

## ENERGY SECTOR ASSESSMENT

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### A. Sector Context

1. **Electricity sector in Papua New Guinea.** Papua New Guinea (PNG) is a vast country with a population of 7.4 million people, of which only about 12.5% are estimated to live in urban areas.<sup>1</sup> It is principally the urban areas that have access to grid connected electricity, and it is estimated that less than 10% of the total population has electricity access. Electricity access in rural areas is estimated to be under 3.7%.<sup>2</sup> The mining industry, which is one of the main drivers of PNG's economy, largely depends on captive power stations for their operations.

2. Lack of funding for upgrading and rehabilitation and even for routine maintenance is leading to a further deterioration in services, while the anticipated rise in demand due to economic growth and an increasing population will further stress the system if large-scale investments are not made to develop the electricity system. Supplying reliable and affordable electricity and expanding access to electricity to a larger proportion of the urban and rural populations is thus essential to make a positive impact on the socioeconomic well-being of PNG's citizens and on the economic development of the country.

3. **Electricity generation capacity and major power systems.** Electricity generation capacity in PNG is about 250 megawatts (MW). Hydropower accounts for about half of the electricity generated and diesel for a third, with the rest generated from gas and geothermal energy plants, which are principally used in the mines (footnote 2). Private sector mines have installed an additional 250–280 MW of capacity for their operations.<sup>3</sup>

4. The three major grid systems in the country operated by PNG Power (PPL) are the Port Moresby System, the Ramu System, and the Gazelle Peninsula System. The Port Moresby System, which serves the capital city and other parts of the Central Province, is supplied from the 62 MW Rouana hydropower station, a 30 MW thermal power station, and a 24 MW diesel-based independent power producer (IPP).<sup>4</sup> The Ramu system serves the economic and industrial load centers in the Momase Region and the Highlands, and is supplied through the 75 MW Ramu hydropower station, a 12 MW hydropower station in the Western Highlands Province, and small hydropower based IPPs and diesel plants that make up for any shortfall and serve as a backup. The Gazelle Peninsula system is supplied through a 10 MW hydropower station and about 9 MW of diesel based power plants (footnote 4). Clearly, the transmission grid covers only some of the major urban and industrial centers, and a large part of the country is vastly underserved in its electricity needs. Parts of the country not covered by the utility grid are powered by mini-grids, which are predominantly powered by diesel.

5. The three grid systems are weak and need to be rehabilitated to improve reliability and reduce technical losses.<sup>5</sup> The current medium-term development plan (MTDP), 2011–2015 targets the early

<sup>1</sup> Population data for 2014 is from ADB. 2014. *Basic Statistics 2014*. Manila; the estimate of the urban population is based on 2010 data from the United Nations Country Statistics database. [https://data.un.org/CountryProfile.aspx?crName=Papua New Guinea](https://data.un.org/CountryProfile.aspx?crName=Papua%20New%20Guinea)

<sup>2</sup> Government of Papua New Guinea, Department of National Planning and Monitoring. 2010. *Papua New Guinea Medium Term Development Plan, 2011–2015*. Port Moresby.

<sup>3</sup> While the private companies predominantly use thermal fuels to generate power, private power includes a 58 MW hydropower system at the Ok Tedi Mining Limited (OTML) mines, and a geothermal plant that supplies power to the Lihir Gold mine. Some natural gas power plants are also installed in the Highlands area. Some of the private generators also supply power to PPM under a power purchase agreement.

<sup>4</sup> Information from PNG Power Ltd.

<sup>5</sup> Electricity system losses in PNG have variously been reported at 21% (Pacific Lighthouses: Renewable energy opportunities and challenges in the Pacific Islands region: Papua New Guinea, IRENA, August 2013, quoting data for 2012, which includes all losses); and up to 28.8% (including technical and non-technical losses as estimated in "Quantification of the Power System

rehabilitation of the existing grid systems and also the development of a framework to reduce non-technical losses in the system.

6. PPL also operates several mini-grid systems, mostly power from diesel generation sets, to supply power to small towns and rural areas.<sup>6</sup> The provincial governments also operate mini-grids in rural areas, especially for supplying power to schools, clinics, and religious establishments.

7. **Energy sector institutions.** The key institutions that govern the operations of the energy sector include the following:

- (i) **Department of Petroleum and Energy (DPE).** DPE is the overarching agency responsible for energy sector policy and planning. It also heads the Electricity Management Committee (EMC), and is expected to oversee the technical regulation of the electricity sector (a function presently performed by PPL).
- (ii) **Independent Public Business Corporation (IPBC).** IPBC is a holding company with ownership in state-owned enterprises, including PPL, and it maintains management oversight of the companies. It may also take operational actions in companies that require support. IPBC participates in monthly review meetings in the energy sector and supports PPL.
- (iii) **Independent Consumer and Competition Commission (ICCC).** ICCC is the regulator for electricity tariffs, but has little capacity to carry out its mandate and cannot independently take decisions. ICCC employs a revenue cap regulation principle and sets license conditions for market participants, though PPL is the only regulated entity at present. The ICCC also issues licenses to IPPs and mining companies that own generation and distribution facilities.
- (iv) **PNG Power Limited.** PPL is a state-owned, vertically integrated electricity utility that provides generation, transmission, distribution, and retail services in most grid connected urban areas.
- (v) **Western Province Power Limited.** This is a wholly-owned subsidiary of PNG Sustainable Development Program Limited and provides generation, distribution, and retail electricity services in the Western Province, principally through small-scale power projects.

## B. Meeting Future Electricity Demand

8. The present average daily peak demand for electricity is estimated to be about 290 MW (excluding the mining sector). The Papua New Guinea Development Strategic Plan, 2010–2030 (PNGDSP) estimates that the peak demand for electricity in 2021 will be about 700 MW and increase to over 1,400 MW by 2030.<sup>7</sup> Meeting this demand will require substantial new power generation resources. The PNGDSP envisages that substantial additional hydropower, gas-based generation, renewable energy, and some coal-based generation will meet the rising demand. Diesel-based generation is expected to be reduced substantially. The demand in Port Moresby is growing rapidly and may impose a greater load on the system. Even presently, the country has inadequate reserve capacity in the system, and is unable to meet demand, especially during dry seasons when water flow is low. The country thus needs to make significant additions to the power generation capacity. The PNGDSP estimates that by 2030, all major cities and towns in the country will be connected through a national transmission and distribution grid, and most consumers will have the option of making payments through pre-payment meters. The PNGDSP also estimates that expanding electricity access to 70% of

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Energy Losses in Southern Pacific Utilities,” Consolidated Report, KEMA, May 2012. Promoting Energy Efficiency in the Pacific ([www.ee-pacific.net](http://www.ee-pacific.net)) estimated total system losses in transmission and distribution at 20% for 2011.

