PROGRAM IMPACT ASSESSMENT

I. SUMMARY

1. This Program Impact Assessment describes key issues faced by the energy sector in general and the electricity and gas sub-sectors in particular, the principal elements of the Government's energy sector strategy, and the likely impacts of the Sustainable and Inclusive Energy Program.

2. Despite impressive economic growth over the last 15 years, more than 35 million Indonesians lack access to electricity and some 28 million[1] live below the poverty line. The country's relatively poor performance in the provision of public services is to a significant extent attributable to energy subsidies, which have taken funds away from much-needed investment in infrastructure, social welfare, and education. The subsidies have also had adverse impacts on the energy sector itself, resulting in wasteful investment, production and consumption decisions. The recent moves to remove subsidies now present various opportunities to improve efficiencies and develop new energy resources. These opportunities may be pursued through improvements in the operating efficiency of energy sector enterprises, greater involvement of the private sector in energy supply, the development of renewable energy resources, introduction of energy efficiency measures, and improvements in the environmental performance of the power subsector.

3. The program comprises three pillars: (i) improved sector governance; (ii) enabled markets for private participation; and (iii) improved regulatory environment for increased access to clean energy and energy efficiency. Improvements in sector governance are facilitated by improved targeting of electricity subsidies, which shifts government spending from subsidies into infrastructure investment with beneficial results while protecting low income households. Further, the resulting higher power prices encourage consumers to avoid wasteful use of electricity. Subsidy rationalization is accompanied by introduction of an economic regulation that will incentivize the State Electricity Corporation (Perusahaan Listrik Negara, PLN) to manage its revenues and improve its operational efficiency and financial performance. The second pillar addresses issues that hamper planning, financing and delivery of projects in both the power and gas sectors. The third pillar entails the scale-up of geothermal energy and other renewables, including biomass and small hydro, with the development of regulations that will promote renewable energy generation and establish an energy efficiency marketplace in the country through measures including minimum efficiency performance standards for appliances, a green building code, requirements for energy services companies etc. The third pillar also includes actions to improve the environmental performance of fossil fuel power plants through clean fossil fuel technologies such as carbon capture and storage, as well as the energy efficiency of domestic appliances and new buildings.

4. The Program Impact Assessment has assessed the program's economic costs and benefits, its fiscal impacts, and its effects on Indonesia's overall economic activity as measured by gross domestic product (GDP). The economic cost-benefit analyses assess the program's impact on Indonesia's economy and the global costs and benefits of changes in carbon dioxide emissions. Where Indonesian market prices for energy and other resources differ markedly from international market prices, they have been converted into economic prices.

[1] World Bank. World Development Indicators. http://www.data.worldbank.org/country/Indonesia
"Poverty headcount ratio at national poverty lines". 2014. (accessed 28 June 2015).

5. Beyond the economic impacts there are fiscal impacts, represented by the financial revenue earned and expenditures incurred by the government as a result of the program. Fiscal transactions are mainly tax and subsidy payments, including increases in government income arising from increased gas production and its associated fiscal costs.

6. The program's economic benefits are estimated to average $5.5 billion per year and readily exceed its economic costs of $3.3 billion per year (Table 1).

Table 1: Summary Economic Program Costs and Benefits / (Constant 2014 $ million)

Benefits	**2014-2015**	**2016-2017**	**2018-2019**	**2020-2023**	**Total**	**Average pa**
Pillar 1	1,685	3,339	3,126	4,319	12,469	1,247
Pillar 2	0	2,115	5,703	11,074	18,892	1,889
Pillar 3	963	2,661	4,730	15,024	23,378	2,338
Total Benefits	2,648	8,115	13,559	30,417	54,739	5,474
Costs						
Pillar 1	224	202	0.5	0.5	427	43
Pillar 2	0	1,479	3,540	6,120	11,139	1,114
Pillar 3	2,010	4,837	5,920	8,836	21,603	2,160
Total Costs	2,234	6,518	9,461	14,957	33,169	3,317
Net Benefits	414	1,597	4,098	15,460	21,570	2,157

7. The fiscal costs and benefits to the government are summarized in Table 2.

Table 2: Fiscal Benefits and Costs of the Program / (Constant 2014 $ million)

Fiscal Benefits	**2014-2015**	**2016-2017**	**2018-2019**	**2020-2023**	**Cumulative**	**Average pa**
Pillar 1	2,844 a/	6,618	7,383	11,127	27,972	2,797
Pillar 2	0	589	1,410	2,442	4,441	444
Pillar 3	5	43	120	218	386	39
Total Fiscal Benefit	2,849	7,250	8,913	13,787	32,799	3,280
Fiscal Costs						
Pillar 1	0.5	0.3	0.3	0.3	1.3	0.1
Pillar 2	1.0	129	492	1,032	1,654	165
Pillar 3	1,727	3,493	3,711	2706	11,637	1,164
Total Fiscal Costs	1,729	3,622	4,203	3,738	13,292	1,329
Net Fiscal Benefit	1,120	3,627	4,711	10,049	19,507	1,951

a/ Subsidy savings in 2015 account for the total $2,844 million reduction in the electricity subsidy.

8. The reduction of electricity subsidies has a positive impact on the government finances and accounts for most of the fiscal benefits of Pillar 1. Pillar 2 has a moderate positive impact by increasing domestic gas production and government revenues. Pillar 3 is a net fiscal drain, largely due to the subsidies that cover the costs of providing universal access to electricity and to a lesser extent the incentives needed to expand renewable energy. Notwithstanding the positive net fiscal impacts of the program, the government is forecast to run an overall budget deficit caused by: (i) the impacts of a lower oil price on government's oil and gas related revenues, (ii) the flow-on effects of the currently reduced GDP growth rate on government income, and (iii) the government's commitment to increase expenditures on essential infrastructure, including by use of the subsidy savings from Pillar 1.

9. The increased tariffs reduce consumption of electricity and thereby contribute to the current reduction in the GDP growth rate. This reduction is subsequently reversed as beneficial

investments in infrastructure take effect, so that by 2023 GDP will be increased by over $113 billion compared to the no-reform scenario.

