

DOCUMENT OF THE INTER-AMERICAN DEVELOPMENT BANK

BOLIVIA

**PROGRAM FOR RURAL ELECTRIFICATION WITH
RENEWABLE ENERGY**

(BO-X1013)

INVESTMENT GRANT PROPOSAL

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ELECTRONIC LINKS	
REQUIRED	
1.	Monitoring and evaluation plan http://idbdocs.iadb.org/wsdocs/getDocument.aspx?DOCNUM=37877574
2.	Full procurement plan http://idbdocs.iadb.org/wsdocs/getDocument.aspx?DOCNUM=37877810
3.	Annual work plan (AWP) http://idbdocs.iadb.org/wsdocs/getDocument.aspx?DOCNUM=37877827
OPTIONAL	
4.	Book: <i>Tendencias y Desafíos del Sector Eléctrico Boliviano</i> [Trends and Challenges in the Bolivian Electricity Sector] http://idbdocs.iadb.org/wsdocs/getDocument.aspx?DOCNUM=35369004
5.	Economic analysis http://idbdocs.iadb.org/wsdocs/getDocument.aspx?DOCNUM=37894538
6.	Promotion, support and development of sustainable energy in Bolivia http://idbdocs.iadb.org/wsdocs/getDocument.aspx?DOCNUM=37230085
7.	National Load Dispatch Committee (CNDC), Annual Report 2012 http://idbdocs.iadb.org/wsdocs/getDocument.aspx?DOCNUM=37868727
8.	Optimal Expansion Plan, National Interconnected System, 2012-2022 http://idbdocs.iadb.org/wsdocs/getDocument.aspx?DOCNUM=37692952
9.	Policy on Alternative Energies for the Electricity Sector http://idbdocs.iadb.org/wsdocs/getDocument.aspx?DOCNUM=37692954
10.	Societal Oversight and Compliance Authority for Electricity, Statistical Yearbook 2011 http://idbdocs.iadb.org/wsdocs/getDocument.aspx?DOCNUM=37868760
11.	National Development Plan (PND) http://idbdocs.iadb.org/wsdocs/getDocument.aspx?DOCNUM=2144510
12.	Impacts (2005-2010), EnDev Bolivia Project – Access to Energy http://idbdocs.iadb.org/wsdocs/getDocument.aspx?DOCNUM=37864320
13.	Isolated electrical systems and diesel consumption in Bolivia http://idbdocs.iadb.org/wsdocs/getDocument.aspx?DOCNUM=37860239
14.	Map of the Bolivian electric power system http://idbdocs.iadb.org/wsdocs/getDocument.aspx?DOCNUM=37868840
15.	Final evaluation, Rural Electrification Program in Chile (CH-0174) http://idbdocs.iadb.org/wsdocs/getDocument.aspx?DOCNUM=35256544

ABBREVIATIONS

AE	Autoridad de Fiscalización y Control Social de Electricidad [Societal Oversight and Compliance Authority for Electricity]
AWP	Annual work plan
CNDC	Comité Nacional de Despacho de Carga [National Load Dispatch Committee]
DGIP	Dirección General de Inversión Pública [General Directorate of Public Investment]
ENDE	Empresa Nacional de Electricidad [National Electricity Company]
GW	Gigawatt
kW	Kilowatt
kWh	Kilowatt-hour
LED	Light-emitting diode
LPG	Liquid petroleum gas
MHE	Ministry of Hydrocarbons and Energy
MPD	Ministry of Development Planning
MW	Megawatt
MWh	Megawatt-hour
NDF	Nordic Development Fund
ORP/GCM	
OTM	Oficina Técnica de Monitoreo [Technical Monitoring Office]
PEVD	Programa Electricidad para Vivir con Dignidad [“Living with Dignity Electricity Program”].
POR	Program Operating Regulations
PRM	Project risk management
PSG	Project specific grant
PVS	Photovoltaic systems
SEPA	Procurement Plan Execution System
SIAP	Integrated Project Administration System
SIGMA	Sistema Integrado de Gestión y Modernización Administrativa [Integrated Management and Administrative Modernization System]
SIN	Sistema Interconectado Nacional [National Interconnected System]
SIRR	Socioeconomic internal rate of return
VIPFE	Vice-ministerio de Inversión Pública y Financiamiento Externo [Office of the Deputy Minister for Public Investment and External Financing]
VMEEA	Vice-ministerio de Electricidad y Energías Alternativas [Office of the Deputy Minister for Electricity and Alternative Energies]

PROJECT SUMMARY

BOLIVIA PROGRAM FOR RURAL ELECTRIFICATION WITH RENEWABLE ENERGY (BO-X1013)

Financial Terms and Conditions				
Beneficiary: Plurinational State of Bolivia			Financial Terms	
Executing agency: Ministry of Hydrocarbons and Energy (MHE) through the Living with Dignity Electricity Program (PEVD) of the Office of the Deputy Minister for Electricity and Alternative Energies (VMEEA)			Amortization period:	N/A
			Grace period:	N/A
			Disbursement period:	4 years
Source	Amount (millions)	%	Interest rate:	N/A
Nordic Development Fund	€4.0 million (equivalent to US\$5,365,200*)	100%	Inspection and supervision fee:	N/A
Total	€4.0 million (equivalent to US\$5,365,200*)	100%	Credit fee:	N/A
			Currency:	Euro
Project at a Glance				
<p>The program's general objective is to support the development and use of sustainable energy in Bolivia, contributing to: (i) increased use of alternative energies and diversification of the generation matrix; (ii) reduced fossil fuel consumption and its cost to the State; (iii) promotion of social uses of alternative energies in rural areas; and (iv) savings to rural families on energy use for lighting.</p> <p>The program's specific objectives are to: (i) displace electricity generation based on fossil fuels in isolated systems located in the department of Beni through the supply, installation, and commissioning at least three generating systems using renewable energy (300 kW); (ii) support the identification of solutions for installing generating systems using renewable sources in isolated systems through the financing of eight studies to the final design stage; (iii) promote renewable energy through the delivery of basic power services to schools and health care facilities in rural areas with 375 photovoltaic (PV) systems (90 kW), 300 solar thermal hot water systems, and 3,000 pico-PV systems; and (iv) disseminate the program outcomes at four workshops, to incentivize renewable energy use.</p> <p>Special conditions precedent to the first disbursement: (i) the program Operating Regulations (OR) have been approved by the MHE and entered into force, with the Bank's prior no objection; (ii) the MHE has delivered the terms of reference for the core staff agreed upon in the OR and paragraph 3.1 of this document to the IDB for approval and start of the hiring process; (iii) the MHE has delivered the annual work plan and updated procurement plan for the first year of execution to the IDB; and (iv) a subsidiary agreement between the Ministry of Development Planning (MPD) and the MHE for transfer of the grant resources has been signed and entered into effect (see paragraph 3.5).</p> <p>Special execution conditions: (i) prior to start of the Component I works, an agreement will be signed between the MHE and the corresponding isolated system operator; and (ii) prior to delivery of the Component II equipment, an agreement will be signed between the MHE and the corresponding beneficiary municipio. In both cases, the program OR will establish the content of these agreements (see paragraph 3.6).</p>				
Exceptions to Bank policies: None.				
Project qualifies as: SEQ <input type="checkbox"/> PTI <input checked="" type="checkbox"/> Sector <input type="checkbox"/> Geographic <input checked="" type="checkbox"/> Headcount <input type="checkbox"/>				

* These resources will be administered by the IDB through a contribution from the Nordic Development Fund (NDF) for a project specific grant (PSG) to finance this program. This PSG will be administered by the IDB in accordance with document SC-114. Pursuant to document SC-114 and the Cooperation Agreement between the NDF and the IDB, dated as of 2 October 1994, amended and restated as of 26 January 2010, the commitment of resources from the NDF for each PSG will be established through the signature of administration agreements between the NDF and the IDB. The administration agreement for the PSG to finance this program will be signed by the NDF and the IDB once the Board of Executive Directors has approved this operation. Consequently, the availability of the resources earmarked for this program will be subject to IDB Board approval of the operation and signature of the aforementioned administration agreement.