<sup>6</sup> The ADB’s Small Towns Project is assisting PPL in converting up to six of the smaller grids to hydropower supply.

<sup>7</sup> Government of Papua New Guinea, Department of National Planning and Monitoring. 2010. *Papua New Guinea Development Strategic Plan, 2010–2030*. Port Moresby.

households by 2030 will lead to the creation of over 100,000 jobs and raise the national income by more than K2.9 billion.

9. The PNGDSP envisages the development of (i) an electricity super-corridor to support a national and regional grid, and (ii) low-cost generation resources at various locations. The plan also foresees greater development of hydropower resources, which could support electricity intensive industries, such as aluminum melting, and power exports to Australia and Indonesia. The plan hinges on increased participation and investment by the private sector, especially in generation. While the PNGDSP foresees increased development of hydropower and gas-based generation, it also expects a phasing out of diesel power generation. It is also expected that some coal-based power will be generated along with increased use of renewable sources such as geothermal, wind, and biomass. The plan is to generate 25% of electricity needs with renewable resources and reduce dependence on diesel power generation.

**Table 1: Planned New Generation Capacity to meet Future Electricity Demand**

Generation Resource (MW)	2010	2015	2020	2025	2030
Hydropower	215	430	580	750	1020
Renewable (non-hydro)	55	90	160	280	500
Natural Gas	70	130	280	390	390
Diesel	160	100	60	40	30
Coal	0	30	30	30	30
<b>Total Capacity</b>	<b>500</b>	<b>780</b>	<b>1,110</b>	<b>1,490</b>	<b>1,970</b>

Source: Government of Papua New Guinea, Department of National Planning and Monitoring. 2010. *Papua New Guinea Development Strategic Plan, 2010–2030*. Port Moresby.

10. Based on the energy sector development plan presented in the Power Sector Development Plan Report, the PNGDSP recommends an approach that combines grid expansion with off-grid electricity systems to effectively meet rural electricity demand and spur rural economic development.<sup>8</sup> The MTDP, 2011–2015, plans to increase rural electricity access from the current level of under 4% to more than 60% of the rural population by 2030. The MTDP, 2011–2015, recognizes that rural populations may not be able to afford high-cost power from distributed generation systems and proposes to use public and donor funds to develop the infrastructure, with rural consumers only paying for the operational and maintenance costs of the system. PPL would own the mini-grids' assets and its personnel would operate and maintain the systems.

### C. Papua New Guinea Government Policy for Developing the Energy Sector

11. The Vision 2050 of PNG seeks to diversify the economy from exploitation of mineral wealth towards broader growth, employment, and improved service delivery. The MTDP, 2011–2015, and the PNGDSP articulate specific actions and deliverables, and the strategies through which they are to be implemented.<sup>9</sup>

12. The MTDP, 2011–2015, is a five-year rolling development plan for the country. It provides the PNG government's strategy and plan to develop the economy including the energy sector, which is identified as a key input to facilitate investment across various economic sectors of PNG. Implementation of the MTDP is a step towards reaching the target of PNG becoming a middle-income country by 2030, as outlined in the PNGDSP. The MTDP, 2011–2015, envisages that policies and investments during the period 2011–2015 will lead to average economic growth of 8.7% a year, which will require a significant amount of energy development. The MTDP, 2011–2015, also forecasts that, by 2015, development of the electricity sector alone would result in an additional gain in GDP of K572 million, increase tax revenues by K165 million, and create 17,522 jobs.

<sup>8</sup> Government of Papua New Guinea, Department of Petroleum and Energy. 2009. *Power Sector Development Plan Report*. Port Moresby.

<sup>9</sup> The MTDP provides a mid-term implementation plan towards achieving the goals of the PNGDSP and the Vision 2050.

13. The MTDP, 2011–2015, and the PNGDSP, 2010–2030, outline a broad plan for a national grid with an electricity transmission super-corridor, which will require significant resources. The MTDP, 2011–2015, recognizes that the investments required for electricity infrastructure in generation, transmission, and distribution will be beyond the capacity of PPL. The government envisages that partnership with the private sector will be necessary for developing the energy sector especially in areas where there is scope for competition and high returns, with PPL focusing on making investments in expanding the grid to areas where competition may be less feasible due to lower returns.

14. The MTDP, 2011–2015, focuses on progressively increasing access to electricity for all households in the country through the development of projects that can be implemented in the short and longer term. In the near-term, the plan envisages reducing technical and non-technical losses and upgrading the existing regional electricity grids of Port Moresby, Rouna, Ramu, and Gazelle, with a longer-term view of developing a national grid. Renewable energy sources would be prioritized to supply electricity to rural areas, with an emphasis on replacing diesel power plants. A framework for development of gas-based power generation is also planned. Subsequent MTDPs (focusing beyond 2015) would build on progress made during the current MTDP and expand the network, with the final objective of achieving access to 70% of the population by 2030, as planned in the PNGDSP.

15. The Electricity Industry Policy (EIP) addresses the strategic objectives of the government. These include improving access to electricity services, improving reliability of electricity supply, and ensuring that power is affordable for consumers. The EIP seeks to improve sector performance under the guidance of the EMC, moving away from uniform national tariffs towards cost-reflective pricing, transferring the technical regulation of the sector to the DPE, and promoting private sector investment in power generation.<sup>10</sup>

16. The country wishes to develop gas based power generation, but while the country has an oil and gas act, it has no gas or petroleum policy at present. Contracts are negotiated and regulatory conditions are mandated through contracts rather than through a transparent policy. The existing liquefied natural gas (LNG) project is exporting all its output and is not available for power generation in the country.

17. Despite these initiatives, the country still lacks a comprehensive energy sector policy. A draft policy has been prepared and is under consideration, and the DPE expects that the policy will be finalized and adopted by end-2014.

## **D. Private Participation in the Energy Sector**

18. The PNG government seeks to create an enabling environment to encourage greater private sector participation in the energy sector. According to the MTDP, 2011–2015, the government plans to introduce a private sector growth strategy and a Public-Private Partnership (PPP) policy. The government also plans to establish a PPP center within 5 years to help public sector agencies develop credible PPP proposals and engage with the private sector. The government expects that the PPP policy will allow the private sector to play a dominant role in electricity generation. The private sector is, however, likely to seek a strong risk mitigation structure to overcome payment and political risks, and also government support for procurement of land from local communities. While the government is considering procuring land for projects to incentivize the private sector, there is no clear policy in support of this plan.

19. The EIP, which was supported by Asian Development Bank (ADB), seeks to promote private investments, but attracting private investments will need the government to create a comprehensive

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<sup>10</sup> The policy allows cost-reflective tariff mechanisms to include some cross-subsidies to ensure affordability for all customer segments.

package of enabling regulatory mechanisms along with a risk mitigation structure. The private sector does not appear to be particularly interested in participating in the electricity market. Hanjung Power Ltd., which started in 1999 and built a 24 MW diesel power station under a 15-year build-operate-transfer agreement to supply power to the Port Moresby grid, remains the only private developer of power in PNG.