II. DEVELOPMENT PROBLEMS AND CONSTRAINTS

10. **Energy subsidies have constrained economic growth and social welfare**. Despite impressive economic growth since the Asian financial crisis in 1997/1998, more than 40 million Indonesians lack access to electricity. According to World Bank indicators for middle income countries, Indonesia is also performing poorly in a number of health and infrastructure areas, particularly in outlying islands where provision of services are challenging and costly. The country's poor performances in both infrastructure and the provision of public services are to a significant extent attributable to energy subsidies, which have taken funds away from much-needed investment in infrastructure, social welfare, and education.[2] In 2013 the government spent approximately Rp300 trillion ($30 billion) on energy subsidies, equivalent to 2.5% of GDP. The links between under-investment in infrastructure, economic growth and poverty reduction are well established, as noted by the World Economic Forum.[3]

11. Indonesia has a long history of energy subsidies dating back to the first oil price shock of the 1970s. The following table shows the growth of the electricity subsidy since 2004, when Indonesia changed from a net exporter to a net importer of oil.[4]

Table 3: PLN Cost of Electricity, Tariffs, and Subsidies

Year	Average electricity cost (Rp / kWh)	Average electricity tariff (Rp / kWh)	Subsidies (trillion Rp)	Subsidy / Cost (%)
2003	618	561	3.36	9%
2004	597	584	3.31	2%
2005	710	589	10.4	28%
2006	934	622	33.9	33%
2007	920	627	37.48	32%
2008	1271	651	78.58	49%
2009	1009	662	53.72	34%
2010	1008	703	58.11	30%
2011	1251	738	93.18	41%
2012	1272	745	103.33	41%
2013	1178	818	101.21	31%
2014	1243	940	99.30	24%

Source: Directorate-General of Electricity (2014b), "Electricity policy development in Indonesia", presentation to IEA, Ministry of Energy and Mineral Resources, Jakarta

[2] Center of Logistics & Supply Chain Studies. *State of Logistics Indonesia 2013*. Indonesia's infrastructure gap remains wide compared to its peers, particularly in transport and power. "*Logistics costs account for around 24% of GDP in Indonesia, compared to Thailand (20 %), China (18%) and Malaysia (13%*)."

[3] World Economic Forum. 2015. Global Competitiveness Report 2014-2015. "*Well-developed infrastructure reduces the effect of distance between regions, integrating the national market and connecting it at low cost to markets in other countries and regions. In addition, the quality and extensiveness of infrastructure networks significantly impact economic growth and reduce income inequalities and poverty in a variety of ways. A well-developed transport and communications infrastructure network is a prerequisite for the access of less-developed communities to core economic activities and services*."

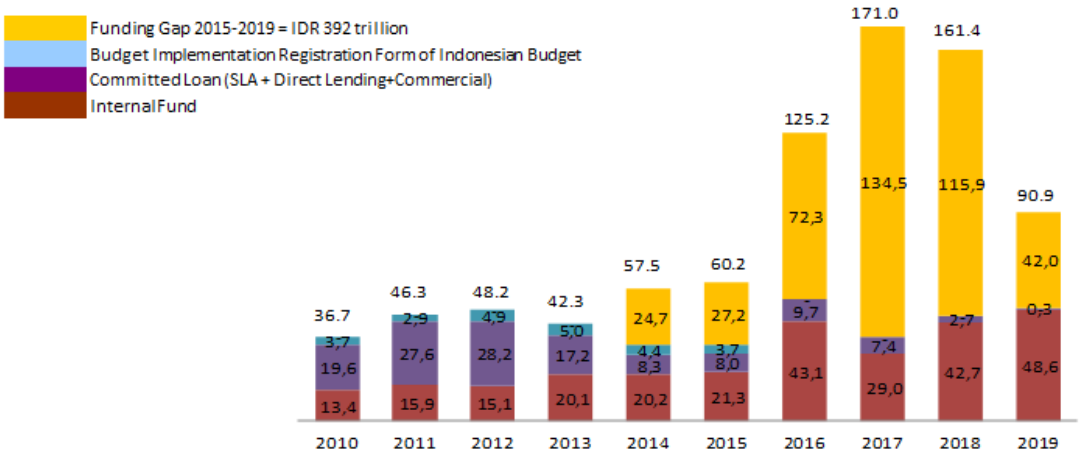
[4] Indonesia remains the world's largest coal exporter, the seventh-largest liquefied natural gas (LNG) exporter and the world's largest producer of biofuels.

12. Although electricity subsidies to large industrial consumers were abolished in 2008, the remaining subsidies for the other consumer groups continued to grow from 2009 to 2012 and outpaced increases in the average cost of electricity. In 2013, electricity tariffs were incrementally increased for certain consumers based on electricity consumption and in 2014 these increases were followed by gradual price increases for medium-sized consumers and other industries. The consequences of low energy prices over such a long period are: inefficient and uneconomic use of energy, an increased reliance on fossil fuels, poor utilization of Indonesia's renewable energy resources, and the government's inability to ensure universal access to electricity. The low prices for energy also created a demand/supply gap for various forms of energy.

13. **Energy demand and investment.** One of the consequences of providing electricity to consumers at less than cost is development of uneconomic energy consuming activities (allocative inefficiency) and wasteful use of electrical energy (demand side inefficiency). The allocative inefficiencies have caused, among other matters, over-investment in power supply facilities and under-investment in other areas of the economy. The role that sales of electricity at less than cost played in creating excessive demand for power was not acknowledged in the national power systems plans, which implicitly assumed all investment was meeting the demands of soundly based economic growth. PLN is now struggling to meet the over-stimulated demands caused by the low tariffs.

14. The issues have been brought into sharp focus by PLN's 2015–2024 electricity power supply business plan (Rencana Usaha Penyediaan Tenaga Listrik, or RUPTL). The RUPTL forecasts that over the 2015 to 2019 period PLN's investment requirements are Rp608.6 trillion ($51 billion) and that private sector support for a further Rp579.7 trillion ($48 billion) of investment in the power sector will be required. However, financing constraints mean that on a "subsidies as usual" or no-reform basis the power sector would face a funding shortfall of Rp392 trillion ($33 billion), with the shortfalls peaking in 2017, as shown in Figure 1.

Figure 1: The Funding Gap



Description	Unit	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2015-2019
Capital Expenditure	trillion IDR	36,7	46,3	48,2	42,3	57,5	60,2	125,2	171,0	161,4	90,9	608,6
PLN + IPP Plant Growth	MW	1.438	2.966	5.308	1.455	2.827	3.573	4.213	6.379	9.238	19.319	42.722
PLN Plant Growth	MW	1.258	2.373	3.633	1.305	2.334	2.091	2.885	3.27	2.726	3.634	14.606
Transmission Growth	thousand ckm	0,1	2	1	1	5	14	11	11	9	5	49,6
Distribution Growth	thousand ckm	42	23	63	57	30	29	30	30	30	31	150,4
Total Customer	million	42	46	50	54	56	60	63	66	68	71	327,2
Sales Volume	TWh	146	156	173	185	202	219	239	260	283	307	1.307,4
Growth	%	9,5	7,3	10,6	7,3	8,6	8,7	9,0	8,8	8,9	8,4	8,8
PLN Electrification Ratio	%	66,5	68,0	73,4	78,1	83,3	85,4	89,0	91,4	93,5	95,3	95,3

Source: Perusahaan Listrik Negara (Persero). "Program Pembangunan Pembangkit 35GW & Transmisi" February 2015.