I. DESCRIPTION AND RESULTS MONITORING

A. Project background and rationale

- 1.1 The Bolivian electric power system is comprised of the National Interconnected System (SIN) and isolated systems. There are 24 hydroelectric plants and nine thermal power plants connected to the SIN. In 2012 the SIN's power capacity was 1,450 megawatts (MW), and peak demand was 1,103 MW. The SIN obtains 33% of its electricity from hydroelectric power plants and 67% from thermal power plants that run mainly on natural gas, which has a fixed cost for generation.
- 1.2 **Isolated systems.** The isolated systems supply power to certain communities not connected to the SIN. Their power capacity is 236 MW with around 200,000 users. There are 57 diesel-powered isolated systems, generating a total 55 MW, with around 58,000 users. The bulk of these isolated systems are located in the northern and eastern parts of the country; the department of Beni accounts for the majority of users (58%).¹
- 1.3 **Electricity coverage.** Urban electricity coverage is estimated at 91%, falling to 53% in rural areas.² The coverage data includes settlements supplied by isolated systems. In total, an estimated approximately 420,000 homes lack electricity, and nearly 20,000 public establishments (health posts, schools, etc.) are not appropriately supplied with power.³ Lack of access to electricity and high poverty levels are directly correlated. Families without electricity meet their energy requirements with batteries (for flashlights and radios) and candles (for lighting) at a relatively high cost of these alternatives for the low-income segment, and tend to reduce their use of lighting in creative and academic activities, which can adversely impact cognitive development and educational attainment. Lack of electricity also has a negative impact on the quality of health and education services, such as limiting their ability to provide a service after dark and the availability of vaccines requiring refrigeration, which is directly related to poverty levels.
- 1.4 **Thermal power.** The lack of electricity is the main reason for the absence of a thermal power supply (hot water, heating) at isolated rural health posts, schools, and homes. This limits effective, hygienic care during childbirth, which is a factor in maternal and neonatal mortality. Some rural communities have a hot water supply using liquid petroleum gas (LPG) transported in cylinders from production centers, which can cost up to five times its market price.
- 1.5 Electricity coverage in rural areas increased by 20 percentage points from 2006 to 2010, but actions to increase that coverage need more impetus. The main reasons for low rural coverage are: (i) distance from the point of generation and the cost of connections to the electricity grid; and (ii) the remoteness and low density of rural

¹ Office of the Deputy Minister for Electricity and Alternative Energies (VMEEA), 2011. See electronic links [13](#) and [14](#).

² 2012 estimate based on official sources. The most recent census available was in 2001.

³ Source: EnDev project impact evaluation (2005-2010).

communities.⁴ The further away a settlement is from the electricity grid, the greater the investment required to connect it, so other, more economical electricity supply alternatives need to be explored. Thus far, diesel- or gasoline-based generation has been regarded as the natural alternative for small-scale electricity supply, when no hydroelectric resources or natural gas system are accessible. However, the highly scattered nature of rural communities means that an estimated 200,000 rural households can only be supplied using decentralized renewable energies (in particular, photovoltaic systems).

- 1.6 Diesel fuel used to generate electricity in the isolated systems is imported and administered by Yacimientos Petrolíferos Fiscales Bolivianos (YPFB). The diesel is supplied to operators at a price of US\$0.16 per liter. The market cost to import the diesel is over US\$1.30 per liter. Despite the fuel subsidy, isolated systems charge an average of US\$0.14 per kilowatt-hour (kWh), with some charging as much as US\$0.30 per kWh, compared with the US\$0.08 per kWh charged by the SIN. What is more, in many cases power is not supplied round the clock, but only between 6 p.m. and 11 p.m.,⁵ which restricts productive activities and other uses such as education and health.
- 1.7 The key factors holding back the development and expansion of small-scale renewable energy systems in Bolivia are: (i) the high investment cost of renewable systems compared to fossil fuel systems (3-10 times higher, depending on the size of the system); (ii) lack of awareness and dissemination of some of the renewable technologies; (iii) the systems' sustainability models; (iv) lack of promotion of productive and low-income uses of solar systems; and (v) the need to develop the legal framework for small systems.⁶ The subsidies for thermoelectric generation by isolated systems (see paragraph 1.6) distort competition and block renewable energy systems from entering the market,⁷ despite the fact that some are competitive with the real cost of generation. This creates the need to demonstrate the viability of generating electricity with renewable sources in both noninterconnected regions and isolated systems.
- 1.8 **Potential of renewable energy sources.** Bolivia has levels of sunshine throughout the year that make 97% of the country suitable for solar energy applications (the

⁴ "Rol e impacto socio-económico de las energías renovables en Bolivia" [Role and socioeconomic impact of renewable energies in Bolivia], Miguel Fernandez, Centro de Estudios para el Desarrollo Laboral y Agrario, 2010.

⁵ The exception is the isolated system managed by the Cooperativa Rural de Electrificación [Rural Electrification Cooperative] (CRE), which charges a rate comparable to the rate in urban areas (US\$0.08 per kWh) with service quality up to standard, since there is a cross-subsidy between the CRE's urban concessions and the isolated system it manages.

⁶ "Estimación del potencial de introducción de energías renovables en Bolivia" [Estimate of the potential for introduction of renewable energies in Bolivia], Miguel Fernández, 2010, http://perusolar.org/17-spes-conferencias/Fernandez_Miguel/Fernandez_Miguel.pdf.

⁷ "Políticas de energías alternativas para el sector eléctrico en el Estado Plurinacional de Bolivia" [Alternative energy policies for the electric power sector in the Plurinational State of Bolivia], 2012.

variation in solar radiation between summer and winter is less than 25%). Highland and valley areas receive between 5 and 6 kilowatt-hours of solar radiation per square meter per day (kWh/m²-day), and the plains receive 4.5 to 5 kWh/m²-day. This is due to Bolivia's latitude and the altitude of the highlands above sea level. The usable hydroelectric potential is estimated at 40 gigawatts (GW), less than 500 MW of which is currently utilized.

- 1.9 **Program rationale.** Article 20 of the Bolivian Constitution establishes the right to universal and equitable access to basic services, including electricity. Also, Article 9 gives the State a fundamental role in guaranteeing access to health and education. Nevertheless, numerous towns and villages in Bolivia lack an electricity supply, affecting the population's standard of living and limiting their access to health, education, and other services (see paragraph 1.3). It is therefore necessary to promote alternatives in order to expand electricity service coverage to unconnected areas by leveraging the potential of renewable energy sources. Moreover, a portion of the population not connected to the SIN is served by isolated systems, which require approximately 30 million liters of diesel a year to operate. In view of the rising trend in international diesel prices and the falling trend in the cost of renewable energy systems, generation with renewable energy sources needs to be implemented to demonstrate its sustainability and help reduce fossil fuel use by the isolated systems, while guaranteeing service quality and continuity and lowering the subsidy cost to the State.
- 1.10 **Living with Dignity Electricity Program (PEVD).** In 2008, the Government of Bolivia approved the "Living with Dignity Electricity Program" (PEVD) (Supreme Decree 29635) of the Office of the Deputy Minister for Electricity and Alternative Energies (VMEEA). The PEVD's objective is to achieve universal access to electricity service in urban areas by 2015, and in rural areas by 2025. To achieve these goals, the PEVD will include a variety of technological options, including photovoltaic systems (PVS). Under the PEVD, projects are identified in a participatory manner, in which rural communities express their needs to municipios and local government, so they can be channeled to the VMEEA.
- 1.11 The success of the PEVD and the Bolivian government's rural electrification efforts depend on three factors:⁸ (i) the required investment, estimated at over US\$1 billion by 2025; (ii) the limited ability to pay for electricity service, especially in rural areas; and (iii) technical weakness in project preparation, duplication of effort, and lack of coordination among the institutions executing projects.
- 1.12 To help meet these challenges, in 2010 the Bank approved the Rural Electrification Program (loan 2460/BL-BO), supporting the PEVD, which provides US\$60 million to support rural electrification by laying power lines and conducting alternative energy pilot projects. The Rural Electrification Program also provides technical assistance, including updating of manuals on preparing rural electrification projects,

⁸ "Tendencias y desafíos del sector eléctrico Boliviano" [Trends and challenges in the Bolivian electricity sector], Enrique Gómez, CEDLA, April 2010.

updating Bolivia's standards for rural grids, defining the structure and functionality of the PEVD, and information and training workshops with all relevant stakeholders. The Rural Electrification Program is run by an executing unit, currently operating with a staff of 18, including technical personnel in the departments of Cochabamba, Oruro, La Paz, and Chuquisaca.