20. The ICCC has published a Draft Third Party Access Code, which provides grid codes and open access rules for private entities to generate and supply electricity in PNG. When adopted, the Code will enable open access on the PNG network and hopefully attract IPPs to participate in the power market and improve supply reliability. But open access may be limited to areas not served by the grid, which may not be attractive to the private sector. Wheeling of power is not allowed at present, and PPL has exclusivity on consumers within a 10 kilometers (km) radius of its grid. However, the private sector is free to develop projects and sell power directly to consumers with loads above 10 MW.

## E. Challenges in Developing the Energy Sector

21. One of the major challenges to developing the energy sector is the lack of a clear implementation plan to realize the goals of the strategy documents (MTDP, 2011–2015, and PNGDSP) prepared by the government. PNG also needs to develop a robust strategy to develop its hydropower resources, which reportedly have the potential to generate about 10,000 MW, yet the country has currently developed only about 215 MW of this capacity. While the PNGDSP plans to develop more hydropower to meet future demand, there is no clear implementation plan to realize this potential. Other renewable sources of energy, such as the increased development of biomass and wind energy, represent yet another untapped opportunity. While the PNGDSP envisages a ten-fold increase in energy from these resources by 2030, there once again is no clear plan to realize this potential. The use of gas to generate electricity is yet another attractive and environmentally clean option to meet future demand, but the present Exxon Mobil LNG project is primarily for export and there is no domestic off-take of gas. Further, there is no clear policy for the gas sector, which will impede the use of gas for power generation.

22. The lack of funds is also a major constraint to realizing strategic goals. PPL has scarce funds for routine maintenance of the existing electricity infrastructure, which has led to de-rating of equipment and unplanned maintenance, resulting in power shortages and poor reliability and quality of supply. While PPL has utilized internal funds along with financing from PNG banks to rehabilitate some of the generation plants, it lacks adequate resources to make major capital investments, and public funds are scarce. The poor operational efficiency of the plants and a low reserve margin have further exacerbated the situation.

23. Institutional capacity is also a constraint. The DPE has inadequate trained staff to undertake all its intended functions and plans to substantially augment its staff. The ICCC is intended to be both the technical and economic regulator, but since it has inadequate technical capacity, the function of technical regulation currently resides with PPL, which itself is the regulated entity. ICCC receives tariff applications from PPL annually and tariffs are decided based on revenue requirements and price caps, but ICCC has no benchmarks for implementing price cap regulation. Nor does it have expertise in assessing demand projects and investment plans prepared by PPL. ICCC also does not review power purchase agreements (PPAs) between PPL and IPPs. ICCC is supposed to conduct hearings on tariff applications, but, due to lack of funds, it generally only posts information on its website and in newspapers. The license fee paid by entities reportedly covers only about 10% of the budget of ICCC, with the government providing the rest of its budget. While the ICCC is an independent entity, the government exercises control over the retail tariffs charged by PPL.

24. The uniform retail tariff is not cost reflective. While there is no explicit subsidy, the uniform tariff cross-subsidizes the cost of supply between the main grid connected regions, which are powered

by cheap hydropower, and the Highlands area, which is powered by expensive diesel generation. The uniform tariff serves as a disincentive for PPL to make investments for increasing electricity access in rural areas. Yet, it has been politically difficult to move away from uniform tariffs, though the EIP allows for flexible tariff setting.

25. Private sector investments are critical for the country, but attracting increased private investment will require enabling policies, such as the planned PPP policy, and risk mitigation instruments to overcome the perception of country and utility risk. While there are draft policies on open access, the utility in PNG remains vertically integrated and PPL is a single buyer for supply to the three main grids serving the urban areas. This too poses a risk for private investments. Investments by the multilateral banks and other development partners are thus essential to the development of the electricity sector.

26. While PNG plans to significantly expand electricity access to urban and rural consumers, the focus clearly is on strengthening and augmenting the grid to supply urban areas. The widely prevalent thinking among country stakeholders is that improving supply and reliability in urban areas is the priority and expanding access to rural consumers can wait; this attitude among stakeholders in PNG's public and private sectors is another key challenge to developing the electricity sector.

## F. ADB's Sector Strategies and Portfolio

27. ADB provided two technical assistance (TA) projects for the gas sector during the periods 2001–2003 and 2005–2008, but the energy sector was not a clear focus of attention in ADB's country partnership strategy (CPS) for PNG for these periods; in fact, the CPS did not focus on the energy sector up until CPS, 2011–2015, which is under implementation.<sup>11</sup> The current CPS recognizes that PNG has made inadequate investments in power generation, transmission, and distribution, resulting in very low levels of electricity access, and unreliable electricity supply even in urban areas.

28. ADB assisted PNG in developing a national power sector development plan, which led to the government of PNG elevating development of the power sector to a national priority in its PNGDSP, 2010–2030.<sup>12</sup> PNG's energy sector development plan for each province is articulated in PPL's 10-year power development plan, which provides a roadmap for priority projects and proposed investments over a 10-year timeframe.<sup>13</sup> PNG requested ADB support for the implementation and financing of its power infrastructure development plan.

29. ADB's strategy was to help PNG make investments in power infrastructure while also providing TA to address issues such as low tariffs that make investments in grid extensions financially unviable. ADB support, which was consistent with the government's policy for the development of the energy sector as articulated in the PNGDSP, focused on increasing access to reliable and affordable energy supply and expanding infrastructure to meet future demand. ADB proposed to provide support to improve conditions for commercial activity in the power sector, increase the supply of sustainable power supply in urban areas, and achieve a 10% reduction in household expenditure on energy services from 2011 levels. ADB also proposed to support increased development of renewable and clean energy generation sources.

30. Consistent with the objectives articulated in the CPS, ADB's country operations business plans for the periods 2011–2012 and 2012–2014 supported the development of loan projects and TA projects.

<sup>11</sup> ADB. 2010. *Country Partnership Strategy: Papua New Guinea, 2011–2015*. Manila.

<sup>12</sup> Government of Papua New Guinea, Department of National Planning and Monitoring. 2010. *Papua New Guinea Development Strategic Plan, 2010–2030*. Port Moresby.

<sup>13</sup> Government of Papua New Guinea, PNG Power Ltd. 2000. *National and Provincial 10-Year Power Development Plan, 2009–2018*. Port Moresby.

31. ADB's strategy for developing the power sector in PNG was implemented through three loan and grant projects with a total approved value of \$129.0 million and six TA projects with a total approved value of \$5.6 million. The projects supported by ADB are listed in Tables 2 and 3, including the two earlier TA projects for the gas sector.

