

SECTOR ASSESSMENT (SUMMARY): POWER¹

Sector Road Map

1. Sector Performance, Problems, and Opportunities

1. In Papua New Guinea (PNG), less than 10% of the population has access to electricity. Where power is available (generally in the main urban centers), the supply is often unreliable. This 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. Two separate power grids are located in the Port Moresby, and Lae–Madang–Highlands areas (Ramu grid). Some smaller grids service smaller urban centers. Because of the unreliability of the power supply, urban areas have considerable self-generation and backup generation capacity, which is expensive and inefficient. Large industrial users, particularly mining sites, also operate off-grid self-generation.

2. PNG has 582 megawatts (MW) of installed generation capacity: 230 MW hydropower (39.5%), 217 MW diesel (37.3%), 82 MW gas-fired (14.1%), and 53 MW geothermal (9.1%). However, the main Port Moresby grid (140 MW) depends heavily on diesel generation. PNG has significant underutilized indigenous energy sources such as hydropower, natural gas, geothermal, and solar-based systems. PNG Power Limited, the national state-owned corporatized power utility, manages about 300 MW of installed generation capacity, including the two main grids and 26 smaller urban centers through 19 independent power systems. 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.

3. The power sector is facing some key development issues and challenges, including (i) high up-front infrastructure costs to extend power to off-grid areas (such as rural areas and smaller urban centers); and (ii) the unreliability of power in urban areas, which discourages economic development. The existing power sector infrastructure requires (i) rehabilitation to improve reliability, (ii) extension of grids to service the growing urban populations, and (iii) expansion of disaggregated generation to service the rural populations. The power transmission and distribution system loses about 20% of the energy it handles. Energy losses have continued to increase, primarily because of outdated and poorly maintained transmission and distribution lines, and inadequate substation sizing.

4. PNG's private power generators include (i) Hanjung Power, which operates a power station (26.4 MW) supplying the Port Moresby grid; (ii) PNG Sustainable Energy, which operates rural grids in Western Province and is expanding operations to other parts of the country; and (iii) mining operations that maintain significant levels of self-generation capacity. In addition, provincial governments have responsibility for maintaining a number of stand-alone rural generation facilities (C-centers), churches provide electricity to some off-grid villages, and the larger mining sites sometimes provide power to adjacent communities. Private participation in the power sector is increasing. As detailed in the draft electricity industry policy (EIP), the government is encouraging more private sector participation.

¹ This summary assessment is extracted from ADB. 2007. *Technical Assistance to Papua New Guinea for the Power Sector Development Plan*. Manila, and ADB, 2009. *Technical Assistance for Promoting Renewable Energy in the Pacific*. Manila. Both reports are available on request.

5. The low electrification rates for rural areas reflect low income levels and the poorly developed formal sector. Other contributors include (i) difficult geographical access conditions, (ii) operational issues related to technical and management capacity, (iii) investment disincentives related to the single national tariff structure, and (iv) high up-front costs for power generation in rural areas. Some customers have demonstrated the capacity and willingness to pay for tariffs significantly higher than the national single rate. However, the extension of power into rural areas has been slow because of financing hurdles and ongoing operational issues.

2. Government's Sector Strategy

6. The Electricity Industry Act, 2002 currently governs activities in the power sector. The government recently prepared the draft EIP and the draft rural electrification policy. The draft EIP recognizes the (i) low level of electricity access, (ii) unreliability of electricity supply and subsequent economic impacts, (iii) high costs for the private sector in terms of cost of power as well as unreliability of service, and (iv) difficulties faced by PNG Power Limited because of outstanding receivables and problems raising capital for infrastructure investments. Under the EIP, the electricity industry should be responsive to market signals and the government should intervene only when the market fails. The proposed policy measures include (i) facilitating competition and contestability in the electricity industry, (ii) expanding rural electrification through government assistance, (iii) enhancing technical regulation, (iv) bringing certainty to investors in the sector by developing a clearly defined access regime, and (v) encouraging private participation in the sector. The EIP proposes state financing of an Electricity Trust Fund to promote rural electrification.

