

SECTOR ASSESSMENT (SUMMARY): ENERGY

Sector Road Map

1. Sector Performance, Problems, and Opportunities

a. Overview

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. Access to electricity is very limited in off-grid rural areas. Lack of access to affordable, reliable power is limiting economic growth in urban areas, constraining growth in smaller urban centers and contributing to poverty in rural areas. Currently, there are two main separate power grids—in Port Moresby, and in the Lae–Madang–Highlands areas (the Ramu grid)—as well as a number of smaller grids servicing the smaller urban centers. Because of the unreliability of the power supply, there is considerable self-generation and back-up generation capacity in urban areas; maintenance and operation costs are high and efficiencies low.

2. PNG has about 580 megawatts (MW) of installed generation capacity, including hydropower (230 MW, or 39.7%), diesel (217 MW, or 37.4%), gas-fired (82 MW or 14.1%), and geothermal (53 MW or 9.1%). PNG has significant underutilized indigenous energy sources such as hydropower, natural gas, geothermal, and solar. PNG Power Limited (PPL), the national state-owned corporatized power utility, manages installed generation capacity of about 300 MW, including the two main grids and 26 other 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 sector generators supplying the main grids or rural communities. The government's ownership in PPL is maintained through the Independent Public Business Corporation. Sector policy formulation is managed by the Ministry of Petroleum and Energy and, specifically, the Energy Division of the Department of Petroleum and Energy. Technical regulation of the sector is currently performed by PPL itself through agreement with the Consumer and Competition Commission; however, it is intended to eventually transfer this function to the Energy Division. Key research activity in the power sector occurs at the University of Technology in Lae, particularly through the Rural Energy Research Group.

3. There are a number of private sector power generators currently operating in PNG, including (i) Hanjung Power Ltd, a private company that operates a power station (26.4 MW) supplying the Port Moresby grid; (ii) PNG Sustainable Energy Ltd, which operates a number of 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, (i) provincial governments have responsibility for maintaining a number of stand-alone rural generation facilities (C-centers), (ii) churches provide electricity to some off-grid villages, and (iii) the larger mining sites sometimes provide power to adjacent communities.

b. Sector Issues

4. A number of key development challenges face the power sector, including improving the quality of the power supply and meeting growing demand on the main power grids (the Port Moresby and Ramu grids), improving power supply in provincial centers, and developing suitable models for expansion of power supply into off-grid areas.

- (i) **Main power grids.** The robust national growth is translating to rapid growth of power demand in the main urban areas.¹ Lack of reliable quality power supply to the main urban areas may limit economic growth. Investments are required in power generation and the transmission and distribution grids for the Port Moresby and Ramu grids.
- (ii) **Town electrification.** Poor-quality power supply in provincial centers and lack of generation to meet growing demand is limiting economic growth in provincial urban centers not connected to the main grids.² The poor development of the provincial power systems is due to (a) difficult geographic conditions, resulting in isolated load centers with relatively low demand;³ (b) high initial investment costs for hydropower, resulting in reliance on diesel generation, which has low upfront investment costs but substantially higher life cycle costs; and (c) the single national tariff structure, which serves as a disincentive for the corporatized PPL to invest in high-cost provincial centers (each additional customer on these systems results in increased financial loss).
- (iii) **Rural electrification.** The difficult geographic conditions mean that it is not technically or financially feasible to extend the existing power grids to more than a relatively small percentage of the rural population. Barriers to rural electrification through grid extension include (a) investment disincentives to PPL related to the single national tariff structure, and (b) lack of community service obligation (CSO) assistance provided to the corporatized PPL to undertake financially nonviable grid extensions. Where grid extensions are not feasible, rural electrification will consist of village-level and household-based generation systems, such as small diesel generators and household solar systems. Currently, the provincial governments are responsible for the management of the village-level power systems; however, due to the lack of an operating budget and maintenance capacity constraints, the majority of the village power systems have ceased to operate. Barriers to upscaled village- and household-based generation systems include (a) lack of CSO financing 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.

5. **Power tariffs.** Power tariffs are independently regulated by the Consumer and Competition Commission and allow full cost-recovery for PPL. Power tariffs are set on a national basis, resulting in uniform tariffs irrespective of local generation costs. The uniform tariff structure cross-subsidizes tariffs for consumers in high-cost centers (provincial centers) through the lower generation costs from the main grids (the Port Moresby and Ramu grids, which are predominantly hydropower-based, and therefore relatively low cost). However, the uniform tariff provides a disincentive for PPL to invest in high cost-generating areas, including provincial centers where high reliance on diesel generation and high diesel transport costs have resulted in high generation costs.