- 1.13 In this setting, the Bolivian government has sought IDB funding to finance this Program for Rural Electrification with Renewable Energy, which builds on the Rural Electrification Program and also will be implemented as part of the PEVD. This program will provide support in two areas: (i) development and implementation of renewable energy projects in the isolated systems of rural areas in the department of Beni, benefiting at least 1,200 users; and (ii) installation of renewable energy systems in noninterconnected rural areas of the highlands, including social uses of energy, benefiting 675 public buildings and 3,000 families. The moderate poverty rate in the rural highlands is 77.8%, while the extreme poverty rate is 58.6%. The moderate poverty rate in the rural plains area (to which the department of Beni belongs) is 48.7%, and the extreme poverty rate 26.0%.⁹

B. Regulatory framework for the electric power sector in Bolivia

- 1.14 Bolivia's electric power sector is consistent with the objectives and basic conditions of the Bank's Public Utilities policy (Operational Policy OP-708). The sector is governed by Law 1604 of 1994 (the "Electricity Act"). The institutional framework provides for separation of roles, with a regulator, which is the Societal Oversight and Compliance Authority for Electricity (AE); a policy formulator and standard-setting entity, which is the VMEEA; an entity responsible for system planning and operation, which is the National Load Dispatch Committee (CNDC); and energy companies to provide the service.
- 1.15 The Ministry of Hydrocarbons and Energy (MHE) heads the sector and is responsible for formulating and evaluating policies, standards, and plans for the power sector. The MHE has four deputy ministerial offices, which include the VMEEA, whose functions and duties include policy design, formulation, and evaluation for the electricity sector, as well as formulation and execution of electrification programs and projects for the entire country. The PEVD is the operational arm of the VMEEA for electrification programs and projects (see paragraph 1.10).
- 1.16 In terms of the electricity sector's structure, the Electricity Act calls for a separation of generation, transmission, and distribution activities, which are performed by private companies, semipublic enterprises, and the Empresa Nacional de Electricidad [National Electricity Company] (ENDE). The CNDC coordinates the SIN's operation. Generators receive payment based on power, reserves, and energy. Electricity is traded through contracts or the spot market, where transaction prices

⁹ Source: Unidad de Análisis de Políticas Sociales y Económicas [Social and Economic Policy Analysis Unit] (UDAPE), Bolivia, 2009.

are set at fifteen-minute intervals based on marginal costs. The transmission and distribution sectors are structured as natural monopolies regulated by the AE, with the participation of public and private enterprises and cooperatives.

- 1.17 **Rates and subsidies.** Transmission companies receive a usage charge to cover their costs of investment, operation, maintenance, and administration. Electricity rates for each distribution concession are set by the AE every four years under the Prices and Rates Regulation (Supreme Decree 26094). These rates cover the costs of investment, operation and maintenance, with the right to obtain a certain level of profit. The “tarifa dignidad” discounted rate entitles users consuming less than 70 kWh/month to a 25% discount. This rate is financed by the system’s revenue and benefits almost half of all residential users, most of whom live in rural or periurban areas.
- 1.18 Under the legislation in force, companies and/or cooperatives in the isolated systems may be vertically integrated and operate both generation and distribution businesses. Vertically integrated isolated systems must be registered with the AE, and their charges are set by the same rules that apply to distribution utilities (see paragraph 1.17). Isolated systems under 500 kW do not require a license. The diesel used by isolated systems for power generation is supplied by the State to the cooperatives that operate the isolated systems (see paragraph 1.6).
- 1.19 **The Bank’s engagement in the sector.** The Bank has considerable experience in the Bolivian electricity sector, and has financed almost US\$240 million in recent years to support the sector, including hydroelectric power generation, transmission and distribution lines, and a rural electrification program, as summarized in Table 1.

Table 1. IDB Loans in Bolivia

Project/Program (loan)	Amount		Approved	Executing agency
	IDB	Local		
Misicuni Renewable Energy Hydroelectric Project (2238/BL-BO)	US\$101.0 million	US\$14.1 million	2009	ENDE
Rural Electrification Program (2460/BL-BO)	US\$60.0 million	US\$0.2 million	2010	VMEEA and ENDE
Cochabamba–La Paz Transmission Line Project (2654/BL-BO)	US\$78.0 million	US\$4.76 million	2011	ENDE

- 1.20 In 2012 the IDB approved the technical cooperation operation “Promotion, support and development of sustainable energy in Bolivia” (ATN/OC-13520-BO; US\$500,000), now in execution, with the principal objective of supporting development of the Bolivian electricity sector, in particular by promoting and conducting projects in renewable energy, energy efficiency (supply and demand side), and rural electrification with renewable energy.

- 1.21 **The government's energy sector strategy.** The National Development Plan (PND),¹⁰ under its "Productive Bolivia" pillar, seeks to: (i) develop the generation and transmission infrastructure to meet electricity demand; and (ii) develop renewable energy sources to guarantee energy independence.
- 1.22 **The Bank's country strategy.** The Bank's country strategy with Bolivia 2011-2015 (document GN-2631-1) gives priority to investments to increase renewable electric power generation and transmission capacity and expand electricity coverage, particularly in rural areas. This program is consistent with that approach, as it will contribute to increasing sustainable energy supply and coverage in rural areas, and reducing the use of fossil fuels.
- 1.23 **Alignment with the Ninth General Capital Increase (GCI-9).** The program is consistent with the GCI-9 objectives to support small and vulnerable countries and contribute to climate change adaptation and mitigation, as it will enable power to be generated from a renewable source, and so help reduce carbon emissions (see document AB-2764). The program will also support poverty reduction, as it focuses on supplying power in areas of Bolivia affected by high rates of extreme and moderate poverty.

C. Objectives, components, and cost

- 1.24 The program's general objective is to support the development and use of sustainable energy in Bolivia, contributing to: (i) increased use of alternative energies and diversification of the generation matrix; (ii) reduced fossil fuel consumption and its cost to the State; (iii) promotion of social uses of alternative energies in rural areas; and (iv) savings to rural families on energy use for lighting.
- 1.25 The program's specific objectives are to: (i) displace electricity generation based on fossil fuels in isolated systems located in the department of Beni through the supply, installation, and commissioning at least three generating systems using renewable energy (300 kW); (ii) support the identification of solutions for installing generating systems using renewable sources in isolated systems through the financing of eight studies to the final design stage; (iii) promote renewable energy through the delivery of basic power services to schools and health care facilities in rural areas with 375 photovoltaic (PV) systems (90 kW), 300 solar thermal hot water systems, and 3,000 pico-PV systems; and (iv) disseminate the program outcomes at four workshops, to incentivize renewable energy use.¹¹
- 1.26 **Components.** The program has three components, as described below.
- 1.27 **Component I. Hybrid systems,**¹² which includes: (i) financing of studies for the selection and design of up to eight renewable electricity generating systems, with

¹⁰ Approved by Supreme Decree 29272 on 12 September 2007.

¹¹ The final number of systems and units in Components I and II may vary according to the results of the bidding processes. Variances are not expected to exceed 10%.

¹² A hybrid system is one that generates electricity from two or more energy sources.

- the source of energy determined according to each site's potential; and (ii) supply, installation, and commissioning of at least three generators running on renewable sources, with capacities of up to 100 kW each, in the department of Beni.¹³
- 1.28 **Component II. Solar systems**, which includes: (i) supply, installation, and commissioning of systems to provide electricity and hot water to 300 schools and 75 health posts in rural areas using PV panels (90 kW), and 300 solar thermal hot water systems; (ii) provision of 3,000 pico-PV systems including portable LED lamps, benefiting households in rural areas.
- 1.29 **Component III. Supervision, monitoring, and dissemination**, which includes support for training and dissemination through four workshops to promote the use of renewable energies for Bolivia, and the budget to finance program monitoring and supervision, ex post socioeconomic analysis, and auditing.
- 1.30 A consulting engagement to provide technical support for the PEVD, including the final design of three hybrid systems with renewable generation and three lighting systems using pico-PV lamps, financed by the IDB (Component I of operation ATN/OC-13520-BO) (see paragraph 1.20), is under way as of November 2013. The studies will be completed in December 2013.
- 1.31 **Program cost.** The program will have a duration of four years and an estimated cost of US\$5,365,200. Three program components are envisaged, as described below. Table 2 presents the indicative budget, broken down by component, with an amount for contingencies (including exchange rate variations), and a percentage fee (see paragraph 2.2).