**Table 2: Approved ADB Loans and Grants to Papua New Guinea in the Energy Sector, 2001–2013**

Loan/ Grant No.	Project Name	Fund Source	Amount (\$ million)	Date Approved	Closing Date
L2713	Town Electrification Investment Program - Tranche 1	OCR	40.9	6 Dec 2010	1 Jun 2016
L2714	Town Electrification Investment Program - Tranche 1	ADF	16.4	6 Dec 2010	1 Jun 2016
G0288	Improved Energy Access for Rural Communities	Others (NZ)	2.5	19 Apr 2012	30 Jun 2015
G9163	Improved Energy Access for Rural Communities	JFPR	2.5	19 Apr 2012	
L2998	Port Moresby Power Grid Development	OCR	51.7	26 Apr 2013	31 Jul 2017
L2999	Port Moresby Power Grid Development	ADF	15.0	26 Apr 2013	31 Jul 2017
	<b>Total</b>		<b>129.0</b>		

ADB = Asian Development Bank, ADF = Asian Development Fund, G = grant, JFPR = Japan Fund for Poverty Reduction, L = loan, NZ = New Zealand, OCR = ordinary capital resources.  
Source: ADB database.

**Table 3: Approved ADB Technical Assistance to Papua New Guinea in the Energy Sector, 2001–2013**

TA No.	TA Name	Type	TASF	JSF	Total	Date Approved	Closing Date	TCR Rating
3736	Gas Pipeline Development	AD	700,000		700,000	10 Oct 2001	31 Dec 2003	PS
4710	PNG Gas Project	PP	1,000,000		1,000,000	2 Dec 2005	31 Oct 2008	PS
4932	Power Sector Development Plan	AD		500,000	500,000	25 May 2007	30 Jun 2009	S
7113	Power Sector Development	PP		1,200,000	1,200,000	8 Aug 2008	31 Mar 2012	
7783	Port Moresby Power Grid Development	PP	1,200,000		1,200,000	28 Feb 2011	31 Mar 2013	
8264	Implementation of the Electricity Industry Policy	PA	1,000,000		1,000,000	10 Dec 2012		
	<b>Total</b>		<b>3,900,000</b>	<b>1,700,000</b>	<b>5,600,000</b>			

AD = advisory, ADB = Asian Development Bank, JSF = Japan Special Fund, PA = policy and advisory, PNG = Papua New Guinea, PP = project preparatory, PS = partly successful, S = successful, TA = technical assistance, TASF = Technical Assistance Special Fund, TCR = technical assistance completion report.  
Source: ADB database.

32. **ADB projects.** ADB has funded three projects in the PNG electricity sector.

- (i) **Town Electrification Investment Program (TEIP, Loans 2713 and 2714).** The TEIP is being financed through ADB's ordinary capital resources and the Asian Development Fund. The project is designed to install six renewable energy projects, including hydropower plants; install related transmission systems; build capacity for the implementing agency and project beneficiaries; and establish a project management unit (PMU). The project is financed in two tranches, with the first tranche supporting the development of three hydropower plants and related transmission lines. The project is designed to improve the quality and reliability of electricity access in urban areas and allow PPL to connect more customers in the residential, commercial, and industrial sectors. The transmission links to be financed through the project will facilitate increased connectivity of

customers outside the main provincial centers. This project is presently under implementation.

- (ii) **Improved Energy Access for Rural Communities Project (Grant 9163 and 0288).** This is being financed through the Japan Fund for Poverty Reduction and funds from New Zealand. It is designed to increase electricity access to rural communities by extending the power distribution in three provinces; trial community-based civil works contracts for power line construction; and provide capacity building to communities to improve productive utilization of electricity. The project is expected to reduce household energy expenditure by 20%, and provide access to an additional 20% of new businesses, 4,500 households, 20 schools, and 20 medical facilities in rural communities. The project will also build the capacity of rural households on the use of electricity.
- (iii) **Port Moresby Power Grid (POMGRID) Development Project (Loans 2998 and 2999).** This is being financed through ordinary capital resources and the Asian Development Fund. It is designed to upgrade and rehabilitate two hydropower plants to increase available capacity; strengthen the distribution grid by upgrading it and reducing losses; extend the grid to connect an additional 3,000 households to increase electricity access; construct a new substation and related transmission lines and rehabilitate some existing substations to improve power quality and reduce outages; and establish a PMU. The project is presently under implementation.

33. **Technical assistance.** ADB has funded six TA projects in the energy sector:

- (i) **Gas Pipeline Development Project (TA 3736).** The objective of the first advisory TA project, in 2001, was to accelerate economic growth through private sector-led development of gas exports from PNG. The TA sought to develop an appropriate ownership structure for the participation of the national and provincial governments and landowners in the project. It also helped to finalize the various agreements needed to reach the implementation stage, and develop mechanisms for the efficient use of project revenues for social projects with high poverty reduction impact. The TA was completed, though the scope changed significantly due to changing circumstances.
- (ii) **PNG Gas Project (TA 4710).** This project preparatory technical assistance (PPTA) project was designed to help PNG develop its gas resources for export to foreign markets; support the development of new gas fields in the Southern Highlands Province; convert oil fields to gas production; construct a gas conditioning facility; and construct a 192 km onshore and 270 km offshore gas pipeline from the Highlands to the PNG–Australia maritime border, from where the gas would be transported by pipeline to Australian customers. PNG had also sought ADB support for financing its equity participation in the project. The PPTA was expected to develop a feasibility analysis that could be used to prepare documentation for an ADB loan, political risk insurance, and possibly a partial credit guarantee; review and prepare safeguard documents related to the environment, indigenous peoples, and involuntary resettlement; agree with the Government on arrangements for fiscal management of project revenues; and review project economic and financial viability and sustainability.

The PPTA objectives were only partly achieved since the project developers later decided against developing the pipeline because of projected increases in construction costs, and decided in favor of shipping LPG instead. As an outcome of this decision, the PNG Government and project sponsors decided not to seek multilateral financing, including from ADB.



- (iii) **Power Sector Development Plan (TA 4932).** This advisory TA was designed to assist the government in examining options to facilitate reliable, safe, and affordable electricity services. The TA was to make an assessment of the power supply situation; review sector policies, legislation, regulations, and procedures; diagnose sector entities and binding constraints; develop a power demand forecast and a least-cost plan; develop an implementable plan; build stakeholder capacity; and disseminate results. The TA was completed with the preparation of a Power Sector Development Plan (PSDP), which was assessed to be satisfactory.
- (iv) **Power Sector Development (TA 7113).** This PPTA was designed to build on the PSDP and update the least-cost plan; design and cost key subprojects; conduct environmental and social safeguards analysis; examine climate impacts; recommend a sector governance framework; and conduct an awareness program and hold public consultations on the plan. The PPTA led to the design of the TEIP.
- (v) **Port Moresby Power Grid Development (TA 7783).** This PPTA was designed to examine issues related to grid planning, identify priority investments for the Port Moresby power grid, and develop project preparatory documentation for the POM Grid Development Project, which was subsequently financed by ADB and is ongoing.
- (vi) **Implementation of the Electricity Industry Policy (TA 8264).** This policy and advisory TA project supported the implementation of PNG's EIP by helping in the preparation of the national electrification roll-out plan (EROP), establishing implementation capacity within the DPE, and assisting in identifying and implementing initial pilot projects.<sup>14</sup>

## G. Evaluation of ADB's Assistance

34. The assessment of the energy sector is made against six key evaluation criteria: strategic positioning, relevance, efficiency, effectiveness, sustainability, and development impact. This section evaluates the ADB portfolio of projects in the energy sector and collectively rates them against each of the criteria along with a justification for the rating.