15. Natural gas, which accounts for about 16% of Indonesia's total primary energy supply, is likewise facing fast growing domestic demand. The country is a mature player in the natural gas industry and has been present in the global liquefied natural gas (LNG) market since 1977. It was the world's largest LNG supplier before Qatar surpassed it in 2006. The country is still the largest gas producer in Southeast Asia and benefits from ample gas reserves, estimated at 2.9 trillion cubic meters as of year-end 2012. Despite this, Indonesia's natural gas production has remained virtually static for many years before declining rapidly more recently (production in 2004 was 1.44 million barrel of oil equivalent (BOE) per day compared to 1.22 million BOE per day in 2014).[5] Consequently, the country is facing a shortage as the domestic appetite for natural gas necessitates re-routing of gas supplies intended for export to its domestic market.

16. Significant obstacles to reversing recent declines in gas production exist, such as the high costs of production of stranded and marginal gas resources, heavy CO_2 content in new fields, a lack of infrastructure to bring gas to market and increasing uncertainty over the extension of older Production Sharing Contracts which are now nearing their end. The regulated domestic pricing regime and the domestic market obligation (DMO) are also factors hindering increases in gas production while driving growth in domestic demand. New production sharing contracts require producers to supply 25% of production to the domestic market. This domestic gas is sold at prices individually negotiated between the supplier and the consumer and approved by the Ministry of Energy and Mineral Resources (MEMR), and which are generally below the export price. There is the prospect that Indonesia will have to import LNG at market prices in order to serve its domestic market if domestic production cannot be increased or unmet demand reduced.

[5] Production data from DG Migas (Directorate-General for Oil and Gas, Ministry of Energy and Mineral Resources).

17. **Scope for demand side efficiencies.** Low electricity tariffs have worked against improvements in the efficiency of electricity use. The National Energy Conservation Master Plan envisages that improvements in the energy efficiency of domestic appliances, buildings etc. could reduce energy consumption by 2025 by as much as 15.6% as compared to a business as usual scenario. The residential and commercial sectors have the greatest potential for energy savings. In the commercial sector there is undoubted scope to improve the overall thermal transfer value of buildings, such as in shopping malls, office buildings, hotels, and hospitals, notwithstanding uncertainties caused by the lack of requirements for certification and by the absence of incentives that could encourage compliance with the standards set out in regulations. In the consumer sector there is a realizable potential to improve the energy efficiency of electrical appliances. The key constraints apart from low energy prices have been an absence of efficiency standards and labels and the higher capital costs of more efficient appliances and facilities. Indonesia is beginning to address several of the various short-comings by setting up mandatory energy consumption standards for large buildings and minimum energy performance standards (MEPS) for appliances, starting with compact fluorescent lamps and air conditioners.

18. **Renewables development and universal access constrained**. Indonesia is well endowed with renewable resources, of which hydro power and geothermal energy have the greatest potential. In spite of Indonesia's renewables potential, the share of renewables in electricity generation amounted to 15% of total generation in 2002 but declined to 11.4%[6] (22.4 terawatt hours (TWh)) in 2012, due mainly to slower growth in hydro and geothermal utilization compared to coal. Opportunities to develop renewable energy have made limited progress, because among other things the government funds provided to the energy sector have largely been absorbed by consumer subsidies rather than used for promotion of renewables.

19. Geothermal energy is particularly suitable for the displacement of base load coal fired generation, with over 4,800 megawatts (MW) of new generation capacity included within the RUPTL 2015–2024. However, geothermal development has been stymied by: the ready availability and relative simplicity of coal fired generation options and the complexities of geothermal development. These include the costs of funding up-front investment in high risk geothermal exploration (that in other countries has been funded as a pure public good), deficiencies in the tendering process, difficulties in access land in protected areas where most resources are found, and by a lack of clarity regarding the roles that each of the state agencies active in geothermal should play. The government launched a Geothermal Fund Facility in 2012 with the intention of helping developers mitigate the financial risks of geothermal exploration, but administration of the fund has been slow, and more critically, has been implemented as a full-recourse bridging loan facility that does little to mitigate exploration risks.

20. Hydropower offers the greatest potential of all renewable energy resources in Indonesia, estimated at more than 75 GW. However, most of this potential is located far from demand centers in remote areas such as West Papua. Mini and micro-hydro installed capacity of 112 MW is only a tiny fraction of total potential. Many micro-hydro sites are located in remote areas where they could play an invaluable role in helping meet rapidly growing rural electrification demand–provided local expertise and maintenance can be made available. Likewise, the most productive sites for wind power are located in coastal areas far from load centers, but could also have a role in helping meet demands in isolated islands. By contrast onshore wind power is

[6] Indonesia's 11.4% share of renewable energy in generation compares with the IEA median of 19.4%.

considered to have limited potential for development due to the problems of distance and insufficiency of suitable sites with adequate wind energy.[7]

21. Indonesia's underdeveloped grid and the need for electrification in remote areas means that distributed and off-grid solar photovoltaic (PV) applications have substantial potential to either displace relatively costly diesel-fired generation in these areas or provide unelectrified households with PV lighting systems. Between 2012 and 2014, MEMR constructed more than 300 PV community systems, each with a capacity of 15 kilowatt-peak (kWp) to 150 kWp. In 2013, the government also introduced a new tendering and pricing framework for grid-connected solar PV systems. Still, a number of challenges remain. Knowledge of solar PV technology remains nascent among local government authorities, enterprises, and financial institutions and regulations do not provide for the level of scale-up needed to achieve economies of scale. PV system costs are relatively high compared to more developed markets and local supply chains require further development. Moreover, grid-connected applications may require upgrading of local grids and planning co-ordination between PLN and regional entities can be a challenge. Increased penetration of solar PV may also require adjustments to local power system operating and balancing procedures, particularly in the case of the smaller islands with limited daytime load profiles.

22. **Institutional challenges.** A major shortcoming of the government's previous policy of paying subsidies to meet the difference between PLN's tariff revenue and its operating costs is that PLN had little if any financial incentive to reduce costs and/or improve its operating efficiency. PLN is a relatively efficient utility in many respects, but nevertheless the sector's potential for energy savings in generation and transmission and distribution functions was estimated in 2010 at 10% and 6% respectively,[8] though this estimate may overstate what can be achieved in practice. An initiative to implement an economic regulation for PLN is under development and should be able to achieve reductions in the costs of supplying electricity of 2% to 3%, sufficient to achieve cost savings on the order of $1 billion per year by 2023. Such an achievement could be enhanced if PLN would measure and compile relevant performance benchmarks for its operating units.