¹³ The tentative beneficiaries are the towns of Baures, Rosario del Rio, Bella Vista, and Hucaraje.

Table 2. Program Cost and Financing (US\$ millions)

Investment category	TOTAL
Component I. Hybrid systems	1,500,000
Determination of scope and design of hybrid systems	200,000
Installation of hybrid systems	1,300,000
Component II. Solar systems	3,050,000
Solar thermal systems	750,000
Photovoltaic systems	2,000,000
Pico-photovoltaic lamps	300,000
Component III. Supervision, monitoring, and dissemination	480,000
Supervision and monitoring	400,000
Training, workshops and dissemination	40,000
Auditing	10,000
Ex post socioeconomic evaluation	30,000
Contingencies	66,940
Administrative fee, 5%¹⁴	268,260
Total	5,365,200

D. Results Matrix

- 1.32 **Expected outcomes.** The program Results Matrix itemizes the associated output indicators and outcomes. Component I is expected to help substitute at least 493 megawatt-hours per year (MWh/year) of diesel generation, saving the State at least US\$225,000 annually. In addition, around 1,200 isolated system users in the department of Beni will have a renewable energy supply. The photovoltaic and solar thermal systems installed (Component II) are expected to provide 941 MWh/year of renewable energy in 675 public buildings. The program will also provide 3,000 families with access to lighting based on pico-PV systems, enabling savings of US\$26/year per family. The program is projected to avoid emission of at least 432 tons CO₂ equivalent per year. Lastly, the program outcomes will be publicized and training provided through the workshops promoting the use of renewable energy in rural areas and isolated systems (Component III). As impact, the program is expected to contribute to at least five additional isolated systems installing renewable generation in the five years following program conclusion, and service improvements at schools and health posts, especially night-time use and refrigeration of vaccines. Furthermore, the information and experience generated during program execution will serve as input and guidance for the design of potential future investments in Bolivia's renewable energy sector.
- 1.33 **Effectiveness of interventions.** The generating systems to be used will be based on existing technologies in widespread use around the world that have demonstrated their effectiveness as a means of electricity generation.¹⁵ The evaluation of the

¹⁴ Part of the administrative fee may be used to cover any expense related to the design, preparation, execution, supervision, monitoring, and evaluation of the program (see paragraphs 2.1 and 3.10).

¹⁵ The IDB has successfully executed rural electrification projects, for example in Chile (loan [CH-0174](#)).

EnDev project in Bolivia (2005-2010) of Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) found that access to energy improved teaching quality at the schools concerned (see [electronic link 12](#)). Similarly, it found that use of the schools for community gatherings after dark allowed the community more time during the day for productive activities. In the case of health facilities, access to electricity allowed better service by providing night-time care and refrigeration of vaccines and medicines. Access to hot water made it possible to improve care during childbirth, enabling washing and disinfection of instruments and equipment. Access to hot water in schools made conditions more conducive to hygiene.

II. FINANCING STRUCTURE AND MAIN RISKS

A. Financing instruments

- 2.1 The Nordic Development Fund (NDF) intends to commit €4 million to this program through a project specific grant (PSG). The IDB administers such operations as established in the “Report on COFABS, Ad-Hocs and CLFGS and a proposal to unify them as project specific grants (PSGs)” (document SC-114). Pursuant to these procedures and the Cooperation Agreement between the NDF and the IDB for the cofinancing of programs and projects, dated as of 2 October 1994, amended and restated as of 26 January 2010 (Article IV, Section 6), the NDF’s commitment will be established through a separate administration agreement, to be signed once the Board of Executive Directors has approved this operation. Consequently, the availability of the resources earmarked for this program will be subject to IDB Board approval of the operation and signature of the aforementioned administration agreement. Under this administrative agreement, the IDB will administer the program resources and charge a 5% administrative fee on the NDF contribution, which will be duly identified in the program budget. As per the administration agreement, the 5% administrative fee will be charged after the contribution has been converted into U.S. dollars. Part of the administrative fee may be used to cover any expense related to the design, preparation, execution, supervision, monitoring, and evaluation of the program. In such case, ORP/GCM will create a cost center for the administrative fee, to be shared among the IDB offices supporting execution of the operation, so as to cover the administrative costs associated with the NDF contribution and its execution and/or implementation. According to the administration agreement, the IDB project team will be responsible for reporting progress to the NDF. In addition, if an uncommitted positive balance remains after project execution has been completed, the project team will be responsible for informing ORP/GCM so as to transfer the unused funds.
- 2.2 The program resources are equivalent to US\$5,365,200 at the XE exchange rate (US\$/€1.3413) on 15 March 2013. The final amount of the resources in dollars will depend on the exchange rate applicable on the date the IDB receives the funds from the NDF in euros, in accordance with the agreement to be signed by the NDF and the IDB. If there is a significant negative variation in the exchange rate such that the

dollar value of the NDF contribution to the budget shrinks by more than can be covered by the contingencies item, the program activities will be scaled back and the team will adjust the budget accordingly.

- 2.3 The disbursement period will be four years. Table 3 shows a preliminary estimate of the cash flow based on the program's final execution plan. This will be updated via the annual work plan (AWP) as a special condition precedent to the first disbursement, together with the procurement plan.

Table 3. Program Annual Cash Flow (US\$)

Year 1	Year 2	Year 3	Year 4	Total
365,760	1,500,000	1,540,000	1,959,440	5,365,200
6.8%	28.0%	28.7%	36.5%	100%

B. Environmental and social safeguard risks and mitigation measures

- 2.4 **Environmental issues.** Given its nature, the program is not expected to produce any direct or indirect adverse socioenvironmental impacts. Indeed, the quality of life of low-income inhabitants of rural and urban areas is expected to improve with the program, through the use of power from renewable sources. The program therefore has been classified as category "C" under the Environment and Safeguards Compliance Policy (Operational Policy OP-703). Nonetheless, the environmental and social specialist of the "Living with Dignity Electricity Program" (PEVD) will monitor execution.

C. Fiduciary risk

- 2.5 The VMEEA has experience executing Bank-financed resources, as the executing agency for the Rural Electrification Program (loan 2460/BL-BO) (see paragraph 1.12), and the project execution team is familiar with IDB fiduciary management policies and instruments. The Rural Electrification Program is being implemented as part of the PEVD, which also has experience in executing loans with financing from the World Bank and other multilaterals. Notwithstanding this, a procurement management capacity update was conducted in May 2013. The analysis concluded that the PEVD needs strengthening in order to enhance program implementation, which is consistent with the medium fiduciary risk rating in the procurement area identified in the project risk management (PRM) matrix (which addresses mitigation actions). The PEVD also has a fiduciary sector strengthening plan.
- 2.6 The subsystems for budget and cash management (financial management), managed through the Integrated Management and Administrative Modernization System (SIGMA), will be used for financial management. Program accounting will be managed using the IDB Integrated Project Administration System (SIAP), in addition to the SIGMA.

- 2.7 **Procurement.** Program procurement will be conducted in accordance with the “Policies for the procurement of goods and works financed by the IDB” (document GN-2349-9) and “Policies for the selection and contracting of consulting services financed by the IDB” (document GN-2350-9). The procurement plan will be managed through the Procurement Plan Execution System (SEPA) (<http://www.iniciativasepa.org>). Procurements will be subject to prior review in the case of works for over US\$300,000, goods and nonconsulting services for over US\$20,000, and the contracting of consulting firms for over US\$20,000. These reviews will be performed on a six monthly basis.
- 2.8 **Audits.** During the execution period, the PEVD will deliver the program’s annual financial statements, audited by an eligible independent audit firm selected according to IDB policies and procedures, within 120 days after the close of each fiscal year. The audit costs will be covered with the Bank loan proceeds.
- D. Other key issues and risks**
- 2.9 **Analysis of alternatives and technical viability.** The program and the support given through technical cooperation operation ATN/OC-13520-BO include financing for the final design of the hybrid systems, including an analysis of alternatives based on socioeconomic criteria. The design studies will include a technical/economic feasibility analysis of the various projects to be implemented, and the design of the basic and detailed engineering. In the case of Component II, the design of the photovoltaic and solar thermal systems will be verified before competitive bidding, to ensure that their competitive bidding and installation comply with relevant norms and standards. Component III of the Rural Electrification Program (loan 2460/BL-BO) executed a project in 2013 to supply pico-PV lamps; bidding documents and technical specifications are also ready for the competitive bidding process for a hybrid system. These documents, and the lessons learned during the bidding processes, will be used as inputs for program execution.
- 2.10 **Economic viability.** A socioeconomic cost-benefit analysis was done for each of the proposed interventions (see [electronic link 5](#)). The accounting price ratios were calculated using accounting factors estimated by the General Directorate of Public Investment (DGIP), to adjust market prices to efficiency prices in ordinary currency terms. The social discount rate used was 12%. A sensitivity analysis was performed in all cases, showing that the project’s socioeconomic viability is not affected by changes in the main parameters, with the socioeconomic internal rate of return (SIRR) remaining above 12% in all cases.
- 2.11 **Economic viability – Hybrid systems.** In the case of hybrid systems, the project benefit used was the substitution of power generated by diesel fuel with renewable energy, and the cost saving this represents for the State. The conditions with and without the project were compared. The project’s socioeconomic assessment yields a SIRR of 23.46%.