¹ Recent estimates by PPL indicate the power demand growth has increased to about 10% per annum in Port Moresby as a result of recent economic activity, spurred primarily by the proposed LNG plant.

² A majority of the provincial urban centers cannot be connected to the two main grids due to PNG's geography.

³ Peak demand for the PPL grids assessed under the technical assistance for Preparing the Power Sector Development Project is 1.2 MW to 3.0 MW, but these peak loads are supply constrained. Local industry self-generation capacity often exceeds installed PPL generation capacity. (Asian Development Bank (ADB). 2008. *Technical Assistance to Papua New Guinea for Preparing the Power Sector Development Project*. Manila [TA 7113-PNG, approved on 8 August]).

2. Government's Sector Strategy

6. **Sector policies.** The government has recognized the range of issues facing the power sector and in response has prepared the (i) draft electricity industry policy (EIP), and (ii) draft rural electrification policy (REP). The draft EIP has undergone extensive consultation and is expected to be passed by the fourth quarter of 2010. The draft EIP will (i) encourage private sector participation in the power sector by facilitating competition and developing a clearly defined access regime, (ii) transfer a range of regulation and planning functions from PPL to the government, and (iii) up-scale rural electrification through government assistance. The EIP will support state financing of CSOs, primarily for provincial urban centers and rural electrification through establishment of an electricity trust fund (ETF).⁴

7. The draft REP sets out the government's plans to improve electricity access for rural areas. While consultation has been conducted, broad stakeholder endorsement of the draft REP has yet to be achieved. Redrafting of the REP is expected to commence in 2011. The draft REP emphasizes (i) provision of reliable, affordable, and sustainable electricity supply; (ii) promoting the increased 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.

8. **Strategies and plans.** Electrification is important in realizing the agenda of the national Medium Term Development Strategy relating to export-driven economic growth, rural development, and poverty reduction.⁵ An expanded, more efficient electricity system will be an integral element of successful economic development in PNG. The government has included the power sector as a key sector in the Papua New Guinea Development Strategic Plan 2010–2030.⁶ The proposed development of the power sector in each province is detailed in the PNG Power 10-year power development plan⁷, which (i) lists the status of current infrastructure and proposed investments over a 10-year timeframe, and (ii) provides a roadmap of priority hydropower developments in the provinces to reduce reliance on diesel generation and improve service delivery. The investment program will support implementation of the power development plan.

9. **Private Sector.** The government and PPL recognize that the private sector will play an important role in providing investment and management capacity for power sector expansion. The government has passed the Public–Private Partnership (PPP) Policy, which will support development of private sector participation in the power sector, along with the EIP.

10. **Tariffs.** The government has recognized the investment disincentive provided by the single national power tariff and proposes to address the issue by (i) allowing flexible tariff-setting under the EIP, (ii) establishing a CSO policy⁸ to support government financing of non-financially

⁴ The ETF has been established and has received initial funds, but disbursements have not yet occurred as the governance structure has yet to be approved under the EIP.

⁵ Department of National Planning and Monitoring. 2004. *The Medium Term Development Strategy 2005–2010: Our Plan for Economic and Social Advancement*. Port Moresby (November).

⁶ Department of National Planning and Monitoring. 2010. *Papua New Guinea Development Strategic Plan 2010–2030*. Port Moresby (March).

⁷ Government of PNG. 2000, *PNG Power National and Provincial Ten Year Power Development Plan 2009–2018*. Port Moresby (July).

⁸ ADB is assisting the establishment of the CSO policy through ADB. 2009. *Technical Assistance for Pacific Private Sector Development Initiative Phase II*. Manila (TA 7430-PNG, approved on 10 December)..

viable power infrastructure, and (iii) establishing an ETF under the draft EIP to finance such investments.

