

## SECTOR ASSESSMENT (SUMMARY): ENERGY

### Sector Road Map

#### 1. Sector Performance, Problems, and Opportunities

1. Nepal has long recognized the development of its large hydropower potential as an important cornerstone of its poverty reduction and economic growth strategy. It has viewed this renewable resource as a means to (i) provide clean energy that enhances economic activities in rural and urban areas, and (ii) generate revenue from exporting energy. However, these goals have not materialized due mainly to inadequate planning and investment in generation, transmission, and distribution; and delays in project developments resulting from an inadequate legal and regulatory framework. The resulting severe power shortage and frequent power cuts, are major constraints to inclusive growth.<sup>1</sup> Coordinated policy and investment efforts must address the disparity between abundant renewable energy resources and the chronic shortage of commercial energy services, focusing on consumer satisfaction with energy services in the near-term, rationalization of tariffs in the medium term, and sector reforms in the long term.

2. **Generation.** In 2012/13, Nepal's total installed power generation capacity was only 719 megawatts (MW). This capacity decreased to 250–300 MW during the dry season, which coincides with seasonal peak demand estimated at more than 1,000 MW. About 85% of existing generation capacity is run-of-river design, which experiences large seasonal fluctuations in output, leading to irregular energy supply. Numerous hydropower projects are at various stages of development with a total capacity of 2,327 MW (for completion by 2020). Of these, seven projects totaling 732 MW are under construction including the 456 MW Upper Tamakoshi plant and the 140 MW Tanahu storage project. While a wet season generation surplus is expected by 2018, the annual supply shortfall will be about 15%. Additional storage capacity will be required to meet year-round demand (unless cross-border transmission capacity is expanded and appropriate power trading agreements are in place).

3. **Transmission.** The lack of infrastructure to deliver energy from generation sites to load centers is a crucial bottleneck. The government's Three Year Plan, 2010–2013 aimed to add 700 kilometers (km) of transmission lines by fiscal year (FY) 2013; 1,916 km existed in FY2009, however, by the end of FY2011, only 64 km had been added.<sup>2</sup> The absence of a clear plan for developing the electrical transmission system is a significant obstacle to greater investment in new hydropower capacity by independent power producers (IPPs). Nepal also lacks sufficient cross-border transmission infrastructure, an additional challenge for near-term imports, midterm seasonal power trading, and large-scale export-oriented projects. The total capacity of existing cross-border connections is only 200 MW. In 2010, the government began construction of a 400-kilovolt (kV) cross-border transmission link to improve power exchange with India.<sup>3</sup> A second 400 kV cross-border line is planned from Bardaghat in Nepal to Gorakhpur in India.<sup>4</sup>

4. **Distribution.** The national electrification rate is 65%, with 93% of urban and 49% of rural households connected to the grid.<sup>5</sup> On average, all grid-connected consumers experience

---

<sup>1</sup> Asian Development Bank, Department for International Development, and International Labour Organization. 2009. Nepal: Critical Development Constraints. *Country Diagnostics Studies*. Manila.

<sup>2</sup> The fiscal year ends on 15 July.

<sup>3</sup> Commissioning of the 400 kV Dhalkebar–Muzaffarpur transmission line is expected in July 2014.

<sup>4</sup> The feasibility study is being funded by Asian Development Bank. 2013. *Report and Recommendation of the President to the Board of Directors: Proposed Grant to Nepal for the Project Preparatory Facility for Energy*. Manila.

<sup>5</sup> Government of Nepal, Central Bureau of Statistics. 2011. *Nepal Labor Force Survey 2008*, Kathmandu. The electrification rates are on a household basis; about 65% of the total population has access to electricity.

power cuts (load shedding) of 12-hours/day or more. The Nepal Electricity Authority (NEA), a government undertaking), which serves more than 2.32 million customers nationwide, has a de facto monopoly over distribution. In FY2012, domestic consumers accounted for 95% of its customer base, but only contributed 44% of total sales; industrial and other commercial consumers accounted for only 2% of the consumer base, but contributed to 46% of total sales.<sup>6</sup> Transmission and distribution system losses have declined from an audited 28.6% in FY2011 to a provisional 26.4% in FY2012. Close monitoring of distribution networks, establishment of loss reduction committees, and penal action against errant users have reduced nontechnical losses.