- 2.12 **Economic viability – Solar systems.** In the case of photovoltaic and solar thermal systems, the supply of power using solar systems (condition “with the project”) was compared with the supply of power using an alternative technical option (condition “without the project”). Additional alternatives considered were LPG cylinders instead of solar thermal systems, and gasoline-powered electrical generators instead of photovoltaic systems, including all investment, operation, and maintenance costs. In the case of photovoltaic systems, the savings to teachers and health workers from not having to spend money on energy sources such as batteries, candles, and lamps was considered as a second source of benefits. The evaluation did not include other potential socioeconomic benefits, such as increased school enrollment, health improvements, or reductions in maternal and child mortality, given the scant baseline data and difficulty of quantifying benefits. The economic benefits of the photovoltaic lamps were estimated from the savings on traditional fuels (candles and batteries) by each beneficiary family. In all cases the SIRR obtained was over 12%.
- 2.13 **Financial viability – Hybrid systems.** The average operation and maintenance (O&M) cost for the renewable energy systems was determined to be US\$0.03 per kWh. This is less than the average isolated system charge (US\$0.14 per kWh), which indicates that installing hybrid systems would make it possible to reduce the total cost of supplying users, and hence lower the usage charge, considering the investment as a grant from the State, which benefits from the substitution of diesel (see paragraph 2.11). Alternatively, if the current charge were to be maintained, cooperatives could also finance up to 40% of investment costs, on top of the O&M costs. The financial analysis will be performed in detail, case by case, before implementing the systems.
- 2.14 **Financial viability – Solar systems.** The O&M costs for solar systems were estimated, including preventive maintenance, repairs, and the necessary ten-yearly battery replacements. The cost of photovoltaic system power services is US\$24 per month. For solar thermal systems, the equivalent O&M cost is US\$10 per month per establishment. In the case of photovoltaic lamps, families will have to pay the equivalent of US\$1.20 per month for the battery replacement.
- 2.15 **Sustainability.** In order to ensure proper O&M for systems during their working life, the MHE will sign agreements with isolated system operators before the start of works. These agreements will be governed by the legal framework in force in Bolivia (see paragraph 1.18) and verified by the regulatory agency (AE). Similarly, in the case of solar systems (photovoltaic systems, solar thermal systems, and pico-PV lamps), the MHE will sign agreements with beneficiary municipios before delivery of the equipment. Signature of these agreements will be a special execution condition for this program. Under them, the beneficiary municipios will undertake to guarantee the resources to ensure sustainability of the equipment.¹⁶ The content

¹⁶ The agreements will establish that the municipios must include the cost of systems maintenance in the budget. The mechanism will be similar to the one currently used in municipios where schools/health posts have electricity service paid for by the municipio.

of these agreements will be established in the program Operating Regulations. Furthermore, all contracts for program-financed projects will include training of local personnel for O&M of the systems. The PEVD Technical Monitoring Office (OTM) will be responsible for monitoring compliance with the agreements, and will perform regular inspections to determine whether the installed systems are functioning properly.

- 2.16 **Other points.** A bill is being prepared for a new law that would bring the electric power sector into line with the new Constitution, which calls for public and private participation. This law, if enacted, is not expected to affect execution of the program, its operation and sustainability, or the sector's consistency with Bank Operational Policy OP-708.

III. IMPLEMENTATION AND MANAGEMENT PLAN

A. Summary of implementation arrangements

- 3.1 **Implementation arrangements.** The beneficiary will be the Plurinational State of Bolivia, and the program will be executed by the Ministry of Hydrocarbons and Energy (MHE) through the "Living with Dignity Electricity Program" (PEVD) of the Office of the Deputy Minister for Electricity and Alternative Energies (VMEEA). The existing capacity of the Rural Electrification Program execution unit, up and running at the PEVD (see paragraph 1.12) will be used for implementation. This execution unit has experience in Bank policies and fiduciary processes. The PEVD's fiduciary and technical team will be strengthened with staff devoted full-time to the program. The PEVD will appoint a manager and form a core team of professional staff devoted full-time to this program, including at least a procurement specialist, a technical specialist for hybrid systems, and a technical specialist for solar systems. A budget has been set aside for these staff; however, they may initially be hired with Rural Electrification Program funds, to ease the startup of implementation. The IDB's approval of the terms of reference for these staff will be a special condition precedent to the first disbursement.
- 3.2 The PEVD will assume sole responsibility for the following activities: (i) preparation and issuance of bidding documents for the contracting of consultants and procurement of goods and services; (ii) organization and monitoring of competitive bidding processes; (iii) contract award, signature, and administration; and (iv) inspection and technical and administrative supervision of the required contracts for goods and consulting services.
- 3.3 The PEVD will also be responsible to the IDB for: (i) coordination of all program-related activities; (ii) preparation of physical/financial status reports; (iii) submission of requests for no objection and disbursements and the keeping of accounting records for preparation of such requests and any financial reports; (iv) implementation and maintenance of a control system to ensure proper use of resources and their safekeeping, as well as a documentary archive of transactions; and (v) preparation and updating of the initial program report, annual work plan

- (AWP), six-monthly status reports, evaluation reports, and the program completion report. The PEVD will act as the permanent liaison between the VMEEA and the IDB, and will be responsible for timely performance of the grant agreement contractual clauses, and of the program-related agreements and activities, as they relate to execution.
- 3.4 **Execution mechanism.** Project execution will be based on an AWP that identifies the specific activities and projects to be carried out, the targets set, and the expected outcomes of each. The PEVD will prepare detailed AWP, which will be sent to the Bank for approval. The activities in the AWP must take interrelationships with other stakeholders into account, as well as the implementation timeframes necessary to ensure that the proposed objectives are met. The updated AWP and procurement plan for the first year will be conditions precedent to the first disbursement.
- 3.5 **Special conditions precedent to the first disbursement:** (i) the program Operating Regulations (OR) have been approved by the MHE and entered into force, with the Bank's prior no objection; (ii) the MHE has delivered the terms of reference for the core staff agreed upon in the OR and paragraph 3.1 of this document to the IDB for approval and start of the hiring process; (iii) the MHE has delivered the annual work plan and updated procurement plan for the first year of execution to the IDB; and (iv) a subsidiary agreement between the Ministry of Development Planning (MPD) and the MHE for transfer of the grant resources has been signed and entered into effect.
- 3.6 **Special execution conditions:** (i) prior to start of the Component I works, an agreement will be signed between the MHE and the corresponding isolated system operator; and (ii) prior to delivery of the Component II equipment, an agreement will be signed between the MHE and the corresponding beneficiary municipio. In both cases, the program OR will establish the content of these agreements.
- B. Summary of arrangements for monitoring results**
- 3.7 **Monitoring.** The PEVD will deliver six-monthly status reports on the progress of activities to the IDB for approval, no later than 31 January and 31 July of each year during program execution. For this purpose, the PEVD will have a monitoring system that integrates financial and accounting information and information on project progress. These reports will focus on the fulfillment of output indicators and progress towards the outcomes included in the Results Matrix (Annex II), analyze problems encountered, and describe the corrective measures taken. The reports to be delivered by midyear will include the AWP for the following year, with a projection of disbursements and the updated procurement plan. These reports will be reviewed at six-monthly meetings between the IDB and the PEVD.
- 3.8 The IDB's Country Office in Bolivia (CAN/CBO) and the Energy Division (ENE/CBO) will conduct supervision for the Bank. They may draw upon the support of individual consultants, in order to ensure proper supervision and monitoring. This is intended to allow timely identification of any obstacles and

inconsistencies in the works and the actions and decisions of the contractors, the PEVD, and other stakeholders.