7. The draft rural electrification policy sets out the government's plans to improve electricity access for rural areas. It emphasizes (i) providing reliable, affordable, and sustainable electricity; (ii) promoting greater use of renewable energy technologies; (iii) ensuring efficient and productive end-use of electricity for the development of rural areas; and (iv) developing human and institutional capacity to plan and manage rural electrification. The Energy Division of the Department of Petroleum and Energy recently completed the national power sector development plan, with support from the Asian Development Bank (ADB).²

8. Electrification is important for export-driven economic growth, rural development, and the poverty reduction agenda of the national medium-term development strategy (MTDS).³ An expanded and more efficient electricity system will be an integral element of successful economic development in PNG. However, the MTDS does not prioritize government spending on electrification. The MTDS was predicated on the expectation that the private sector would finance necessary power investments, and that national budget resources could focus on nonrevenue-generating economic and social infrastructure, such as roads, education, and health. However, the market has not responded as expected and the power situation in PNG is dire. While there may be sufficient willingness and capacity to pay for power consumption, investments in power generation, transmission, and distribution capital assets—especially in smaller urban centers (towns), villages, and rural areas—appear to be less attractive. Support would target areas where the power sector is able to play a catalytic role in economic development and where capacity to pay for power consumption exists.

² ADB. 2007. *Technical Assistance to Papua New Guinea for the Power Sector Development Plan*. Manila (TA 4932-PNG, approved on 25 May).

³ Government of Papua New Guinea, Department of National Planning and Monitoring. 2004. *The Medium Term Development Strategy 2005–2010: Our Plan for Economic and Social Advancement*. Port Moresby (November).

3. ADB Sector Experience

10. ADB has previously supported a series of technical assistance (TA) projects in the power sector that looked into gas-based power generation,⁴ power system planning,⁵ institutional assessment of the PNG Electricity Commission,⁶ review of electricity tariffs,⁷ and hydropower planning,⁸ as well as specific site assessments at Luwini (Divune) hydropower site⁹ and the Ramu–Port Moresby transmission interconnection.¹⁰ ADB also processed loans to (i) develop hydropower sites (Divune, Lake Hargy and Upper Warangoi),¹¹ and (ii) support the reinforcement of the Ramu grid.¹² In 2009, ADB completed a TA project with preparation of the national Power Sector Development Plan,¹³ which will provide strategic assistance to the sector through the preparation of the power demand forecast and least-cost supply development plan. In response to a government request, ADB has provided project preparatory TA for the development of hydropower resources in secondary urban centers not connected to the main power grids.¹⁴ The TA will prepare the Town Electrification Project. In addition, ADB is implementing two regional TA projects with components being implemented in PNG: (i) Promoting Energy Efficiency in the Pacific,¹⁵ which is assisting PNG Power with grid efficiencies; and (ii) Promoting Renewable Energy in the Pacific,¹⁶ which is assisting the Energy Unit, Department of Petroleum and Energy (DPE) in trying out innovative approaches to rural hydropower.

11. PNG's development partners have traditionally focused on policy support in the power sector and the development of small off-grid power supply projects that reduce poverty directly. The Pacific Islands Applied Geoscience Commission has provided assistance, including consultation on the draft national electricity industry policy and draft rural electrification policy through the Pacific Islands Energy Policy and Strategic Action Planning. The World Bank, with support from the Global Environment Fund, has been supplying rural teachers in Western Province with solar lighting kits. It has also launched the regional Sustainable Energy Financing Project to provide financing to the power sector in Pacific countries, including PNG. In the previous few years, development partners have shown increased interest in financing larger infrastructure projects. Opportunities also exist to cofinance power infrastructure projects with development partners.

⁴ ADB. 1989. *Technical Assistance to Papua New Guinea for the Gas-Based Power Generation Study*. Manila.

⁵ ADB. 1989. *Technical Assistance to Papua New Guinea for the Power System Planning Study*. Manila.

⁶ ADB. 1983. *Technical Assistance to Papua New Guinea for the Institutional Study of the Papua New Guinea Electricity Commission*. Manila.

⁷ ADB. 1989. *Technical Assistance to Papua New Guinea for the Electricity Tariff Review*. Manila.

⁸ ADB. 1977. *Technical Assistance to Papua New Guinea for the Hydrological/Hydroelectric Planning Project*. Manila.

⁹ ADB. 1986. *Technical Assistance to Papua New Guinea for the Luwini (Divune) Hydropower Project*. Manila.

¹⁰ ADB. 1989. *Technical Assistance to Papua New Guinea for the Ramu–Port Moresby Transmission Interconnection Study*. Manila.

¹¹ ADB. 2000. *Report and Recommendation of the President to the Board of Directors: Proposed Loan to Papua New Guinea for the Divune Hydropower Project*. Manila; ADB. 1979. *Report and Recommendation of the President to the Board of Directors: Proposed Loans and Technical Assistance Grant to Papua New Guinea for the Upper Warangoi Hydropower Project*. Manila.

¹² ADB. 1986. *Report and Recommendation of the President to the Board of Directors: Proposed Loan and Technical Assistance to Papua New Guinea for the Ramu Grid Reinforcement Project*. Manila.

¹³ ADB. 1989. *Technical Assistance to Papua New Guinea for the Power Sector Development Plan*. Manila.