23. The World Bank and International Finance Corporation rank Indonesia in 166th place in the world for ease of doing business, underlining the rigorous processes involved in starting up. Compared to the Organization for Economic Co-operation and Development average of five, it takes nine procedures to establish a corporate entity in Indonesia, taking an average of 47 days to complete. Businesses must liaise with the Investment Coordinating Board, the Ministry of Law and Human Rights and the Ministry of Manpower, as well as completing several registrations for local and national government.

24. Based on macroeconomic projections for 2015 and the new government's budget posture (aiming for strong increases in capital and related expenditures), the World Bank has forecast a budget deficit for 2015 of 2.5 percent of GDP.[9] This deficit is being caused by the impacts of a lower oil price on government's oil and gas related revenues, the flow on effects of reduced GDP growth on other government income, and the commitment to increase expenditures. While compared to other countries this is a conservative level of deficit, it allows little room for further spending since the government's deficit is capped at 3% of GDP by law.

[7] International Energy Agency (IEA). Indonesia 2015. Energy Policies beyond IEA Countries. 2015.
[8] Directorate General New Renewable Energy & Energy Conservation Ministry of Energy and Mineral Resources. Fourth Technical Working Group III Meeting: Energy Efficiency Master Plan October 2010.
[9] World Bank. Indonesia Economic Quarterly, March 2015.

III. REFORM PROGRAM

25. In response to these issues, the government has over the last two years initiated a series of efforts to: (i) improve the targeting of energy subsidies, (ii) facilitate the development of renewable energy resources, (iii) encourage greater private sector participation in energy supply, and (iv) lay the groundwork to accelerate national electrification so as to approach universal access by 2020. Many of these efforts have already begun to bear fruit. The rationalization of energy subsidies in 2014, for example, has enabled to government to increase the budget for infrastructure spending by more than 50% in 2015 compared to 2014.[10]

26. These measures complement many of the initiatives that have been championed by the Asian Development Bank (ADB), World Bank and other development partners. The preparatory work undertaken with support from development partners has helped provide a basis for preparation of the program's reform measures. The three enabling pillars of the program–designed to address the problems and constraints outlined above are: (i) improved sector governance; (ii) enabled markets for private participation; and (iii) improved regulatory environment for increased access to clean energy and energy efficiency. All of the program's reform measures listed in Table 4 work towards the achievement of one or more of the above pillars.

A. Pillar 1 - Sector Governance Improved

27. Initial steps have already taken to greatly reduce energy subsidies and the remaining steps will be taken over the medium term to complete the move to market prices. In the power sub-sector this involves completing the removal of consumer subsidies from all but poor consumers and the establishment of an automatic tariff indexation system that enables PLN to recover unavoidable increases in costs.

28. The immediate impacts have been (i) increases in the average electricity tariff, (ii) substantial reductions in the power supply subsidy costs funded from the national budget (with savings reallocated to other government programs), (iii) reduced growth in electricity demand with attendant savings from the avoided economic and environmental costs of electricity supply, and reduced use of electricity in uneconomic activities. Despite the fiscal and economic benefits of the reform, the increased energy prices will reduce demand for electricity. The resulting reductions in GDP growth are relatively short term and are being reversed as the savings on subsidy spending are redirected into beneficial infrastructure investment.

29. The removal of subsidies also provides a platform for plans to reorient PLN from a cost-plus operation that was highly dependent on subsidies to an organization that focuses on operational efficiency and financial performance. An improvement of 1% in PLN's operating efficiency would produce savings of over $220 million per year while incurring relatively modest costs, here estimated to be of the order of $1 to $2 million, to establish and operate a new economic regulation. Improvements in PLN's financial performance are in turn expected to improve PLN's borrowing capacity and its ability to support essential investment and development of power supply facilities, including new connections. The government has already created a foundation for driving this performance improvement by identifying key operational

[10] Ministry of Finance, APBN-P 2015 Budget in Brief, April 2015, http://www.kemenkeu.go.id/en/Publikasi/budget-brief-apbn-p-2015.

performance indicators and requiring PLN to regularly report performance against these indicators.

B. Pillar 2 – Markets for Private Participation Enabled

30. The government is setting up a national one stop shop to streamline investment processing procedures for private investors in the energy sector. Integration of licensing procedures and other requirements under the one stop shop enables a significant reduction in project preparatory activities with a corresponding reduction in development costs and greater certainty that new capacity will be commissioned as planned.

31. The program will support activities to increase the interest of foreign and private investors in Indonesia's upstream and midstream gas industry. Key elements will include addressing areas of uncertainty and delay in the existing framework for approving and extending Product Sharing Costs (which the government has already implemented), the introduction of a reference pricing mechanism for sales of new gas production to the domestic market, incentives for production from marginal and stranded fields and from unconventional sources and improved coordination of planning of gas infrastructure. Later activities under the program will include reforming the tendering process for gas pipeline and LNG terminal infrastructure to make this faster and more attractive and the introduction of a national gas transmission charging mechanism and a roadmap to create a national gas transmission entity to support investment in new infrastructure.

32. The reference price for new gas sales is expected to be linked to a measure of the value of gas derived from the prices of alternative fuels and to raise prices closer to export-parity levels, making production for the domestic market more attractive. This will also facilitate increases in the DMO which will increasingly direct gas towards the domestic market. The impacts on customers will be mitigated through the establishment of a gas aggregator which will blend existing and new gas streams and on-sell to customers at an average price, thereby avoiding large price shocks and a bifurcated market between existing and new customers.

C. Pillar 3 – Regulatory environment for increased access to clean energy and energy efficiency improved.

33. **Geothermal energy**. The government is addressing the chronic constraints that have held back geothermal development. The process was started in 2014 when a revised geothermal law (Geothermal Law 21/2014) was issued. The revised law, among other matters, clarifies the process for permitting of projects in forested areas and streamlines the process for tendering of new projects. In addition, regulations have been issued that establish regional price ceilings and oblige PLN to build the transmission lines needed to evacuate electricity from new plants and to purchase their outputs (Permen ESDM 17/2014). By the end of 2017 other reforms envisaged in the revised geothermal law will be implemented including a mechanism to improve the quality of resource data prior to the launch of tenders, and the centralization of tendering in the national government, which has better technical resources to prepare and evaluate tenders than the local governments that previously held this authority. By 2019 the government will be able to adopt international standards for assessing and reporting on geothermal reserves. These measures have been instrumental to the inclusion of 4,815 MW new geothermal generating capacity in PLN's RUPTL 2015–2024.