5. **Off-grid renewable energy.** Nepal is estimated to have the potential to develop more than 100 MW of micro hydropower, 2,100 MW of solar power,<sup>7</sup> and 3,000 MW of wind power.<sup>8</sup> Off-grid renewable energy is also a priority program for the government as it is a clean, safe and environment-friendly solution to providing commercial energy to remote sparsely populated areas not viable for grid extension. Development partners have assisted in initiating several renewable energy technology-based interventions for mini- and micro-energy projects; many are still operating. As of 2010, renewable energy technology projects included about 40 mini-hydro plants with 15 MW capacity, 864 micro-hydropower plants with 15 MW, 1,262 pico-hydropower plants with about 2.5 MW, about 6.4 MW-peak of solar photovoltaic in more than 227,000 households, and 9.2 kilowatts of wind energy, in addition to institutional and community plant installations.<sup>9</sup> The current Three Year Plan, 2010–2013 envisages adding 15 MW of mini and micro hydropower; 225,000 solar home systems; 90,000 domestic, 50 community, and 75 institutional biogas plants; 1 MW of wind power; and 4,500 improved water mills.<sup>10</sup>

6. **Public utility operations.** Since its establishment in 1985, NEA has dominated the energy sector. By the end of FY2011, it had accumulated losses of NRs27 billion, attributed to the absence of a tariff increase during 2001–2012, the rising cost of energy purchases and operations, and high system losses. In response, the Ministry of Energy authorized the financial restructuring of NEA in December 2011. The restructuring included (i) increasing NEA's capital share to NRs50 billion, (ii) writing off accumulated losses, and (iii) converting interest due to the government into equity. The Electricity Tariff Fixation Commission approved an average retail tariff increase of 20%, which allowed NEA to revisit its power purchase agreements with the IPPs. These initiatives should contribute to improving NEA finances and its capacity to invest to meet the rising demand for electricity.

7. **Private sector participation.** The government is committed to attracting private investment in hydropower generation. Since initial operations in 1992, 25 IPPs now account for 187 MW of grid-connected capacity and 31.3% of total electricity supply. The 16 major IPP projects now under construction will add 537 MW of generation capacity by 2017. The government has also allowed the private sector to become involved in distribution: Butwal Power Company is supplying electricity to about 36,000 consumers, and 94 community group arrangements are providing electricity to 73,000 households. However, the private sector has to deal with several constraints including inconsistent policies, lack of comprehensive planning, public sector financing limits, NEA's credit and offtake risks, and difficulty with land acquisition and right-of-way issues.

<sup>6</sup> Nepal Electricity Authority. 2013. *A Year In Review: Fiscal Year 2012/2013*. Kathmandu

<sup>7</sup> Using 2% of the suitable land area. Average annual solar irradiation in Nepal is estimated at 4.5 kWh/square meter/day (Alternative Energy Promotion Centre. 2008. *Solar and Wind Energy Resource Assessment*. Kathmandu)

<sup>8</sup> Requiring about 10% of the suitable land area (footnote 7).

<sup>9</sup> Alternative Energy Promotion Centre. 2010. *Annual Progress Report 2009/10*. Kathmandu.

<sup>10</sup> Government of Nepal. 2010. *Three Year Interim Plan, 2010–2013*. Kathmandu.

## 2. Government's Sector Strategy

8. The government adopted the Electricity Act, 1992 to develop and manage hydropower and to standardize and safeguard electricity services, covering issues such as licensing, royalties, duties and taxes, tariff fixation, and land acquisition. The Hydropower Development Policy, 2001 lists objectives and establishes governing rules for hydropower. It specifies the generation, transmission, and distribution functions for creation of an independent power systems operator. In the absence of updated corresponding legislation, this policy document continues to provide the basic framework for private sector participation. The National Water Resource Strategy, 2002 calls for NEA to become commercially viable through corporatization, improved management, and separation of its rural electrification operations; and for generation to become the responsibility of a separate corporation. Cabinet approved the new Nepal Electricity Act and the Nepal Electricity Regulatory Commission Act, but government approval was stalled due to the absence of Parliament from May 2012 to early 2014; the proposed legislation is expected to be put forward under the current government. The Nepal Electricity Regulatory Commission Act will establish an independent regulatory agency for power.