### 1. Strategic Positioning

35. Overall, the strategic positioning of ADB's support to the energy sector is rated *successful*. The strategy for supporting the development of the energy sector as described in the CPS, 2011–2015, along with the periodic updates, is clearly consistent with the needs of the country and the government's strategy for developing the energy sector.

36. The government's MTDP, 2011–2015, and PNGDSP, 2010–2030, articulate the plans to achieve the goals of PNG's Vision 2050. In the near term, the MTDP, 2011–2015, seeks to reduce technical and non-technical losses and upgrade the existing regional electricity grids to improve the availability, reliability, and quality of power. In the longer term, the MTDP, 2011–2015, seeks to expand the electricity grid, promote renewable energy, develop gas-based generation, and expand electricity access to 70% of the population. The MTDP, 2011–2015, also seeks to promote private sector investments in the power sector.

37. Consistent with PNG's strategy, ADB support for the energy sector is focused on increasing access to a reliable and affordable energy supply, expanding infrastructure to meet future demand, facilitating private sector investments, reducing household expenditure on energy services, and supporting increased development of renewable and clean energy generation. ADB's support is also consistent with PNG's EIP, whose preparation ADB supported.

<sup>14</sup> Preparation of the EROP was supported jointly with the World Bank.

38. A challenge to implementation is the government's commitment to restructure the electricity sector, improve the performance of sector entities, develop mechanisms to encourage private investment, focus public efforts on expanding rural electricity access that would be of limited interest to the private sector, and support civil society organizations (CSOs).

39. Other key development partners supporting the energy sector are the World Bank, Japan International Cooperation Agency, and the New Zealand AID Program. The development partners are also supporting improved policies for the sector, and increased investments in generation, transmission, and distribution to expand electricity access. The World Bank, for instance, is supporting the EROP, feasibility studies and procurement support for hydropower, preparation of third party grid access codes, and mapping of renewable energy resources in the country. Japan International Cooperation Agency is supporting transmission upgrades in the Lae Province, and New Zealand is supporting increased electricity access through clean energy sources.

40. ADB's strategy for the energy sector in PNG is consistent with the efforts being made by other major development partners. However, stakeholders expressed concern that there is only ad hoc coordination among donors, which does not support a consistent donor view to the government. The government is not taking the lead in coordinating donor assistance, although the Department of Planning, for instance, could undertake this role. The IPBC at times coordinates some of the donor efforts and provides guidance on needed support and helps avoid duplication. Stakeholders also commented that ADB, as the major partner in PNG's energy sector, could take on a more active role in coordinating with the government and shaping its thinking and long-term policies for the sector.

41. While the CPS strategy for the sector is broadly consistent with the government's strategy, there could be greater emphasis on sector reforms and the strengthening of sector institutions through capacity building, increased rural energy access, and development of the gas sector for power generation.

## 2. Relevance

42. The program was *relevant* in relation to the ADB and government strategic priorities. Through its projects and TA projects, ADB has supported, and continues to support, rehabilitation and installation of new energy infrastructure, increased access to electricity for urban and rural consumers, improved reliability and affordability of electricity, and capacity building of sector institutions. All ADB projects have therefore been relevant to the Government of PNG and are consistent with CPS sector strategies.

43. The TEIP and the POMGRID Development Project are designed to rehabilitate and install new hydropower plants and install related transmission facilities. ADB projects have been designed in consultation with local stakeholders and are acknowledged to be very relevant to the country. The focus of projects is consistent with government policy and resonates with stakeholders, who agree that ADB's assistance is valuable. The projects being supported are also consistent with the 10-year development plan, while the project components have been identified by PPL.

44. Strengthening the grid is also very critical from the country's point of view, and ADB's projects include this important element. The focus on expanding energy access in urban and peri-urban areas is also viewed positively. Given the low access in rural areas, there is some criticism that ADB is less focused on rural electricity access, but the majority of stakeholders are of the view that electricity is not a priority for rural consumers and should not be a primary focus for ADB support.

45. The grant project on Improved Energy Access for Rural Communities is coupled to the TEIP and addresses rural electricity access, which is very relevant given the very poor access in rural areas and the dependence on high-cost diesel generation. The support for community based civil works contracts and

the capacity building to increase productive use of electricity are also very relevant to rural areas. The components of this grant project are also consistent with the governments EIP, which seeks to support community-based organizations and CSOs.

46. ADB's TA projects have supported the preparation of the loan projects and the implementation of the EIP, all of which were relevant to the ADB energy portfolio and were consistent with government strategy for the electricity sector. Two earlier TA projects, which supported the development of the gas sector, were relevant at the time of their design, but changing circumstances in the gas market in the country made them less relevant. However, these two TA projects are not the focus of this evaluation.

47. The design and monitoring framework (DMF) of the two loan projects are well developed with clear and measurable performance targets and indicators. The non-physical outputs of the projects should be easy to measure and monitor, despite the data gathering limitations in PNG.

### 3. Efficiency

48. Overall, the efficiency of ADB's energy projects and TA is rated *efficient*. The economic internal rate of return (EIRR) of the two loan projects is expected to be above the threshold of 12%. Since the two loan projects are currently in the early stages of implementation, it is difficult to assess if they will remain efficient.

49. The TEIP is designed as a multitranche financing facility (MFF), which should improve project efficiency by not requiring ADB Board approval for the financing of the different phases of the project, thereby reducing transaction costs. But the MFF mechanism can also be taken advantage of, since project cost overruns in one phase can be shifted to subsequent phases without requiring Board approval.