34. **Other renewables.** Actions are underway to expand generation from mini-hydro power plants (less than 10 MW), solar power (by the deployment of rooftop PV), wind-power,

biomass/biogas, and waste-to-energy schemes. In general the approach has been the establishment of feed-in-tariffs based on regional avoided costs (with some provision for externalities) that will enable private investors to better assess the potential for investment. Current studies and PPA negotiations indicate that the measures being taken will result in: (i) 280 MW of wind capacity by 2022, (ii) 250 MW of justified PV roof-top capacity by 2024[11], and (iii) an uptake of 1,481 MW[12] of mini hydro power plants.

35. **Electricity access.** Government has initiated a comprehensive national electrification effort. Key measures are expected to include: new requirements for comprehensive least cost electrification planning, greater scope for private sector involvement, increased funding, and streamlined funding processes, together with the measures noted in the previous paragraph regarding the establishment of feed-in tariffs that can help attract private sector investment for electrification. The goal is for Indonesia to increase the current electrification rate from 84% of households (end 2014) up to 97% by 2020 and to over 99% by 2023.

36. **Energy efficiency.** The reform of energy prices has overcome a major deterrent to demand side efficiency improvements. The government is moving to take advantage of the improved potential for use of energy efficient equipment - MEMR has already adopted MEPS for air conditioners and compact fluorescent lamps along with related appliance labelling protocols, and the Ministry of Public Works and Housing has issued requirements for a green building code. It is now working on: (i) additional MEPs for other appliances; (ii) establishing a legal basis for the registering and operating energy service companies; (iii) a requirement for municipalities to adopt efficient street lighting, and (iv) preparing a national efficient building code and related guidelines for adoption by municipalities.

IV. ESTIMATIONS OF THE BENEFITS AND COSTS OF THE REFORMS

37. Table 4 summarizes the main features of the reforms, and indicates the major impacts and their incidence in each of the main output areas.

Table 4: Summary of Economic Impacts of the Program's Reforms

Output	Pillar 1	Pillar 2	Pillar 3	Summary of Economic Impact
	Governance	Private Sector	Clean Energy Access	
Adoption of economic tariffs for power	*	*		Avoided economic and environmental costs of electricity supply that would otherwise be used in uneconomic activities. Subsidy savings invested in infrastructure and thereby stimulate economic growth
Improved performance of public sector enterprises	*			Reduction in PLN's costs of electricity generation, purchase, and network operations

[11] ADB. 2013. *Technical Assistance to Indonesia for Sustainable Infrastructure Assistance Program.* Manila.
[12] PLN Renewables Division. October 2014. RE Deployment Strategies to Lower Generation Cost in Isolated Grids. https://cleanenergysolutions.org/news/serig.

Output	Pillar 1	Pillar 2	Pillar 3	Summary of Economic Impact
Facilitated planning, financing and delivery of energy projects	*	*	*	Reduction in the costs of electricity generation and supply
Promotion of gas production for the domestic market.		*	*	Provides gas for electricity generation, industry, transport, and for household consumption – alleviating need for gas imports while enabling the displacement of other fuels in the transport and domestic / residential sector.
Scale up of geothermal based electricity generation and other renewables		*	*	Avoids carbon dioxide and other emissions from fossil fuel alternatives – promotes use of domestic resources.
Improved energy efficiency policies and standards		*	*	Appliances, street lighting, and building standards improved to enable more efficient use of energy
Cleaner fossil fuel technologies and increased environmental standards.			*	At least 2 new carbon capture and storage pilot projects initiated and more stringent standards set for emissions of harmful gases – NOX, SOX, and particulates by new power plants.

A. Impact Assessment – Methodologies and Major Assumptions

38. **The base case against which the program is assessed.** The performance of the energy sector in 2014 is the starting point that has been used for comparing projections of the impacts of reform (the "with policy reform" case) against the counterfactual "without policy reform" case. Although the government had increased electricity prices for some groups of consumers in 2013 and 2014, the revised State Budget presented in January 2015 and approved in February 2015 confirmed the intentions to increase the scope and extent of the reductions in subsidies (for all but the poorest consumers) and that the increases will be automatically indexed in order to maintain PLN's increased ability to recover its costs from the tariff. This has thereby provided the main platform from which the program's reforms have been launched.

39. **Calculation of economic costs and benefits.** Electricity demand will normally fall as electricity prices increase, all other factors constant, and can be estimated by the price elasticity of demand. Assumptions for price elasticity of between –0.1 in the short run and –0.3 in the long run are consistent with the changes in PLN's aggregate sales over the 5 years up to and including 2014 and have therefore been used to forecast reductions in demand caused by actual and expected increases in electricity prices from 2014. The economic benefits of reduced electricity consumption (i.e. the suppliers' avoided costs of electricity supply and the avoided emissions of carbon dioxide from electricity generation) are calculated from the difference between the "with" and "without" reform demand forecasts (refer to Figure 2). However, consumers also incur off-setting economic costs equivalent to the foregone consumption that had been induced by low priced electricity. The losses by consumers were calculated from an analysis of consumers' willingness to pay for electricity[13] but are assumed to be offset after two

[13] P. Choynowski. 2002. Measuring Willingness to Pay For Electricity. *ADB Economics Technical Note.* Manila: Asian Development Bank.

years by returns from the investment of government's subsidy savings into infrastructure developments.

40. **Fiscal impacts and GDP.** The switch of government spending from payment of subsidy to investment in infrastructure reduces current spending but increases infrastructure investment. The impact of this switch has been calculated by multiplying the subsidy savings by the difference between the fiscal multiplier on investment (0.6) and the fiscal multiplier for spending[14] (0.2). The calculations indicate that the shift is likely to lift the GDP growth rate by some 0.3 percentage points per year of additional infrastructure spending–sufficient to return GDP growth from around 5% in 2014 back to 8% per year by 2023.

B. Identification of Benefits of the Program

41. The program's benefits arise in several ways. Firstly, by improvements in various types of efficiency (allocative, operational, and demand) that affect energy supply and demand, secondly by increases in the production of domestic energy resources including natural gas and renewable energy, thirdly by providing un-electrified households with access to electricity thereby lifting their living standards, and by mitigating the adverse environmental and health impacts of fossil fuels.