9. In 2008, the government approved the National Electricity Crisis Resolution Action Plan to provide immediate and long-term strategies for dealing with a worsening power situation. It also formed a task force to prepare a road map for developing an additional 10,000 MW of hydropower generation capacity in 10 years. The Rural Energy Policy, 2006 targets installation of improved biomass technologies, off-grid micro-hydro systems for rural electrification (capable connecting to the national grid when it is extended), and white light-emitting-diode and photovoltaic-based solar lights to replace kerosene lamps. The policy provides for special programs to enhance the benefits of rural energy services for women and other marginalized groups, and increase their representation in the formation of community-based organizations through social mobilization.

10. Because the government has major financing responsibilities in numerous other sectors, it will be unable to make sufficient investments on its own to fully develop Nepal's hydropower potential. To leverage investments, share risks, and mobilize private investment, public-private partnerships (PPPs) are being pursued as a key strategic model for hydropower expansion. PPP is already used in power distribution through NEA's community electrification initiatives. The Asian Development Bank (ADB) will continue to strengthen these initiatives with a facility to implement large-scale PPP hydropower projects and to provide related advisory services.<sup>11</sup>

## 3. ADB Sector Experience and Assistance Program

11. ADB; the European Commission; the European Investment Bank; the Japan International Cooperation Agency (JICA); KfW; the Netherlands Development Organization; the United Nations Development Programme; the World Bank; and the governments of the People's Republic of China (PRC), Denmark, India, and Norway are the major development partners in the sector. Of these, ADB; JICA; KfW; the World Bank; and the governments of the PRC, India, and Norway have been the most active in the on-grid subsector. Nepal's other development partners are more involved in off-grid development. The development partners regularly coordinate sector investments and support for establishing an enabling institutional framework.

---

<sup>11</sup> ADB. 2013. *Report and Recommendation of the President to the Board of Directors: Proposed Grant to Nepal for the Project Preparatory Facility for Energy*. Manila

12. ADB has been the leading partner in Nepal's power system development, focusing on support for NEA's expansion of generation, transmission, and distribution capacity. ADB and JICA cofinanced the Kali Gandaki "A" Hydroelectric Project, a 144 MW power plant commissioned in 2002.<sup>12</sup> ADB assistance projects for transmission in 2009 and 2011, cofinanced by Norway, strengthened transmission infrastructure from the western border to the central region, and supported the evacuation of electricity from generation sites in eastern Nepal to the load center in Kathmandu. For distribution, ADB assistance has focused on increased access; rehabilitation of small hydropower plants; and other clean energy interventions, such as solar street lighting, and energy-efficient lighting. ADB has also supported several rural electrification projects with local community participation. ADB approved the 140 MW Tanahu Hydropower Project in 2013 to address the issue of limited generation of electricity from storage-type hydropower plants;<sup>13</sup> JICA, the European Investment Bank, and Abu Dhabi Fund for Development cofinanced the project. It includes pilot programs to expand the access of women and other marginalized groups to energy resources and energy-based livelihoods in partnership with NEA, Alternate Energy Promotion Centre, and nongovernment organizations.

13. ADB's main focus in the new country partnership strategy will be to make the energy sector a key driver of inclusive economic growth through investments in both on-grid and off-grid subsectors. ADB's on-grid investments will include support for developing large-scale hydropower projects, expanding transmission capacity to connect new hydropower plants to the grid and to facilitate cross-border power exchange, and expanding and improving the distribution network including village electrification in the new transmission corridors. ADB will provide transaction advisory services to the government to explore suitable PPP modalities and catalyze private sector investment in large-scale hydropower development (footnote 3).