¹⁴ ADB. 1989. *Technical Assistance to Papua New Guinea for Preparing the Power Sector Development Project*. Manila.

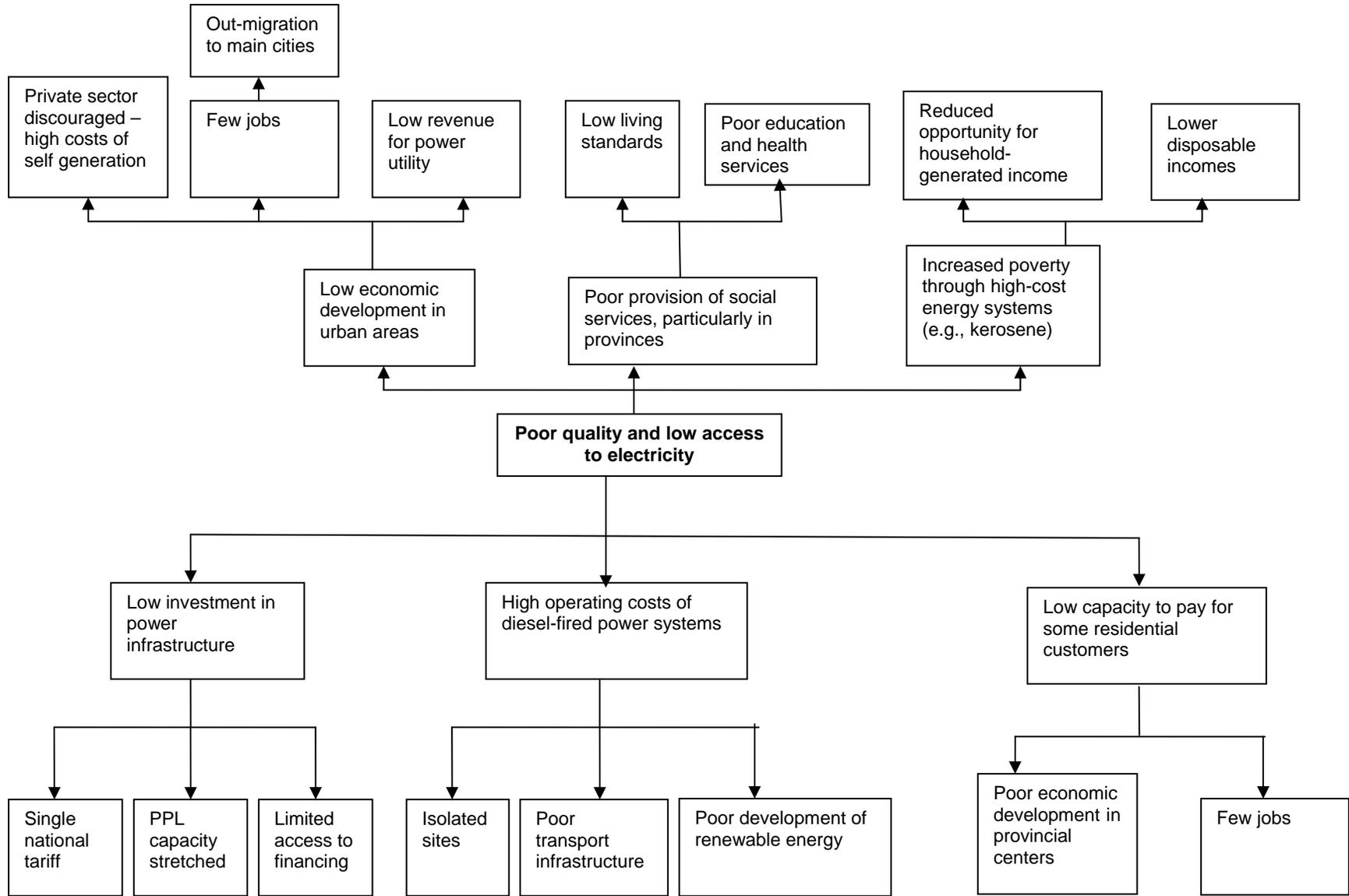
¹⁵ ADB. 1989. *Technical Assistance for Promoting Energy Efficiency in the Pacific*. Manila.