42. **Improvement in allocative efficiency**. The increase in power prices that is being used to recover electricity costs and reduce the power subsector subsidies has helped deter consumers from wasting electrical energy and using electricity for uneconomic production of goods and energy services such as lighting, and air-conditioning. Increased power prices have clearly contributed[15] to a drop in the rate of growth in electricity consumption below what had been anticipated in Indonesia's 2014 power demand forecasts. Electricity demand forecasts of 219 TWh for 2015 that had been prepared in 2014 (Figure 1) are well above the current revised forecast (207 TWh) prepared by ADB staff that takes the price increases into account.

43. **Improvements in operating efficiency.** The first pillar will support the reorientation of PLN to an organization focused on improving financial performance. The World Bank has been supporting the government to develop an economic regulation for PLN that will be the basis for achieving the forecast gains in operating efficiency. An improvement of 1% in PLN's operating efficiency (defined as operating cost per unit of electricity sold) is sufficient to produce savings of over $220 million per year while incurring relatively modest costs of the order of $1 to $2 million to establish and operate the necessary economic regime. The improvement in PLN's performance will also help strengthen PLN's financial status and ability to fund its investment program. The Ministry of Finance's intention is to "mainstream" economic regulation in the 2020 to 2025 period.

44. **Improvements in demand side efficiency.** The removal of energy subsidies has provided a strong impetus to introduce more energy efficient appliances and buildings among others. The scope for energy efficiency improvement has been long recognized, however the effectiveness of possible efficiency initiatives had been affected by below-cost energy. The moves to higher efficiency appliances will be accompanied by development of standards and labelling requirements and by reviewing the need for some form of incentives to help ensure their acceptance by the local market. The efficiency of appliances in the market and the scope

[14] ADB ERD. Working Paper Series No. 85 – November 2006; for fiscal multipliers for Indonesia.
[15] Prices rises are not the only reason for the drop in consumption as other factors such as reduced exports are also having an impact on domestic economic activity.

for introduction of higher quality appliances and their energy savings potential has been assessed for three common household appliances, namely air-conditioners, electric fans, and refrigerators. Similar proposals are in hand to improve energy efficiency standards for major new buildings such as hospitals, shopping malls, offices, and schools. Given the current lack of requirements for certification and the absence of incentives that could encourage compliance with the standards set out in regulations, the savings potential for new buildings have been estimated by assuming relatively conservative savings and a slow penetration rate.

45. **Increases in domestic energy production**. The reforms to upstream contracting, pricing of supplies to the domestic market and incentives for production from marginal fields and unconventional resources are expected to reverse the recent decline in domestic gas production and allow for an increase of around 0.23 million BOE per day or 20% by 2023.[16] The improvements in the coordination of infrastructure planning will relieve current bottlenecks in delivering this increased production to the domestic market. The introduction of a new pricing mechanism for sales to the domestic market will also address concerns among producers over an increasing DMO, allowing for continuing increases in the share of existing production allocated to the domestic market rather than to exports while preserving incentives for exploration and production.

46. **Increases in renewable energy.** Indonesia's diversity of renewable energy resources provides the basis for ensuring a more sustainable and more environmentally friendly electricity supply, with a less volatile cost structure. The use of geothermal energy for electricity production will provide over 4,800 MW of base load generation that displaces coal fired generation and avoids both local and global impacts of fossil fuel emissions. The utilisation of mini-hydro, biomass, PV, and wind-power that are the only local energy resources on many remote islands will play an important role in providing access to currently unelectrified households, the majority of which are situated in rural areas.

47. **Increases in access to modern energy**. The number of households that could benefit from access to electricity for lighting in the first instance and supply of natural gas for cooking is readily ascertained from government population data, national household and income surveys and PLN and other supplier data. The benefit of electrification in rural areas where the need for electrification is highest, such as Indonesia's eastern islands, has been comprehensively assessed for the island of Sumba[17] and provides useful information and insights into the costs, benefits and potential mechanisms for optimising investments using local renewable resources.

48. The costs of rural electrification are much higher than on Java-Bali and other densely populated areas and will take advantage of the potential to use their renewable energy resources for both grid-connected and isolated households that lie beyond the economic reach of an extended network. Numerous studies show that the welfare benefits of rural electrification for a household adopting electricity typically range from $10 to $20 a month or up to $1 per kilowatt hour[18] and produce major improvements in householders' standard of living.

C. Valuation of Economic Benefits of the Program

49. The following table details the estimated economic benefits of the program.

[16] Projected increases in production from Medium-Term National Development Plan (RPJMN), 2015–2019.
[17] ADB. 2012. *Technical Assistance to Indonesia for Scaling Up Renewable Energy Access in Eastern Indonesia.* Manila.
[18] World Bank. *One Goal, Two Paths: Achieving Universal Access to Modern Energy in East Asia & the Pacific,* 2011.

Table 5: Projected Economic Benefits / Constant $ 2014 million

Period		2014-2015	2016-2017	2018-2019	2020-2023
1. Sector Governance Improved					
1.1	Economic Tariffs for Power				
	Electricity Cost Savings	1,119	1,960	1,477	377
	Avoided CO_2 Costs	367	638	481	125
1.2	Improved Performance of PLN				
	Cost Savings	199	741	1,168	3,817
2. Markets for Private Participation Enabled					
2.1	Energy Projects Facilitated				
	One Stop Shop	Not quantified			
	Private power wheeling & trade	Not quantified			
2.2	Domestic Gas Markets Enhanced				
	Increase in gas supply	0	2,115	5,703	11,074
3. Access to Clean Energy Increased and Energy Efficiency Promoted					
3.1	Scale Up of Geothermal Generation				
	Geothermal Generation Additions	270	314	800	2,615
	Avoided CO_2 Costs	1	6	13	44
3.2	Expand Other Renewables				
	Mini Hydro	108	303	296	428
	Wind	12	33	27	51
	PV Solar	0	18	18	9
3.3	Electricity Access Framework				
	Benefits of New Connections	392	811	849	1,176
3.4	Energy Efficiency Improved				
	Appliances, Street Lighting, Buildings	141	918	2,118	8,237
	Avoided CO_2 Costs	39	258	609	2,464
Total Economic Benefits		**2,648**	**8,115**	**13,559**	**30,417**

1.1 Electricity cost savings are due to the reduction in electricity consumption caused by increased tariffs and continue until electricity demand driven by a revival of GDP growth overtakes the counterfactual (no reform) consumption (Figure 2).

The reduction in generation results in reduced CO_2 emissions from fossil fuel power plants. The avoided emissions are valued at $30 per ton.

1.2 Cost savings result from improvements in PLN's operating efficiency. A reduction in PLN's operating costs of 3% spread over 9 years is considered achievable. Most of the potential for reduction is thought to be in transmission and distribution.