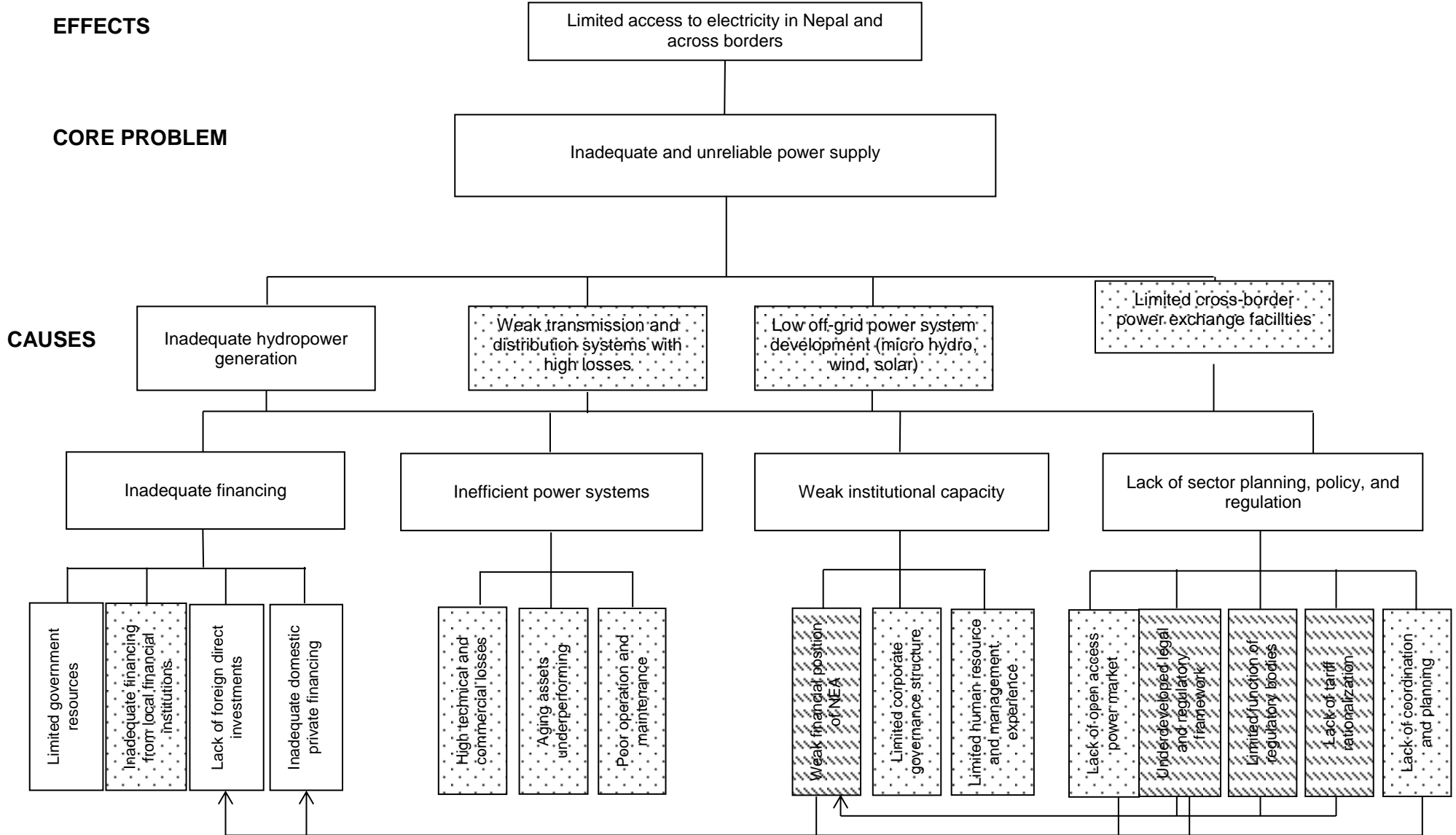
14. ADB will help the government develop off-grid power through the use of renewable energy sources, and will support initiatives that increase energy efficiency. ADB interventions in the energy sector will comply with stringent social and environmental safeguard requirements, and will enhance inclusive economic and environmentally sustainable growth. ADB will support the development of the institutional capacity of sector agencies to address such concerns as the need to enhance inclusiveness in access to energy. ADB will conduct a policy dialogue with the government to (i) improve the governance and efficiency of the energy sector; (ii) create an independent regulatory authorities for energy and water; and (iii) introduce appropriate structural reforms, including the enactment of relevant legislation, full implementation of NEA's financial restructuring plan, and regular tariff revisions. Support for sector planning frameworks, such as a regional transmission master plan and basin-level planning, will be considered, in coordination with other development partners.