- 3.9 **Evaluation.** PEVD will deliver an evaluation report to the Bank after 18 months of execution, running from the date on which the program was declared eligible for disbursements; a midterm report 60 days after the date on which 50% of the loan proceeds have been disbursed; and a final evaluation report 60 days after the date on which 90% of the loan proceeds have been disbursed. The terms of reference for these reports will require the “no objection” of the IDB.
- 3.10 **Ex post socioeconomic evaluation and impact evaluation.** An ex post cost-benefit evaluation will be conducted at program end, financed by the program. In addition, an impact evaluation will be performed for activity (ii) of Component II (see paragraph 1.28), using experimental methodologies and a quasi-experimental, double difference methodology (propensity score matching) to create a counterfactual group for comparison of the conditions with and without the program. This evaluation will be financed by the IDB with resources of the administrative fee (see paragraph 2.1) (see electronic link, “[Monitoring and evaluation plan](#)”). The necessity of the impact evaluation will be included in the program Operating Regulations (see paragraph 3.5).

Development Effectiveness Matrix			
Summary			
I. Strategic Alignment			
1. IDB Strategic Development Objectives	Aligned		
Lending Program	i) Lending to small and vulnerable countries, ii) Lending for poverty reduction and equity enhancement, and iii) Lending to support climate change initiatives, renewable energy and environmental sustainability.		
Regional Development Goals	i) Percent of households with electricity, and ii) Stabilization of CO2 equivalent emissions (metric tons per habitant).		
Bank Output Contribution (as defined in Results Framework of IDB-9)	i) Percentage of power generation capacity from low-carbon sources over total generation capacity funded by IDB, and ii) Climate change pilot projects in agriculture, energy, health, water and sanitation, transport, and housing.		
2. Country Strategy Development Objectives	Aligned		
Country Strategy Results Matrix	GN-2631-1	i) Increase in energy generated from renewable resources in the SIN, and ii) Greater rural electricity coverage.	
Country Program Results Matrix	GN-2696	The intervention is not included in the 2013 Country Program Document.	
Relevance of this project to country development challenges (If not aligned to country strategy or country program)			
II. Development Outcomes - Evaluability	Highly Evaluable	Weight	Maximum Score
	8.5		10
3. Evidence-based Assessment & Solution	7.8	33.33%	10
4. Ex ante Economic Analysis	10.0	33.33%	10
5. Monitoring and Evaluation	7.8	33.33%	10
III. Risks & Mitigation Monitoring Matrix			
Overall risks rate = magnitude of risks*likelihood	Low		
Identified risks have been rated for magnitude and likelihood	Yes		
Mitigation measures have been identified for major risks	Yes		
Mitigation measures have indicators for tracking their implementation	Yes		
Environmental & social risk classification	C		
IV. IDB's Role - Additionality			
The project relies on the use of country systems (VPC/PDP criteria)	Yes	Financial management: Accounting and reporting. Procurement: i) Shopping method, ii) Contracting individual consultant, and iii) Use of some national subsystem.	
The project uses another country system different from the ones above for implementing the program			
The IDB's involvement promotes improvements of the intended beneficiaries and/or public sector entity in the following dimensions:			
Gender Equality			
Labor			
Environment	Yes	Mitigation of climate change through substitution of fossil generation.	
Additional (to project preparation) technical assistance was provided to the public sector entity prior to approval to increase the likelihood of success of the project	Yes	Local consultants supported: (i) the evaluation criteria and the selection of beneficiaries, (ii) the technical assessment to develop the best practices to replace fossil fuel generation by renewable technologies, (iii) engineering to develop design of renewable energy, and (iv) impact evaluation.	
The ex-post impact evaluation of the project will produce evidence to close knowledge gaps in the sector that were identified in the project document and/or in the evaluation plan			

The overall objective of the program is to support the development and use of sustainable energy in Bolivia, mainly in rural areas. Program documentation presents information that validates the potential of these energy sources in the country. The diagnosis is solid, and presents the factors that impact on the low coverage in rural areas, and that have limited the development of renewable energy systems, however, this discussion is lacking on empirical evidence. The proposed interventions are in line with the diagnosis, but the document does not provide evidence of the effectiveness of the interventions. The results matrix has vertical logic, and includes SMART indicators with baseline and defined targets.

The economic analysis is based on the costs avoided by the substitution of diesel, valued at its shadow price, with generation using renewable energy systems. The evaluation plan proposes a mix of methods to evaluate different components of the project, including non-experimental and an ex-post cost-benefit assessment.

Project documentation includes a risk matrix that identifies potential risks and mitigation measures, including indicators to monitor implementation.

RESULTS MATRIX

Project objective	<p>The program's general objective is to support the development and use of sustainable energy in Bolivia, contributing to: (i) increased use of alternative energies and diversification of the generation matrix; (ii) reduced fossil fuel consumption, its cost to the State, and associated emissions; (iii) promotion of social uses of alternative energies in rural areas; and (iv) savings to rural families on energy use for lighting.</p> <p>The program's specific objectives are to: (i) displace electricity generation based on fossil fuels in isolated systems located in the department of Beni through the supply, installation, and commissioning at least three generating systems using renewable energy (300 kW); (ii) support the identification of solutions for installing generating systems using renewable sources in isolated systems through the financing of eight studies to the final design stage; (iii) promote renewable energy through the delivery of basic power services to schools and health care facilities in rural areas with 375 photovoltaic (PV) systems (90 kW), 300 solar thermal hot water systems, and 3,000 pico-PV systems; and (iv) disseminate the program outcomes at four workshops, to incentivize renewable energy use.</p>
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Impact	Unit	Base (2013)	Target (2023)	Observations/Mean of verification
Impact. Support for development and use of sustainable energy in Bolivia				
Number of isolated systems using diesel generation that install renewable generation	Systems	0	8	Reports from the VMEEA and its Alternative Energies department.
Number of beneficiary health posts with refrigerated vaccine storage and night-time care.	Health posts	0	75	Reports from the VMEEA and its Alternative Energies department.
Number of beneficiary schools with classes and community activities after dark.	Schools	0	300	Reports from the VMEEA and its Alternative Energies department.

Outcomes	Unit	Base (2013)	Target (2018)	Observations/Mean of verification
Outcome 1. Increased use of alternative energies and diversification of the generation matrix				
Number of beneficiaries of isolated systems in Beni with power from an alternative energy source	Users	0	1,200	<p>This is an outcome indicator rather than an output indicator, since in order to supply power to users a system for the management, operation, maintenance, and administration of the isolated system must be in place, as well as the equipment in good working order.</p> <p>Measurement will be done on an ex post basis by an individual consultant, who will analyze the information on the operating company, which will establish the number of beneficiaries connected to the isolated systems following the intervention.</p>

Outcomes	Unit	Base (2013)	Target (2018)	Observations/Mean of verification
Power generated from alternative energy sources in isolated systems located in Beni	MWh/year	0	493	This is an outcome indicator rather than an output indicator, since in order to supply power to users a system for the management, operation, maintenance, and administration of the isolated system must be in place, as well as the equipment in good working order. The power generated will be measured by the service operator, based on the power fed into the system from the solar-photovoltaic plant.
Percentage of power generated from alternative energy sources in isolated systems located in Beni	%	0	0.8%	The power generated will be measured by the service operator, based on the power fed into the system from the solar-photovoltaic plant.
Outcome 2. Reduced fossil fuel consumption and its cost to the State				
Thousands of liters per year substituted by alternative energy sources in the isolated systems located in Beni.	Thousand liters/year	0	164	Ex post measurements will consider the savings in diesel fuel used for electric power generation, resulting from implementation of the hybrid systems. Based on historical annual diesel consumption figures and consumption forecasts for the implemented system.
Equivalent cost of substituted diesel for the State.	US\$000/year	0	225	An ex post economic evaluation will be conducted, considering the cost of subsidized diesel to the State before the hybrid system was implemented and the cost of continuing this mode of generation.
Outcome 3. Reduced emissions associated with fossil fuel consumption				
Number of tons of CO ₂ equivalent avoided through the use of alternative energies.	Tons CO ₂ e/year	0	432	Includes isolated systems and solar thermal systems. For isolated systems, reflects the substitution of diesel (3 kWh per liter of diesel, 2.65 kg of CO ₂ per liter). Means of verification: Reports from the VMEEA and its Alternative Energies department.
Outcome 4. Social uses of alternative energies in rural areas				
Number of public buildings in rural areas with alternative energy applications for social uses (education, health)	Public buildings	0	675	Reports from the VMEEA and its Alternative Energies department.
Power generated in public buildings based on alternative energies (photovoltaic/solar thermal) and used for education or health purposes.	MWh/year	0	941	Reports from the VMEEA and its Alternative Energies department.
Outcome 5. Reduced rural family expenditure on lighting through use of renewable energy				
Beneficiary family expenditure on lighting.	US\$/year	40	14	Reports from the VMEEA and its Alternative Energies department.