50. While the objectives of the TEIP are consistent with government strategies and the MTD, 2011–2015, stakeholders were critical of the quality of the PPTA that helped design the project. They commented that the analysis in the PPTA reports appeared to place more emphasis on safeguards than on the technical analysis of the project. Moreover, the PPTA did not apparently provide a pre-feasibility study of project subcomponents, which now needs to be conducted. The revised analysis of project subcomponents has resulted in project subcomponent costs being between 50% and 100% higher than previously anticipated. This has led to a revision in the scope of the project, which will now install only three hydropower plants instead of the six stated in the report and recommendation of the President.<sup>15</sup>

51. While deficiencies in the PPTA could be a reason for the increase in project costs, part of the cost escalation is also attributable to the fact that the PPTA was completed in 2010 and the project is being reevaluated and implemented in 2014. Stakeholders were of the view that approvals from Manila take a long time—it was stated that some of the safeguard plans had not been approved even several months after document submission. Some of the safeguard reports prepared by the PPTA were also considered to be inadequate and had to be redone at a high cost. While some of these changes in project design could be for valid reasons, the increase in costs due to delays caused by the weaknesses of PNG sector institutions could have been foreseen. Stakeholders opined that the lack of adequate funding for the PPTA may have been a cause for the weakness in project assessment and design.

52. The project has been also delayed by 18–24 months. The inadequate analysis of project subcomponents in the PPTA, the weak capacity of PNG stakeholders, and ADB's management of the project, which shifted from ADB (Manila) to PNG Resident Mission, are all reportedly causes of this

<sup>15</sup> ADB. 2010. *Report and Recommendation of the President: Proposed Multitranchise Financing Facility to Papua New Guinea for the Town Electrification Investment Program*. Manila.

delay. Delays have also been caused by the utility's lack of experience working with ADB and its lack of experience in establishing a PMU (paras. 62–63).

53. The increased cost estimate, the delay in project implementation, and the revised scope of the project are all likely to have a negative impact on the EIRR of the TEIP (the report and recommendation of the President estimated that the EIRR for the three main project subcomponents would range from 16.4% to 18.1%). A revised EIRR has not yet been estimated for the project.

54. Given the significant increase in the cost of the project, it was reported that the project will very likely tap into funds from Tranche 2 of the project to implement components earlier planned to be completed with Tranche 1 financing. If this is permitted by ADB, the scope of Tranche 2 projects planned earlier will have to be commensurately reduced.

55. On a positive note, it was reported that the extension of the transmission lines under this project will expand supply to rural areas in the Highlands area and extend the Moresby grid by about 36 km. The project will also be integrated with other planned projects in the area and will be supplemented with diesel generation. This will lead to about 4,000 households being connected instead of 3,000 as originally planned. This is likely to have a positive impact on the economic and financial viability of the project.

56. Implementation of the grant project for Improved Energy Access for Rural Communities, associated with the TEIP, has also been delayed. There is some criticism that ADB has not kept its partner agencies, who are cofinancing the project, fully informed of the progress of this project.

57. The TEIP was the first loan project for PPL and the learning curve for project stakeholders was steep. The POMGRID Development Project is already benefiting and learning from this experience. The PPL team had greater interaction with the PPTA team for the POMGRID Development Project, which reportedly improved the project design. The PPTA team was based in the PPL office and was available for consultations. However, it was reported that even in this project, funds were inadequate for the PPTA and some studies could not be undertaken. For instance, a loss reduction study and a study on capacitor banks for reactive power correction were not undertaken. The PPTA design was overall better than in the earlier project and led to fewer delays. Also, it was reported that the PPTA erred on the conservative side and actual project costs may be slightly lower. The EIRR of the project is estimated to be 17.9%. The project is in the early stages of implementation and the EIRR may have to be revised depending on the outputs and outcomes achieved.

58. Given PPL's lack of capacity to comply with all ADB processes, and learning from the earlier project experience, ADB supported the establishment of a separate PMU for the POMGRID Development project. It is staffed by an outside team, though a full complement of expertise among the staff is still lacking. PMU consultants have prepared a report with gap analysis and are expected to provide specifications to develop bid documents by the end of 2014. The project end date is now estimated to be in the third quarter of 2017.

#### 4. Effectiveness

59. The effectiveness of ADB's support to the electricity sector in PNG cannot be fully assessed, because the two loan projects and one grant project are still in the early stages of implementation.

60. **Achievement of physical outcomes.** It is expected that the TEIP will only partly achieve its intended physical output when fully implemented, since the scope of the project has been revised and only three hydropower plants will be installed instead of the six that had originally been planned.

61. Stakeholders claimed that the pre-design of the project subcomponents in the PPTA was inadequate and the revised technical analysis conducted after project approval differs from the earlier planned project outcome. It was stated that this could partly be because the PPTA may have relied on old hydrology data and data from earlier utility studies that were not reliable and yet were used with no attempt to validate and update the information. It was also reported that the PPTA may not have used data from actual project sites, and that the load demand in the project area has risen substantially, making it unlikely that the project will now displace diesel as previously planned.

62. Delays have also been caused by the utility's lack of experience working with ADB and in establishing a PMU—for instance, it was initially planned to use an internal team from PPL to staff the PMU, but PPL could not provide adequately qualified staff, thus further delaying the establishment of the PMU and project implementation. It was opined that the lack of adequately trained personnel in the country and the relatively low public salaries also hindered efforts to staff the PMU.

63. The PMU now has 13 staff exclusively for the project, some of whom are PPL staff while the rest are hired from the outside. Some experts, such as the gender and environment experts on the PMU team, were earlier associated with the PPTA and are familiar with the ADB implementation process. The PMU, however, does not yet have the capacity to independently prepare bid specifications and bid documents, and reportedly needs external support to undertake some tasks. Further, it is reported that local procurement guidelines and political interference have made procurement challenging.

64. The relatively small size of the project components has posed its own challenges, and PPL received very few bids for project implementation.<sup>16</sup> There was a plan to bundle projects, but that was not possible since projects are located at very different locations. Stakeholders feel that ADB's qualification criteria for bidders are too stringent, especially for small projects.

65. Notwithstanding the misgivings with the PMU process, it is now generally acknowledged by stakeholders that the concept of a PMU is very good and will help streamline the project implementation process. Further, despite stakeholders' reservations and criticisms, it appears that only about 30% of the delay in project implementation could be attributed to the ADB process and the limitations of the PPTA, with the utility and PNG government processes being responsible for the rest of the delays in implementation. Also, local stakeholders are reportedly not taking ownership of the projects, leading to project mismanagement.

66. PPL will be responsible for the operations and maintenance (O&M) of the Improved Energy Access for Rural Communities Project. In the past, PPL has developed projects in rural areas that suffered from a lack of local expertise to operate and maintain systems. The lessons learned by PPL from this experience will likely make the project effective, though its implementation has also been delayed.

67. The POMGRID Development Project is likely to achieve its intended physical outputs when fully implemented, since there has been no revision in its scope.

68. While the eventual realization of planned outcomes for the two loan projects is yet to be determined, the practical DMF developed for the projects will make it easier to monitor and track project effectiveness. However, as noted above, implementation of both these projects, as well as the Improved Energy Access for Rural Communities Project, has been delayed.