3. ADB Sector Experience and Assistance Program

11. ADB has a long engagement in the PNG power sector. ADB supported the development of the power sector through a series of technical assistance (TA) projects during 1970–2000,⁹ and processed four loans for hydropower and transmission projects.¹⁰ Between 2000 and 2005, ADB provided two TA projects to assist in the development of the gas sector.¹¹ In 2009, ADB completed TA for preparation of the national Power Sector Development Plan,¹² which will provide strategic assistance to the power sector through preparation of the power demand forecast and least-cost supply development plan. Additionally, ADB is currently implementing two regional TA projects with components being implemented in PNG: (i) Promoting Energy Efficiency in the Pacific,¹³ which is assisting PPL with grid efficiencies; and (ii) Promoting Renewable Energy in the Pacific,¹⁴ which is assisting the Energy Unit, Department of Petroleum and Energy in trialing innovative approaches to rural hydropower.

12. PNG's development partners have traditionally focused on policy support in the energy sector and development of small off-grid power supply projects with direct poverty alleviation benefits. The Pacific Islands Applied Geoscience Commission provided support for a number of energy sector issues in PNG, including consultation regarding the draft national energy policy and draft REP 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 the Western Province with solar lighting kits. It has also launched a regional Sustainable Energy Financing Project, designed to provide financing support for household power supplies in a range of Pacific countries, including PNG. The World Bank has combined with PNG Sustainable Energy as a local implementing agency. Recently, bilateral donors have shown interest in providing financial support for larger infrastructure investment projects.

⁹ ADB.1995. *Technical Assistance to Papua New Guinea for Hydrocarbon Sector Policy and Strategy Study*. Manila; ADB. 1991. *Technical Assistance to Papua New Guinea for Gas-based Power Generation Study*. Manila; ADB. 1989. *Technical Assistance to Papua New Guinea for Power System Planning Study*. Manila; ADB. 1986. *Technical Assistance to Papua New Guinea for Luwini Hydropower*. Manila; 1984. ADB. *Technical Assistance to Papua New Guinea for Ramu-Port Moresby Transmission Interconnection Study*. Manila; ADB. 1983 *Technical Assistance to Papua New Guinea for Institutional Study of Papua New Guinea Electricity Commission*; ADB. 1979 *Technical Assistance to Papua New Guinea for Electricity Tariff Review*; ADB. 1977. *Technical Assistance to Papua New Guinea for the Hydrological/Hydroelectric Planning Project*. Manila.

¹⁰ ADB. 1977. *Report and Recommendation of the President to the Board of Directors: Proposed Loan for Provincial Mini-hydropower Project in Papua New Guinea*. Manila; ADB. 1979. *Report and Recommendation of the President to the Board of Directors: Proposed Loan for Upper Warangoi Hydropower in Papua New Guinea*. Manila; ADB. 1979 *Report and Recommendation of the President to the Board of Directors: Proposed Loan for Ramu Grid Reinforcement in Papua New Guinea*. Manila; ADB. 1986 *Report and Recommendation of the President to the Board of Directors: Proposed Loan for Divune Hydropower Project*. Manila.

¹¹ ADB. 2005 *Technical Assistance to Papua New Guinea for PNG Gas Project*. Manila; 2001. *Technical Assistance to Papua New Guinea for Gas Pipeline Development*. Manila.

¹² ADB. 2007. *Technical Assistance to Papua New Guinea for Power Sector Development Plan*. Manila.

¹³ ADB. 2009. *Technical Assistance to Papua New Guinea for Promoting Renewable Energy in the Pacific*. Manila.

¹⁴ ADB. 2009. *Technical Assistance to Papua New Guinea for Promoting Energy Efficiency in the Pacific*. Manila.