Outputs/Costs (US\$000s)	Unit	Base	Year 1 (2014)	Year 2 (2015)	Year 3 (2016)	Year 4 (2017)	Target (2017)	Observations/Mean of verification
Component I. Hybrid systems								
Output 1. Number of isolated systems with hybrid power supply, and power capacity. ¹	Systems	0	-	1	1	1	3	Final acceptance report on works execution, installation, and commissioning of the hybrid systems (VMEEA).
	US\$000s	0	-	500	500	300	1,300	
MILESTONE								
Civil works for implementation of the hybrid systems	Civil works	0	0	1	1	1	3	Execution will be verified through progress reports prepared by the works supervision firm and approved by VMEEA.
Supply of goods for the hybrid generating systems	kW	0	0	100	200	0	300	
Output 2. Studies of hybrid systems prepared	Studies	0	0	2	3	3	8	Final acceptance report on the final design studies prepared (VMEEA).
	US\$000s	0	0	50	75	75	200	
Component II. Solar systems								
Output 3. Photovoltaic systems installed and operating in schools and health posts.	Systems	0	-	50	125	200	375	Final acceptance report on the supply of goods and installation of photovoltaic systems (VMEEA).
	US\$000s	0	-	500	500	1,000	2,000	
MILESTONE								
Identification of public buildings by the executing agency	Number of public buildings	0	-	100	175	100	375	VMEEA technical/management report.
Supply and installation of photovoltaic solar panels	kW	0	-	-	35	55	90	Execution will be verified through progress reports prepared by the works supervision firm and approved by VMEEA.
People trained in the operation and maintenance of photovoltaic solar systems	Number of people	0	-	100	175	100	375	Execution will be verified through documented VMEEA training reports.

¹ Four locations have been preselected for isolated systems. The studies to be conducted will determine the location and final number of systems to be installed, which could be increased to four. A total power capacity of 300 kW is envisaged, but this will be determined according to the outcomes and final costs of the supply processes.

Output 4. Solar panel arrays installed and operating in public buildings	Systems	0	-	100	100	100	300	Final acceptance report on the supply of goods and installation of solar panel arrays (VMEEA).
	US\$000s	0	-	250	250	250	750	
MILESTONE								
Identification of public buildings by the executing agency	Number of public buildings	0	-	300	0	0	300	VMEEA technical/administrative report.
Supply and installation of solar thermal panels	Number of solar panels	0	-	100	100	100	300	Execution will be verified through progress reports prepared by the works supervision firm and approved by VMEEA.
Output 5. Pico-PV lamp systems installed and operating	Unit	0	-	1,000	1,000	1,000	3,000	Final acceptance report on the supply of goods and delivery of pico-PV lamps to beneficiaries (VMEEA).
	US\$000s	0		100	100	100	300	
Component III. Supervision, monitoring, and dissemination								
Output 6. Workshops to promote the use of alternative and renewable energies.	Number of workshops	0	1	1	1	1	4	Documented reports on training workshops prepared by the VMEEA.
	US\$	0	10	10	10	10	40	

FIDUCIARY AGREEMENTS AND REQUIREMENTS

Country:	The Plurinational State of Bolivia
Project number:	BO-X1013, Program for Rural Electrification with Renewable Energy
Executing agency:	Ministry of Hydrocarbons and Energy (MHE) through the “Living with Dignity Electricity Program” (PEVD) of the Office of the Deputy Minister for Electricity and Alternative Energies (VMEEA)
Prepared by:	Carolina Escudero (PRM) and Abel Cuba (FM)

I. EXECUTIVE SUMMARY

- 1.1 The MHE has four deputy ministerial offices, one of which is the Office of the Deputy Minister for Electricity and Alternative Energies (VMEEA), whose functions and duties include policy design, formulation, and evaluation for the electricity sector, as well as formulation and execution of electrification programs and projects for the entire country. In 2008, the Government of Bolivia approved the “Living with Dignity Electricity Program” (PEVD) (Supreme Decree 29635) of VMEEA. The PEVD’s objective is to achieve universal access to public electricity service in urban areas by 2015, and in rural areas by 2025. The PEVD is also the VMEEA’s operational arm for rural electrification programs and projects.
- 1.2 Project procurement and payment activities will be conducted by the PEVD at its headquarters in La Paz. The operation’s accounting records will be kept using SIGMA system.¹ Financial reports required by the Bank will be supported with the SIAP system.² National competitive bidding and contracting processes will use the standard documents provided to the agencies concerned by the Office of the Deputy Minister for Budget and Fiscal Accounting (VPCF) in the State Procurement System (SICOES), which were prepared and updated with the involvement of the Office of the Deputy Minister for Public Investment and External Financing (VIPFE). These documents are published on the SICOES portal. This portal may also be used for national competitive bidding processes, since it has been authorized as a country procurement subsystem for use in Bank operations in the publication of country procurements.

¹ Integrated Management and Administrative Modernization System (SIGMA).

² IDB Integrated Project Administration System (SIAP).

- 1.3 Annual audits, in accordance with the relevant Bank policies, are planned for the supervision of this operation. Contribution resources have been slated to cover the cost of these audits.
- 1.4 In the fiduciary area, support will be provided during execution in the preparation of procurement and financial management plans (including disbursements) that contribute to the expected outcomes.

II. FIDUCIARY CONTEXT OF THE EXECUTING AGENCY

- 2.1 As a public entity, the VMEEA is subject to Law 1178 of 20 July 1990 on Government Administration and Control (SAFCO), which governs the State resource administration and control systems and how they relate to national planning and public investment systems.
- 2.2 The VMEEA uses the SIGMA system for all its financial records, ensuring that information on budget execution is reliably available in a secure form. However, this system is unable to provide information in anything other than local currency, or in accordance with the investment categories established in the project cost table, nor does it record expenditures on a cash basis. The IDB's SIAP system will therefore be used as an auxiliary accounting and reporting system for accountability and financial reporting purposes. This system will be used by the executing agency until another system integrated with the government accounts is available.
- 2.3 As a government agency, the VMEEA, including the PEVD, may be subject to review by the Office of the Comptroller General (CGE), if envisaged in the annual work plan. Supervision of the MHE Internal Audit Unit is also subject to annual programming. Nonetheless, programs executing normally are subject to annual reviews by an independent audit firm, as required by each financier.
- 2.4 The System of Basic Rules for the Procurement of Goods and Services will be used, through the SICOES system (www.sicoes.gob.bo) as the mechanism for publicizing invitations to bid and the outcomes of national competitive bidding and simplified processes in Bolivia.

III. FIDUCIARY RISK EVALUATION AND MITIGATION MEASURES

- 3.1 The operation's overall fiduciary risk³ is rated as MEDIUM; actions have therefore been established in the program risk management (PRM) matrix to mitigate the risk factors. Additionally, as a consequence of the update to determine the PEVD's procurement management capacity for IDB-financed programs, a proposed strengthening plan has been prepared, and is set to begin implementation in August or September 2013 with the team executing loan 2460/BL-BO.

³ See the PRM matrix at <http://idbdocs.iadb.org/wsdocs/getDocument.aspx?DOCNUM=37877610>.

IV. CONSIDERATIONS FOR THE SPECIAL PROVISIONS OF THE CONTRACT

- 4.1 **Exchange rate agreed with the executing agency for accountability purposes.** The exchange rate agreed with the executing agency for the conversion of expenditures in local currency into the currency of the operation will be the exchange rate in effect in the borrower country on the date the resources supplied by the Bank are converted into local currency.
- 4.2 **Financial statements and other audited reports.** During the execution period the PEVD will deliver annual program financial statements, audited by an independent audit firm acceptable to the Bank, within 120 days after the close of each fiscal year.
- 4.3 In prior agreement with the Bank, in order to ensure timely support from the auditor during program execution and create opportunities for strengthening and control of the use of resources, the executing agency may engage the independent auditors at the start of the program, to periodically conduct ex post fiduciary reviews (procurement and financial management), within the scope of the program auditing mentioned in the previous paragraph.