69. The TA projects in general have achieved their intended output.

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<sup>16</sup> A pre-bid meeting and site visits were held, and while 19 firms had purchased bid documents only four bids were reportedly received.

- (i) The TA for the preparation of the Power Sector Development Plan was successful in developing a plan, which has been the basis for the government's electricity strategy and is being periodically updated.
- (ii) The two TA projects that designed the two loan projects were rated successful in their completion reports, though, as noted in the section above, certain deficiencies have led to project delays, cost increases, and a revision in scope in the case of the TEIP.
- (iii) The TA to support implementation of PNG's EIP, prepare the national EROP, and build capacity within the DPE was completed.
- (iv) The two early TA projects for the development of gas projects in the country were rated successful and partly successful in their completion reports, given the challenges they encountered because of changes in the gas market in the country. The outcomes of these TA projects could not be evaluated during the sector assessment since there were no stakeholders available with the institutional memory of the projects.

70. **Achievement of capacity development outcomes.** ADB projects have supported capacity development of sector entities in the development of sector strategies and plans, and in the establishment of the PMU. These efforts have been successful, despite the many challenges in establishing a functional PMU for the TEIP, which is the first time that a PMU has been established for an ADB project in the electricity sector. However, this success has largely been driven by the support from foreign consultants and contractors, as human resource capacity at the sector entities remains weak and it is difficult to retain trained and capable staff given the low public sector salaries.

71. The lack of capacity at sector institutions was widely acknowledged during the sector assessment as a drawback to improved sector operations. It appears that this lack of absorptive capacity of the stakeholders has not been fully considered in designing the projects, which is apparent in the delays in project implementation. Thus, even when projects are consistent with the government and CPS priorities, they may not be effective if the stakeholder agencies are unable to fully benefit from them.

## 5. Sustainability

72. ADB's support to the energy sector over the evaluation period is rated *less likely sustainable*. Since both projects are in their early stages of implementation, assessing their sustainability is slightly speculative. A key measure of sustainability of projects is the ability of PPL, the executing agency and project beneficiary, to finance the recurrent costs and O&M costs of projects. PPL operates with a trust account and, despite relatively high tariffs, its financial position is unclear since financial accounts are not available. To date, PPL has been unable to finance routine O&M and ordinary capital expenditures. Moreover, the energy infrastructure needs to be rehabilitated, and this is being done with ADB and other funds.

73. PPL has not previously implemented ADB supported projects and has faced a steep learning curve in establishing a PMU, and developing and bidding subprojects. PPL also does not have much capacity, or experience, to disburse ADB funds and manage loan projects. The PMU's capacity is also weak. PPL may need to set up a separate project account to ensure that it has the funds it needs to make projects sustainable. Stakeholders opine that PPL's management capacity to implement the projects is also weak, as is human resource capacity in all electricity sector institutions. There has been resistance to efforts to reform and liberalize the electricity sector, and promote private sector participation. The political will to make changes is also less certain. The dependence of sector institutions on external consultants and contractors will enable the institutions to move projects forward, but this will not be sustainable without transfer of capacity. All these factors potentially weaken the sustainability of ADB projects.

74. The financial internal rate of return (FIRR) for the TEIP is estimated to be 9.6%, which is above the Weighted Average Cost of Capital (WACC) of 2.4%. However, the increased cost estimate for the project, the delay in project implementation, and the increase in load demand are all likely to negatively impact the FIRR. Also, as noted earlier, the significant increase in project cost may require tapping into Tranche 2 funds to implement components intended to be completed with Tranche 1 financing. This would reduce the scope of projects to be implemented in Tranche 2 and possibly impact the FIRR. The low FIRR will also impact the sustainability of the project. The FIRR for the POMGRID Development Project is estimated to be 10.2%, which is higher than the WACC.

## 6. Development Impact

75. The development impact of ADB's support is provisionally rated *successful*. ADB's support for the sector is consistent with the government's objective to provide 70% of households with access to a reliable and affordable electricity supply by 2030. ADB's support for the sector, as described in the CPS, 2011–2015, seeks to improve access to sustainable clean energy and achieve a 10% reduction in household expenditure on energy services from 2011 levels.

76. The goals of the ADB support are achievable provided the projects are implemented as planned. ADB's loan and grant projects are currently in the early stages of implementation and it is difficult to assess, at this early juncture, if they will achieve the planned outputs and outcomes.

77. Equally, it is also too early to state if ADB support for the sector will achieve cross-sectoral impacts and inclusive growth. ADB's grant project seeks to expand electricity access to rural areas, and its loan projects seek to improve access in urban and peri-urban areas. If these projects are implemented as planned, they are likely to support inclusive growth and have cross-sectoral impacts on income growth.

## 7. Overall Assessment

78. Overall, the PNG Energy Sector is rated *successful*. Table 4 shows the rating for each criterion. Strategic positioning, relevance, efficiency, effectiveness, and impact of the ADB program were all satisfactory on average, while sustainability was not.

Table 4: Energy Sector Overall Performance Rating

Rating Criteria	Criteria Weight	Assessment	Score	Weighted Average Score
Strategic Positioning	0.1	Successful	2	0.2
Relevance	0.1	Relevant	2	0.2
Efficiency	0.2	Efficient	2	0.4
Effectiveness	0.2	Effective	2	0.4
Sustainability	0.2	Less likely sustainable	1	0.1
Development Impact	0.2	Successful	2	0.4
<b>Overall assessment</b>	<b>1.0</b>	<b>Successful</b>		<b>1.7</b>

The evaluation scoring system rates the overall sector performance based on the following criteria: (i) if the overall weighted average score for criteria combined is  $\geq 2.7$ , the overall performance is highly successful; (ii) if it is  $< 2.7$  but  $\geq 1.6$ , it is successful; (iii) if it is  $< 1.7$  but  $\geq 1.6$ , it is borderline successful; (iv) if it is  $< 1.6$  but  $\geq 1.5$ , it is borderline less than successful; (v) if it is  $< 1.5$  but  $\geq 0.8$ , it is less than successful; and (vi) if it is  $< 0.8$ , the overall performance is unsuccessful.

Source: Asian Development Bank Independent Evaluation Department.

## H. Conclusion: Key Findings, Lessons and Suggestions

79. **Key findings.** The electricity sector in PNG is characterized by very low access, unreliable and expensive service, and infrastructure that is in need of rehabilitation. ADB is the lead development

partner in the energy sector in terms of the value of assistance, but its support has been fairly recent and so its infrastructure projects are still in the early stages of implementation. The PNG government has developed an MTDP and DSP consistent with its broader developmental goals and seeks to expand access to reliable and affordable electricity. PNG has also adopted the EIP late in 2013, which sets the framework for implementation of the MTDP, 2011-2015, and the PNGDSP, 2010–2030. The country, however, still lacks an overall energy policy, though a draft is under preparation and is expected to be finalized by the end of 2014. There is no clear framework for reforms through unbundling of the sector, and there is no consensus among stakeholders on the best approach for reforming the sector. This has implications for developing the electricity sector, including increased private sector investments. The challenge in procuring land for projects is also a barrier to private investments.