¹⁶ ADB, 2009. *Technical Assistance for Promoting Renewable Energy in the Pacific*. Manila

16. ADB will support the expansion of the power sector in provincial centers by developing least-cost hydropower projects and improving distribution systems. This is expected to improve access to energy in the provinces significantly. ADB will explore options for financing least-cost generation options, primarily through TA for Preparing the Power Sector Development Project, which will prepare the Town Electrification Project. In addition, the proposed grant project for Improved Power Supply to Poor Communities will increase the social benefits from power sector expansion activities. ADB will support the expansion of power generation capacity on the two main PNG power grids to meet anticipated demand growth (i) on the Port Moresby grid from economic development in the capital associated with the proposed liquefied natural gas project, and (ii) on the Ramu grid from the development of mining sector projects. ADB will build on recent TA for the development of power sector planning capacity¹⁷ by providing technical support to the Department of Petroleum and Energy for the implementation of the Electricity Industry Policy. As requested by the government, TA will also be provided to support sustainable development through the promotion of renewable energy, particularly in off-grid areas, and improved energy efficiency. This will be carried out primarily through the regional TA projects for Promoting Energy Efficiency in the Pacific and Promoting Renewable Energy in the Pacific, both of which identify PNG as a target country. ADB will continue to explore areas to support private involvement in the power sector. Where possible, ADB will also provide support to increase access to international carbon markets through the development of projects eligible for the Clean Development Mechanism. ADB will also support capacity development in climate change mitigation. Assistance will be provided through the ADB Carbon Market Initiative Technical Support Facility, backed up by the Asia Pacific Carbon Fund and the Future Carbon Fund, as required. ADB's private sector operations will strongly support pioneering clean energy projects with innovative contractual and financial structures to encourage private participation.

¹⁷ ADB. 2007. *Technical Assistance to Papua New Guinea for the Power Sector Development Plan*. Manila (TA 4932-PNG).

Problem Tree for the Power Sector



Sector Results Framework (Power Sector, 2011–2015)

Country Sector Outcome		Country Sector Outputs		ADB Sector Operations	
Outcomes with ADB Contributions	Indicators with Targets and Baselines	Outputs with ADB Contributions	Indicators with Incremental Targets (Baselines Zero)	Planned and Ongoing ADB Interventions	Main Outputs Expected from ADB Contributions
Improved conditions for commercial activity through provision of reliable, sustainable, and more affordable power in urban areas	<p>Additional power generation capacity to meet anticipated demand increases (additional 100 MW by 2015)</p> <p>Improved conditions for commercial and industrial power customers (reduced self-generation by 50% by 2015 in target towns)</p> <p>Improved reliability of power supply by reduced power outages in target urban areas (measure to be determined)</p>	<p>Improved power supply in provincial towns</p> <p>Improved power supply for the Port Moresby grid</p> <p>Improved demand side management</p>	<p>Additional power generation capacity by hydropower (GWh per year) in five provincial urban centers (from 0 GWh in 2011 to 120 GWh in 2015)</p> <p>Additional power generation for the Port Moresby grid (additional 50 MW by 2015)</p> <p>Improved efficiency in power usage (improved demand-side efficiency by 50 MWh by 2015)</p>	<p>Planned key activity areas</p> <p>Construction of power generation to supply demand in provincial towns and the main grids</p> <p>Upgrades to distribution systems</p> <p>Construction of clean energy generation</p> <p>Improved demand-side and supply-side efficiency of power system</p> <p>Pipeline projects</p> <p>Town Electrification (2010: \$100 million)</p> <p>Improved Power Supply to Poor Communities (2010: \$3 million)</p> <p>Power Grid Development project (2011: \$100 million)</p> <p>Ongoing projects</p> <p>TA 6485-REG: Promoting Energy Efficiency in the Pacific</p> <p>TA-7329 REG: Promoting Renewable Energy in the Pacific</p>	<p>Planned key activity areas</p> <p>Upgraded distribution systems</p> <p>Clean energy generation</p> <p>Pipeline projects</p> <p>Town Electrification</p> <p>Improved Power Supply to Poor Communities</p> <p>Power Grid</p>
Improved access to power supplies for households	<p>Reduced household expenditure on energy services (10% reduction in target group by 2015)</p> <p>Increased opportunities for household-derived income generation (20% increase in target group by 2015)</p>	<p>Increased number of households connected to power supply</p>	<p>Increased number of households with access to power (40,000 additional by 2015)</p>	<p>Planned key activity areas</p> <p>Provision of power and lighting services to unserved households</p> <p>Pipeline projects</p> <p>Town Electrification (2010: \$100 million)</p> <p>Improved Power Supply to Poor Communities (2010: \$3 million)</p> <p>Ongoing projects</p> <p>TA-7329 REG: Promoting Renewable Energy in the Pacific (\$3 million across 3 countries, approximately \$1 million in PNG)</p>	<p>Planned key activity areas</p> <p>Provision of power and lighting services to unserved households</p> <p>Pipeline projects</p> <p>Improved Power Supply to Poor Communities</p>

GWh = gigawatt-hour, MW = megawatt, MWh = megawatt-hour, REG = regional, TA = technical assistance.