V. PROCUREMENT OF GOODS, WORKS, AND CONSULTING SERVICES

- 5.1 **Procurement execution.** Procurements will be conducted in accordance with policy documents GN-2349-9 and GN-2350-9, and executed by the PEVD.
- a. **Procurement of works, goods, and nonconsulting services.** Contracts for works, goods, and nonconsulting services generated under the program and subject to international competitive bidding (ICB) will be executed using the standard bidding documents issued by the Bank. Procurements subject to national competitive bidding (NCB) will use national bidding documents agreed upon with the Bank and published on the SICOES portal. Amendments to such documents will require the no objection of the Bank.
 - b. **Selection and contracting of consultants.** Contracts for consulting services generated under the program, regardless of the contract amount, will use the standard request for proposals issued by or agreed upon with the Bank (or satisfactory to the Bank, if not yet agreed), and its corresponding contracts with the changes authorized by the Bank. The project's sector specialist will be responsible for reviewing the terms of reference for the contracting of consulting services.
- **Selection of consulting firms** will use the standard request for proposals issued by the Bank or the Bank's Country Office in Bolivia.
 - **Short list of consulting firms** may comprise solely (100%) Bolivian firms for contracts with amounts below the thresholds set by the Bank for the country. For Bolivia, this threshold is US\$200,000.

- **Selection of individual consultants** will be based on their qualifications to perform the work, on the basis of comparison of qualifications of at least three candidates. For Bolivia, when so required or deemed advisable, the SICOES system may be used to disseminate calls for proposals to select individual consultants, or notices may be published in the local and international press, as appropriate, or on the UNDB portal, to invite qualified consultants to submit their résumés.
- c. **Direct contracting** may be used for expenditures under US\$500 individually, and not exceeding US\$5,000 as a lot, for the sake of efficiency and speed of execution. These contracting processes must be approved by the project team leader in the procurement plan, and will be subject to ex ante supervision.
- d. **Procurement planning.**⁴ The PEVD will publish the procurement plan in the Procurement Plan Execution System (SEPA) and update it at least annually, or as required to reflect the project's actual execution needs and progress made.
- e. **Advance procurement/Retroactive financing** will be used in the manner established in the loan contract.
- f. **Domestic preference.** No domestic preference is envisaged for the planned goods procurement processes under this operation.
- g. **Terms of reference and technical specifications.** The program sector specialist will be responsible for reviewing the terms of reference for the contracting of consulting services and the technical specifications for the procurement of works, goods, and nonconsulting services.

5.2 Table of threshold amounts (US\$000)

Works			Goods and nonconsulting services			Consulting services	
ICB	NCB	Shopping	ICB	NCB	Shopping	International publicity Consulting	Short list 100% national
More than US\$3,000	US\$3,000 or less	Less than US\$250	More than US\$250	US\$250 or less	US\$50 or less	More than US\$200	US\$200 or less

⁴ See [IDBDOCS 37877810](#), Procurement plan for the first 18 months of execution.

- 5.3 **Main procurements.** The main procurements planned under this operation are listed below.

Activity	Procurement method	Estimated date	Estimated amount (US\$000)
Goods			
Supply, installation, and commissioning of three renewable generation systems in hybrid systems (300 kW)	ICB	Q1/2014	1,300
Supply, installation, and commissioning of 50 photovoltaic systems at health posts	ICB	Q1/2014	500
Supply, installation, and commissioning of 300 photovoltaic (PV) systems at rural schools	ICB	Q1/2014	1,500
Supply and distribution of 300 pico-PV lamp systems	ICB	Q1/2014	300
Supply and installation of 300 solar thermal systems	ICB	Q1/2014	750
Consulting services			
8 detailed design studies to equip isolated systems	CQS	Q1/2014	200
17 individual consulting engagements to strengthen the execution unit (procurement management, supervision, monitoring, etc.)	NICQ	Q1/2014	400
1 individual consulting engagement, socioeconomic evaluation of the program	NICQ	Q3/2017	30
Several facilitators for dissemination workshops on energy efficiency and rural electrification	NICQ	Q1/2014	40

* To access the procurement plan for the first 18 months, click [here](#).

- 5.4 **Procurement supervision.** Thresholds for post review will be set based on the executing agency's fiduciary capacity, the complexity of the procurements, and/or external factors that may jeopardize the timely and proper execution of procurements. Given the PEVD's capacity for fiduciary management and procurement, rated as MEDIUM, project execution will initially be subject to the ex ante review modality. The Bank may determine to apply the ex post supervision modality, based on the PEVD's performance in procurement management. In view of the above, six-monthly procurement supervision visits will be conducted, to update the fiduciary risk level and monitor contract progress.

Threshold for ex post review			
Works	Goods and nonconsulting services	Services of consulting firms Short list may be 100% national	Services of individual consultants
Not applicable	None	None	None
Direct procurements will be subject to ex ante review, without exception.			

- 5.5 **Recurrent expenditures.** Recurrent expenditures consist of the operating and maintenance expenses required to run the program during its useful life, including: radio and print media spots, translations, bank charges, basic office supplies,

photocopies, mail and courier, and fuel. These expenditures would be financed by the program within the annual budget approved by the Bank and have been included in the program budget. Recurrent expenditures may be contracted out, following the executing agency's administrative procedures, provided that they are substantially analogous to the Bank's procedures and adhere to the procurement principles established in the procurement policies. The executing agency will deliver reports on such expenditures to the Bank each quarter.

- 5.6 **Records and files.** The PEVD will be responsible for establishing the supporting documents, procedures, and controls necessary for program execution, and for safeguarding them in accordance with the loan contract and local laws.

VI. FINANCIAL MANAGEMENT

- 6.1 **Programming and budget.** The VMEEA, acting through the MHE's Directorate-General of Administrative Affairs, will program the execution of scheduled activities and works approved by mutual agreement with the Bank. To do so, it will ensure the necessary budget allocation each year, following the guidelines set by the Ministry of Economy and Public Finance.
- 6.2 **Accounting and reporting systems.** SIGMA will be used as the main support for recording funds. This system integrates the various accounting events at different points in time in a single registry: budget recording (budget execution); recording of financial position (assets, liabilities, equity, and earnings), and cash management recording (cash flows and transfers). Accounting will be on the accrual basis, using International Accounting Standards (IAS) in parallel with government standards, since execution must be through the SIGMA system, which is governed by the latter. The IDB's Integrated Project Administration System (SIAP) will also be used, to present program financial statements on a cash accounting basis.
- 6.3 **Disbursements and cash flow.** The principal disbursement modality will be "advance of funds," notwithstanding any other mechanism the Bank may use to make payments or reimburse expenditures. Disbursements under the advance of funds modality are based on liquidity requirements, supported by financial programming for a period no longer than six months. To request new advances, at least 80% of the previous advance must be substantiated. Expenditures incurred with the advanced funds will be subject to ex post review.
- 6.4 **Administration of the loan proceeds.** Resources disbursed to the project will be deposited in a designated separate account in the General Treasury Account. The executing agency must keep a specific register in the currency of the operation; an additional register must also be kept in local currency for payments to program suppliers and contractors.
- 6.5 **Internal control and internal audit.** Efforts will be coordinated with the MHE's Internal Audit Unit, to include an evaluation of the program's internal control system in its annual work plan.

- 6.6 **External control and reports.** An external audit will be conducted annually, financed with the the contribution resources and conducted in accordance with the Bank's operational policies. By prior agreement between the Bank and the executing agency, the scope of the program audits may include ex post fiduciary, procurement, and financial management reviews, the results of which will form part of the program audits.
- 6.7 **Financial supervision plan.** Expenditures will be subject to ex post supervision. Nevertheless, based on the risk associated with the program, the annual supervision plan will include at least periodic visits by the audit firm engaged by the executing agency.

VII. EXECUTION MECHANISMS

- 7.1 The PEVD's fiduciary personnel will conduct the program's fiduciary operations. The execution mechanism isdescribed in the proposal for operation development (POD).