Sector Road Map and Policy Framework

Policy Objective/Initiative	Issues	Action taken by Government and Development Partners	Actions to be Taken under the Program	Outcomes/Status
Government Sector Policy as expressed through the Papua New Guinea Development Strategic Plan (DSP) 2010–2030				
Access to reliable and affordable energy supply will be increased.	<p>Less than 10% of the population has access to electricity</p> <p>Power generation is unable to meet growing demand.</p> <p>As a corporatized entity, PPL is reluctant to invest in non-profitable grid extension activities.</p>	<p>The government has drafted an electricity industry policy.</p> <p>PPL has commenced feasibility studies for additional generation.</p> <p>The government has drafted a community service obligation (CSO) policy (to be approved 2011). An electrification trust fund (ETF) under the EIP will fund CSOs.</p>	The investment program will construct hydropower plants and transmission lines to increase generation and lower the cost structure of power generation in provincial centers.	Increased generation capacity to meet increased demand in provincial centers and support economic development.
Electricity corridors will be constructed.	<p>Power access is currently limited to the Port Moresby and Ramu grids, which do not connect provincial load centers.</p> <p>Limited access to reliable power is limiting economic growth.</p>	DSP identifies a number of growth corridors for targeted investment to support economic development.	The investment program will construct hydropower plants and transmission lines along a number of the main economic corridors identified under the DSP to support economic development.	Improved economic development in targeted corridors
Diesel generation will be replaced with hydropower generation.	Most provincial urban centers rely on high-cost diesel generation.	The National and Provincial Ten Year Power Development Plan 2009–2018 identifies priority hydropower sites to replace diesel generation in provincial centers.	Construction of six hydropower plants to replace diesel generation	Diesel generation partially replaced by hydropower generation in targeted provincial centers
Private sector involvement will be increased.	<p>The investment levels needed to increase generation capacity will require private investment.</p> <p>Expansion of the power sector will require capacity support from the private sector for operation and maintenance.</p>	<p>Passing of public–private partnership (PPP) policy</p> <p>Drafting of EIP, which promotes private sector investment in the power sector</p>	<p>Design PPPs models for consideration under tranche 2</p> <p>Undertake trial assessment of CSO requirements for a subproject under the investment program</p>	Increased private sector investment in hydropower generation, particularly for provincial centers
Government Sector Policy as expressed through the draft electricity industry policy (EIP)				
Access to electricity services will be improved.	<p>Access to electricity is less than 10% and essentially limited to main urban areas.</p> <p>PPL has monopoly status which provides efficiency disincentives.</p>	<p>The draft EIP is to be approved by cabinet in fourth quarter 2010.</p> <p>Electricity trust fund (ETF). The ETF will be established under the EIP to finance power projects through competitive tendering. Disbursement is to commence at the end of 2011.</p>	<p>The investment program will assist with trialing the CSO policy in the power sector by using one of the subprojects as a trial to calculate CSO financing.</p> <p>The investment program has</p>	The combination of flexible tariffs, CSO financing through the ETF and private sector involvement will improve access to reliable and affordable power.

Policy Objective/Initiative	Issues	Action taken by Government and Development Partners	Actions to be Taken under the Program	Outcomes/Status
Reliability of electricity supply will be improved. Affordability of power to consumers will be improved.	The uniform power tariff is a disincentive to investing in provincial urban and rural areas. Poor-quality power (frequent power outages) A large portion of the population has a limited capacity to pay for power. System inefficiencies result in higher costs.	Flexible tariffs. The EIP allows Independent Consumer and Competition Commission to implement flexible tariffs. CSO policy. The draft CSO policy is anticipated to be approved in 2011. Asian Development Bank is supporting the CSO policy. ^a Private sector. The EIP will promote the private sector. Government will tender new power generation. ADB has supported the Power Sector Development Plan. ^b PPP Policy. Government passed the National PPP Policy in December 2008, ADB is supporting the PPP Center. ^a	provided capacity development training for alternative private sector models for hydropower generation. The investment program will further develop potential models by December 2011 for consideration under tranche 2 subprojects.	
Development objectives as expressed through the National and Provincial Ten Year Power Development Plan 2009–2018				
Develop the most appropriate mode of power supply that is cost-effective, economical, financially viable, technically sound and sustainable.	Power generation in provincial centers is heavily reliant on diesel generation, which has low construction costs but high operational costs. Limited access to project financing prevents investment in hydropower (high upfront costs but low operational costs).	Drafting of EIP, which promotes renewable power generation	Undertake feasibility studies on a range of hydropower sites to demonstrate least-cost generation expansion Provide project financing to allow investment in hydropower to lower the cost structure of power supply in provincial centers	Lower cost structure of power systems in provincial centers and improved quality of power supply
Replace diesel-based generation with renewable energy	Lack of access to financing limits replacement of diesel generation with hydropower generation.	Draft EIP promotes hydropower generation.	Construction of hydropower generation to replace diesel-based generation	Reduced reliance on diesel generation and reduced cost of power in provincial centers
Develop reliable electricity transmission to load centers	New generation sources require transmission lines to connect to load centers.		Construction of transmission lines between hydropower plants and provincial centers	

^a ADB. 2009. *Technical Assistance for Pacific Private Sector Development Initiative Phase II*. Manila (TA 7430-PNG, approved on 10 December).

^b ADB. 2007. *Technical Assistance to the Independent State of Papua New Guinea for the Power Sector Development Plan*. Manila.

Source: Asian Development Bank.