---

<sup>12</sup> ADB. 1996. *Report and Recommendation of the President to the Board of Directors: Proposed Loan and Technical Assistance Grants to Nepal for the Kali Gandaki "A" Hydroelectric Project*. Manila.

<sup>13</sup> ADB. 2013. *Report and Recommendation of the President to the Board of Directors: Proposed Loans and Administration of Technical Assistance Grant to Nepal for the Tanahu Hydropower Project*. Manila.

### Problem Tree for the Energy Sector



☐ To be supplied by the ensuing project

▨ Being supported by ongoing Asian Development Bank projects

## Sector Results Framework (Energy, 2013–2017)

Country Sector Outcomes		Country Sector Outputs		ADB Sector Operations	
Outcomes with ADB Contribution	Indicators with Targets and Baselines	Outputs with ADB Contribution	Indicators with Incremental Targets <sup>a</sup>	Planned and Ongoing ADB Interventions	Main Outputs Expected from ADB Interventions
Increased use of commercial energy by households	Households on electricity grid Baseline (2012): 56% Target (2017): 70% Per capita electricity consumption Baseline (2012): 102 kWh Target (2017): 180 kWh	Energy infrastructure and system expanded and improved	Installed electricity generation capacity Baseline (2012): 705 MW Target (2017): 1,590 MW Off-grid renewable energy generation (excluding large hydropower) Baseline (2012): 35 MW Target (2017): 50 MW New transmission line installed Baseline (2012): 0 Target (2017): 2,000 km New distribution line installed or upgraded Baseline (2012): 0 Target (by 2016): 1,000 km	<b>Planned Key Activity Areas</b> Large hydropower (large dams), renewable (solar, small hydro, wind), electricity transmission and distribution, energy sector development (tariffs and pricing, public–private partnerships, and unbundling) <b>Projects in the Pipeline</b> South Asia Subregional Energy Cooperation Power System Expansion (2014) (\$180 million) Hydropower development through PPP (2015) (\$150 million) <b>Ongoing Projects</b> Energy Access and Efficiency Improvement (\$63.2 million) Electricity Transmission Expansion and Supply Improvement (\$75 million) Detailed Engineering Study for Tanahu Hydropower (\$2.5 million) Tanahu Hydropower (\$150.0 million) Project Design Facility (\$21.0 million)	<b>Planned Key Activity Areas and Projects in the Pipeline</b> Hydropower projects with capacity up to 740 MW initiated 4.8 MW renewable energy generation (excluding large hydro power) established 385.5 km transmission line and 1,000.0 km distribution line installed or upgraded Cross-border transmission capacity expanded by 1000 MW <b>Ongoing Projects</b> 550 km transmission line and 600 km distribution line installed or upgraded 29,000 households electrified Three PPP distribution centers established One million energy-efficient lighting and 1,000 solar and solar–wind street lighting units set up Four hydropower plants rehabilitated Poor households headed by women and disadvantaged households covered under distribution strengthening and expansion Sectorial GESI framework adopted
Increased cross-border energy trade	Amount of power trade Baseline (2012): 100 MW Target (2017): 400 MW				

ADB = Asian Development Bank, GESI = gender and social inclusion, km = kilometer, kWh = kilowatt-hour, MW = megawatt, NEA = Nepal Electricity Authority, PPP = public–private partnership, TA = technical assistance.

<sup>a</sup> Targets are set according to government targets under Government of Nepal. 2013. *Three Year Interim Plan Approach Paper, FY2014–FY2016*. Kathmandu.

Sources: Asian Development Bank and government agencies