2.1 The impacts of the integration of licensing procedures and other requirements under the one stop shop have not been quantified, but should be significant. For

example, reports[19] are that investment commitments from foreign investors rose tenfold in the first quarter of 2015 with commitments for the construction of power plants surging to over $8 billion compared to $780 million in the same period of 2014–driven by among other things the government's efforts to reform power prices and simplify licensing.

2.1 Law No. 30 of 2009 on Electricity provided for power wheeling and trading. MEMR Regulation 01/2015 was recently issued to regulate implementation of this provision. The potential benefits and the costs of establishing the technical standards for interconnection between private power companies with PLN's network and other technical and financial management requirements will need detailed planning and evaluation and the creation of an appropriate system of organization and management to control trading and settlements. The benefit of wheeling and power trade is the development of captive generation by domestic industrial consumers such as mines and industrial parks that can thereby transport electricity from their power plants in one location to processing plants at other locations. Development of private generation reduces the amount of PLN investment required and opens the way for power trading and exchange by independent power producers and the development of cross-border trade in electricity.

2.2 Increased domestic production of natural gas and increased allocation of existing production to the domestic market will allow growing demand to be met without the need for LNG imports. The economic benefit is estimated as the cost of imported regasified LNG delivered to Central Java. In 2015, this is estimated at $8.0/ 1 million British Thermal Unit (MMBTU) based on current spot prices but increasing over time as LNG prices recover from their current lows in line with projected increases in oil prices to reach $13.5/MMBTU by 2023.

3.1 The scale-up of geothermal generation is the estimated output of the new power plants included within the RUPTL 2015–2024. Geothermal generation on the main grids (Java-Bali and Sumatra) displaces coal fired generation, and on other grids a mix of fossil fuel generation, thereby avoiding carbon dioxide and other emissions.

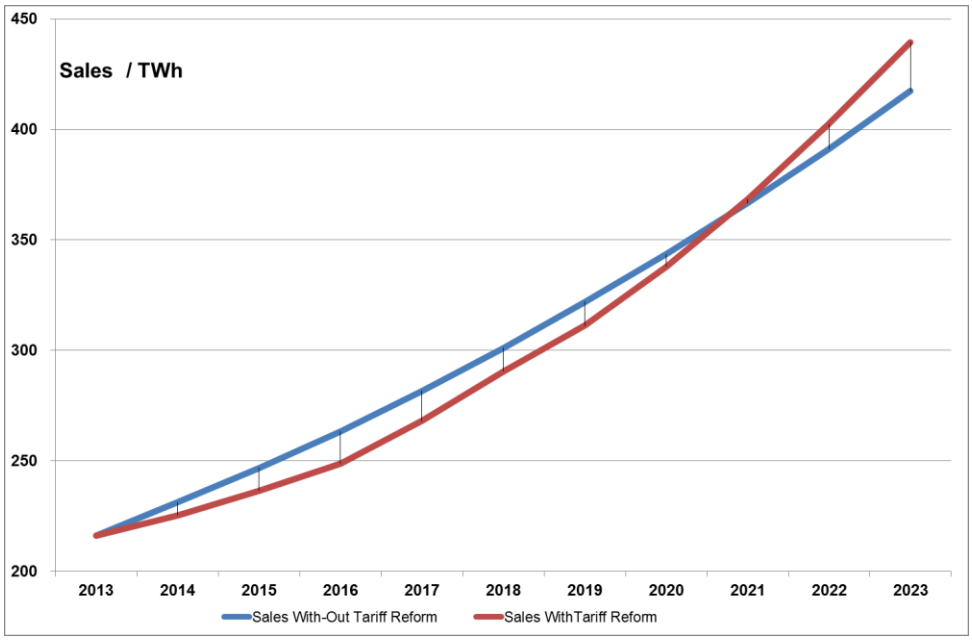
3.2 Other renewables include mini-hydro, wind and PV solar, many of which will play a key role by enabling private power generators to supply electricity to households in rural areas that are otherwise heavily reliant upon diesel fired generation.

3.3 Electricity access concerns the connection of unelectrified households thereby generating social benefits that on average are estimated to have a value to households some four times greater than the applicable tariff.

3.4 Energy efficiency benefits are the savings in electricity costs and the avoided emissions from power plants. They are the results of using more energy efficient appliances, buildings, and street lights.

[19] Jakarta Globe, April 9, 2015 - Foreign Investment for Power Plants on the Rise.

Figure 2: Generation Cost Savings from Reduction of Subsidies



Note: Generation cost savings is represented by the enclosed area between the two lines.

D. The Economic Costs of the Program

50. The following table details the costs of the Program.

Table 6: Projected Economic Costs of the Program / Constant $ 2014 Million

Period		2014-2015	2016-2017	2018-2019	2020-2023
1. Sector Governance Improved					
1.1	Economic Tariffs for Power				
	Costs of reductions in consumption	224	202	0	0
1.2	Improved Performance of PLN				
	Costs of economic regulation for PLN	1.0	0.5	0.5	0.5
2. Markets for Private Participation Enabled					
2.1	Energy Projects Facilitated				
	One Stop Shop	1.0	0.2	0.1	0.1
	Private power wheeling & trade	Not quantified			
2.2	Domestic Gas Markets Enhanced				
	Cost of Increase in gas supply	0	1,479	3,540	6,120
3. Access to Clean Energy Increased					
3.1	Scale Up of Geothermal Generation				
	Costs of Increased Generation	15	159	395	1,323
3.2	Expand Other Renewables				
	Mini Hydro	62	174	171	247
	Wind	0	28	28	14
	PV Solar	13	26	26	52
3.3	Electricity Access Framework				
	Investment Costs	1,400	2,900	3,200	2,100
	Operating Costs	300	600	700	900
3.4	Energy Efficiency				
	Appliances, Street Lighting, Buildings	220	950	1,400	4,200
Total Economic Costs		**2,234**	**6,518**	**9,461**	**14,957**

1.1 There is an economic cost due to consumers' loss of the benefits provided by their foregone electricity consumption. This cost is incurred in the 2014 to 2016 years as prices increase, but is subsequently reversed by the impacts arising from reallocation of subsidy spending into more beneficial infrastructure investment.

1.2 The improved performance of PLN is the outcome of the planned program to develop, implement and operate a regime of economic regulation. The costs are from the development, implementation and administration of economic regulation.

2.1 The one stop shop costs are the administrative, establishment and operational costs of the one-stop shop. They are insignificant relative to overall costs–being estimated at a maximum of $1 million in 2014–2015 during the establishment phase and less in subsequent years. Private power wheeling and trading costs have not been estimated as a reasonable estimate of the costs will need to be established by expert techno-economic evaluation.

