project will support the implementation of FYPDP and NEROP.

7. **Private sector.** The government and PPL recognize that the private sector will play an important role in providing investment and management capacity to expand the energy sector. The government is developing incentives and risk allocation schemes for investors and lenders to attract investment. The public-private partnership (PPP) model has enjoyed considerable success globally. The government is framing laws and regulations to support such transactions. The following documents govern PPP procurement in PNG:

- National Public-Private Partnership Policy, 2008 (Draft 1), prepared by the Public-Private Partnership Task Force; and
- Public-Private Partnership Act, 2014 (amended in 2022)

B. **Major Development Partners: Strategic Foci and Key Activities**

8. ADB is coordinating all project-related activities closely with other development partners. The table below lists the indicative projects of major development partners active in PNG.

<table>
<thead>
<tr>
<th>Development Partner</th>
<th>Project Name</th>
<th>Duration</th>
<th>Amount ($ million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADB, MFAT</td>
<td>Town Electrification Investment Program (Tranche 1)</td>
<td>2010–2020</td>
<td>$59.1</td>
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<tr>
<td>ADB</td>
<td>Town Electrification Investment Program (Tranche 2)</td>
<td>2017–2020</td>
<td>$45.9</td>
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<td>ADB</td>
<td>Port Moresby Power Grid Development Project</td>
<td>2013–2022</td>
<td>$66.7</td>
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<td>ADB, AIFFP</td>
<td>Power Sector Development Project</td>
<td>2021–2027</td>
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<tr>
<td>ADB</td>
<td>State-Owned Enterprises Reform Program</td>
<td>2020–2022</td>
<td>$500.0</td>
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<tr>
<td>DFAT</td>
<td>Edevu-POM 132/66kV Transmission line + substation + Moitaka upgrade</td>
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<td>A$73.0</td>
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<tr>
<td>DFAT</td>
<td>Niupower to Kanudi Trans Line Capacity Upgrade (34 to 80MW)</td>
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<tr>
<td>DFAT</td>
<td>Port Moresby and Ramu Grid Dynamic Modelling Studies</td>
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<td>DFAT</td>
<td>9MW Solar + 2 Hr Battery Storage in Markham</td>
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<td>DFAT</td>
<td>Rehab of Ramu 1 Hydropower</td>
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<td>A$3.0</td>
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<td>DFAT</td>
<td>Tariff Price Setting Training of PPL Staff</td>
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<td>A$0.18</td>
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<td>DFAT</td>
<td>Mini Grid Upgrade / New Generation</td>
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<td>DFAT</td>
<td>POM Grid Urgent Repairs</td>
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<td>Energy Meters</td>
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<td>Enga Electrification</td>
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<tr>
<td>MFAT</td>
<td>Enga Electrification</td>
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<td>NZ$5.0</td>
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<tr>
<td>MFAT</td>
<td>ROGE -Existing distribution line in Sabusa and Hula and Enga</td>
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<td>NZ$11.7</td>
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<tr>
<td>JICA</td>
<td>Ramu Second Line Transmission - Existing</td>
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<td>Special Grant to Support Ramu Transmission</td>
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<td>Technical Corporation to Fund Capacity Building and Hybrids Study</td>
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<td>USAID</td>
<td>Papua New Guinea Electrification Partnership (PEP) Activity</td>
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<td>Energy Utility Performance &amp; Reliability Improvement Project</td>
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<td>World Bank</td>
<td>PNG Energy Sector Development Project</td>
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</tr>
</tbody>
</table>


Sources: PNG Power Limited and ADB.
C. Institutional Arrangements and Processes for Development Coordination

9. The Department of National Planning and Monitoring (DNPM) is in charge of coordinating foreign development assistance. The DNPM works closely with the Department of Petroleum and Energy, the Treasury Department, and PPL. Extensive consultation with development partners such as the United States Agency for International Development, the Government of Australia (including the Australian Infrastructure Financing Facility for the Pacific), Japan International Cooperation Agency, and the World Bank Group took place throughout project design.

D. ADB Experience and Assistance Program

10. ADB has provided $171.7 million in loans and $3.4 million in technical assistance and will continue to mobilize support to improve the sector's sustainability and effectiveness. ADB has supported the sector since 2010, primarily through the Town Electrification Investment Program multi-tranche financing facility. That program, with two tranches, has helped the government improve the power supply in provincial centers by replacing high-cost diesel generation with hydropower and grid expansion. ADB also provided support to connect rural communities along the transmission lines constructed under the Town Electrification Investment Program. ADB helped improve network reliability and increase the share of renewable energy in the Port Moresby grid.

11. The project supports the operational priorities of ADB's Strategy 2030 by (i) addressing remaining poverty and reducing inequalities; (ii) accelerating progress in gender equality; (iii) tackling climate change, building climate and disaster resilience, and enhancing environmental sustainability; (iv) making cities more livable; and (v) strengthening governance and institutional capacity. It will contribute to Sustainable Development Goal 7: ensuring access to affordable, reliable, sustainable, and modern energy for all. The project is in line with ADB's 2009 Energy Policy and country partnership strategy for PNG, 2021–2025, and is included in ADB's country operations business plan for PNG, 2021-2023. ADB will leverage SOE reform through new policy-based lending to support SOE reform in PNG. The project will also help further sector reforms by strengthening the financial management capacity and governance structure of PPL. Through Pacific Private Sector Development Initiative, ADB has supported the government’s PPP Task Force to prepare detailed project development guidelines, PPP Centre budget estimates, position descriptions, and other key institutional materials.

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13 By enhancing the continuity and resilience of energy supply during extreme weather events.


17 ADB. 2020. *Report and Recommendation of the President to the Board of Directors: Proposed Programmatic Approach and Policy-Based Loan to Papua New Guinea for the State-Owned Enterprises Reform Program (Subprogram 1)*. Manila.

Problem Tree for Energy

Causes

- Weak grid to off-take intermittent electricity generated by renewable energy
- Difficult terrain and scattered population
- High share of fossil fuels generation in national energy mix
- Weak governance and operational capacity of PPL

Effects

- Low private sector investment in generation, transmission, and distribution assets
- Low electricity access in town and rural areas
- Low penetration of renewable energy

Papua New Guinea (PNG) has one of the lowest electricity access rates in the Pacific

- Increase in investment costs of infrastructure and the risks of private entities to invest in PNG
- Decrease in welfare caused by high electricity tariffs
- High public expenditure on oil imports for power generation

Reduced economic development and inclusive growth