80. The energy institutions in PNG are weak in terms of capacity and access to resources to implement their mandate. The weak capacity of the DPE is a major constraint to developing the energy sector. The capacity of PPL to undertake project development is also weak. Although the PMU has gained much from previous project experience, it is still largely dependent on external consultants and contractors. Further, PPL operates on a budgetary allocation from the treasury and there are no financial accounts designated for the utility. The weak capacity of sector institutions could be an obstacle to developing ADB-funded projects, as evident from the delayed implementation of ongoing ADB projects.

81. Electricity tariffs in the country are high. The high electricity tariffs can be attributed to high usage of diesel generator sets to generate electricity. There is no explicit subsidy in prices, though there is cross-subsidization among customer classes. Consequently, the utility, PPL, is not able to fully recover the cost of supply from CSOs.

82. Regulatory capacity is also weak. The ICCC nominally regulates tariffs based on revenue requirements and price caps,<sup>17</sup> but it has no benchmarks available for price cap regulation. Further, it has no independence in rate setting. License fees cover only about 10% of the ICCC budget and the rest is provided by the government, which further undermines its independence. The regulator lacks technical capacity and technical regulation is ironically conducted by PPL, the regulated entity. For instance, ICCC has no capacity to regulate the investment plans and demand projections made by PPL. ICCC at the present does not review PPAs between PPL and IPPs, and PPA prices are negotiated directly with the utility based on the principle of avoided costs. The lack of an independent regulator and the move to shift some regulatory functions to the DPE, which is also the policy making entity, could be a potential barrier to private sector investments.

83. The potential for non-hydro renewable energy has not been exploited, though solar home electric systems have been installed in rural areas and solar water heating systems in urban and rural areas.<sup>18</sup> PNG has also not embarked on an energy efficiency program, and energy efficiency is not mandated by the ICCC.

84. Electricity access in rural areas is extremely poor and generally non-existent. The Ministry of Petroleum and Energy and the sector entities are more focused on improving and expanding urban electricity access. Electricity access was reportedly not a high priority in rural areas, especially for households.

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<sup>17</sup> Tariff applications are made annually by PPL to ICCC. Fuel cost pass through are made on a quarterly basis.

<sup>18</sup> It was reported that the theft of solar panels is a problem in urban and rural areas. Over 3,000 solar home lighting systems and over 3,000 solar water heating systems have reportedly been installed in PNG with government support, starting from the 1980s. By 2004, an estimated 7,000 homes in Port Moresby used solar water heating. Solar PV is marketed by private suppliers and used mainly for lighting, but also for communications. An \$11.3 million Japanese-supported project provided solar electrification for 320 schools in all 20 PNG provinces in 1997–1998 (Pacific Lighthouses, Renewable energy opportunities and challenges in the Pacific Islands region: Papua New Guinea, IRENA, August 2013).



85. **Lessons.** There are important lessons to be learned from an evaluation of the relevance and efficiency of ADB-funded projects. Since the projects are in the early stages of implementation, there are fewer lessons to be learned from evaluating the effectiveness and sustainability of projects.

86. The success of TA projects hinges on the choice of consultant; strong ADB support and commitment; flexibility in TA scope to accommodate changing circumstances; and careful consideration to the implementation timeframe and funding for TA projects. The first PPTA in support of the TEIP was reportedly inadequately prepared, leading to revisions in project design and substantially higher costs, and project implementation has been delayed by almost two years. The implementation of the POMGRID Development Project has benefited from the earlier experience, but it has also been delayed due to the weak capacity of PPL to implement projects.

87. Stakeholders are of the opinion that consultants need to spend more time in the country, consult more with local entities, and have some knowledge of the region, to prepare better project proposals.

88. The sector entities such as PPL and ICCC need substantial capacity building and resource strengthening to undertake project development. This has been evident from the difficult experience establishing a PMU for the TEIP. Future assistance can therefore be focused on these areas.

89. Increased coordination with the energy team at the PNG Resident Mission is also preferred by stakeholders over project management from Manila.

90. **Suggestions.** Some suggestions for ADB support to the energy sector in PNG are provided in Table 5.

**Table 5: Suggestions**

Suggested Programs for ADB Support	Objectives of Program
Sector reform and governance	<p>While the options for reform of the electricity industry were not examined during the assessment, stakeholders were strongly of the opinion that the management and operational efficiency of PPL could be improved by functionally unbundling the vertically integrated utility. Sector reform would also improve sector governance and transparency, and enable increased private sector investments. The EIP is supportive of sector reform, but the DPE and other sector entities need the assistance of development partners to undertake gradual reforms of the electricity industry.</p> <p>The IPBC, as the holding company for all state-owned enterprises, has considerable management capacity, which could be leveraged to overcome the weak capacity of PPL.</p>
Capacity building and policy support	<p>The ICCC needs support for economic regulation and rate setting. Some technical regulatory issues are being transferred to the DPE, which is not desirable since the DPE is also the policy-making entity (at present, PPL undertakes technical regulation and is in effect regulating itself). The ICCC also needs more resources, and greater independence in its functions. ADB could consider supporting the ICCC through capacity building programs.</p> <p>ADB has supported the establishment of project management units at PPL to implement loan projects, but PPL has had difficulty staffing it with trained personnel. PPL also has weak capacity to plan and manage utility operations and implement projects, and would benefit from more capacity building.</p> <p>ADB could also consider supporting assessments for expanded use of non-hydro renewable energy resources such as solar, wind, and biomass.</p> <p>PNG has oil and gas act but no gas or petroleum policy, so contracts are negotiated and regulatory conditions are mandated through contracts rather than through a transparent policy. ADB could support the development of a gas policy, which would also support gas-based power generation and reduce the country's dependence on diesel-based generation. ADB could also help build the capacity of the DPE and other relevant entities to develop the gas sector.</p>
Rural access to electricity	<p>ADB should consider increased support for expanding rural access to electricity, where access is under 4% and is an obstacle to economic and social development and the well-being of communities. The lessons learned from the ongoing Improved Energy Access for Rural Communities grant project would be valuable in designing additional projects.</p> <p>PNG is not a signatory to the United Nations' Sustainable Energy for All (SE4ALL) program, which leverages international support for countries to expand rural access to energy. ADB could support PNG's participation in this global initiative, which seeks to provide energy access to all by 2030.</p>

ADB = Asian Development Bank, ICCC = Independent Consumer and Competition Commission, DPE = Department of Petroleum and Energy, EIP = Electricity Industry Policy, PNG = Papua New Guinea, PPL = PNG Power Ltd.