2.2 The costs of increased domestic supply are for domestic gas delivered to Central Java (before onshore transmission and distribution costs). For existing gas production reallocated to domestic supply, this is estimated to be $6.2/MMBTU assuming a wellhead cost of $5.5/MMBTU[20] and a pipeline cost of $0.7/MMBTU. For new gas production, a supply curve is estimated on the assumption that the marginal cost is equal to the reference price for new gas supplies in each year and that this reference price will trend upwards to reach export parity (the netback value to Indonesia of LNG exports) by 2023. Estimates of volumes of suppressed demand are such that it is assumed that this can absorb the full increase in supply whether from increased domestic production or from imported LNG at a higher cost.

3.1 The costs of scaling up geothermal energy are based on price caps that have been developed for each region. These price caps are a conservative proxy for estimating geothermal power costs as only projects at or below this price cap will proceed.

3.2 Using the same rationale as for estimating geothermal power costs, the costs of the other renewables are based on the relevant regional feed-in tariffs (FITs).

3.3 The costs of electrification are taken from estimates made by World Bank for Indonesia with allowances for the current acceleration of the electrification program and for cost increases that transform the original estimates to constant 2014 currency values (footnote 18). These figures are consistent with recent work carried out under TA 8287-INO: Scaling Up Renewable Energy Access in Eastern Indonesia.

3.4 Energy efficiency estimates are extracted from various studies such as the national energy conservation master plan.

E. The Fiscal Benefits and Costs of the Program

51. The following table details the fiscal benefits (increases in government income) arising from implementation of the program.

[20] Pertamina reports the domestic wellhead price is between $5.0 to $6.0/MMBTU: Pertamina (2015), “Gas Pricing and Financing”, Indonesian Petroleum Association Conference, Jakarta, January 2015.

Table 7: Projected Fiscal Benefits (Government Income) /Constant $ 2014 Million

Period		2014-2015	2016-2017	2018-2019	2020-2023
1.1	Economic Tariffs for Power				
	Reduced Power Sector Subsidies	2,844	6,618	7,383	11,127
1.2	Improved Performance of PLN				
2.2	Domestic Gas Markets Enhanced				
	Increased Government Income	0	589	1,410	2,442
3.4	Energy Efficiency				
	Street Lighting Electricity Savings	5	43	120	218
Total Fiscal Benefits		**2,849**	**7,250**	**8,913**	**13,787**

1.1 The fiscal benefit is government's saving from the reduction in the power supply subsidy.

2.2 On average the government receives approximately 45% of gas sales revenues at the well-head. The fiscal benefit is government's 'take' from increased domestic production and from diversion of LNG exports into the domestic market.

3.4 Most of the energy efficiency initiatives other than street lighting have no significant impact on government income.

52. The following table details fiscal costs of actions where applicable.

Table 8: Fiscal Costs (Government Expenditure) of the Program /Constant $ 2014 Million

Period		2014-2015	2016-2017	2018-2019	2020-2023
1.2	Fiscal Costs of economic regulation for PLN	0.5	0.25	0.25	0.25
2.1	One Stop Shop	1.0	0.2	0.1	0.1
2.2	Fiscal Costs of Gas Increase	0	129	492	1,032
3.2	Expand Other Renewables	2	8	1	6
3.3	Electricity Access	1,600	3,300	3,600	2,700
3.4	Energy Efficiency	125	185	110	0
Total Fiscal Costs		**1,729**	**3,622**	**4,203**	**3,738**

1.2 The government shares the costs of economic regulation with PLN.

2.2 Fiscal costs associated with increasing domestic gas supplies are the loss of government revenues from LNG exports that are diverted into the domestic supply market.

3.2 The fiscal costs of other renewables are the calculated difference between financial revenues and financial costs of each.

3.3 Fiscal costs of providing access are the calculated difference between financial revenues at the applicable PLN tariff for residential consumers and the estimated financial costs of electrification. The costs of electrification are taken from

estimates made by World Bank for Indonesia with allowances for the current acceleration of the electrification program and for cost increases that transform the original estimates to constant 2014 currency values (footnote 18). These figures are consistent with recent work carried out under TA 8287-INO: Scaling Up Renewable Energy Access in Eastern Indonesia.

3.4 Energy efficiency costs are for the street lighting program and include both investment and operating allowances.

Table Summary Program Impact Assessment

Channel of Effect		Impact on the Sector / Economy		Estimated benefits, Winners and Losers
General	**Specific**	**Short to Medium Term**	**Long Run**	
Sector Governance Improved	Adoption of economic tariffs for electricity. Introduction of economic regulation for PLN	Reduced electricity consumption and reduced GDP growth rate. Subsidy savings.	Sustainable long term growth from economic use of electricity and increased GDP growth rate. Reduction in PLN's costs of electricity supply	Subsidy savings invested in economically beneficial infrastructure. Electricity consumers lose the benefits of low priced electricity, but avoid supply shortages. PLN and the private sector's ability to finance electrification and other power sector infrastructure requirements strengthened.
Markets for Private Sector enabled	Investment procedures streamlined. Domestic gas supply enhanced	 Greater allocation of gas production to the domestic market	Private sector participation in energy supply helps avoid gap in demand and supply of energy (electricity and gas). Increased domestic production of natural gas	Sustainable electricity supply has benefits for consumers and investors. Lower levels of LNG imports, reducing costs of energy supply for electricity generation, industry, transport and households. Longer-term fiscal cost to government from substitution of domestic sales for exports
Regulatory Environment for Increased Access to Clean Energy and Energy Efficiency Improved	Constraints on geothermal development addressed. Other renewables enhanced. Electrification program boosted Energy Efficiency Promoted Carbon capture and storage enabled	Development of over 4,000 MW of additional geothermal capacity is confirmed. A feasible and effective mechanism for investment in rural electrification is put in place. Improved quality appliances and labeling requirements introduced, and more efficient buildings, and industries. Regulatory basis for requiring industrial operations and power plants to lower emissions of local air pollutants and greenhouse gas emissions.	Ongoing development of geothermal energy fields with energy and environmental benefits. Universal access to electricity is achieved in Indonesia. Savings in energy consumption achieved. Minimizing environmental impacts from fossil-fuel expansion	Sustainable geothermal and other renewable energy supplies augment national requirements for additional generating capacity and help reduce emissions of CO2. Poor households, many in remote islands, gain access to electricity and begin to enjoy material improvements in their living standards. Efficient use of electricity has long term economic advantages for consumers and assists in moderating the need for investment in additional power supply capacities. Would discourage expansion in fossil-fueled operations and enable a preference for clean energy

ADB = Asian Development Bank, GDP = gross domestic product, LNG = liquefied natural gas, MW = megawatts, PLN = State Electricity Corporation