CASE STUDY - UGANDA
Power sector and public-private partnerships

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Acronyms

AFD	Agence Francaise de Développement
AfDB	African Development Bank
BEL	Bujagali Energy Limited
BOOT	Build, Own, Operate, Transfer
BTOR	Back to Office Report
CPPR	Country Portfolio Performance Review
CSO	Civil Society Organizations
CSP	Country Strategy and Program
CSPE	Country Strategy and Program Evaluation
CSR	Corporate Social Responsibility
DAC	Development Assistance Committee
DEG	German Investment Corporation
DRC	Democratic Republic of Congo
EIB	European Investment Bank
EAIF	Emerging African Infrastructure Fund
ERA	Electricity Regulatory Authority
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
EU	European Union
FAD / ADF	Fond Africain de Développement / African Development Fund
FiT	Feed-In Tariff
GDP	Gross Domestic Product
GoU	Government of Uganda
GWh	Gigawatt-hour (billion Watt-hours)
IDA	International Development Association – World Bank Group
HPP	Hydropower Plant
ICT	Information and Communication Technology
IDEV	Independent Development Evaluation
IFC	International Finance Corporation – World Bank Group
IPP	Independent Power Producer
IPS	Industrial Promotion Services
ISR	Implementation Status and Results Report
KfW	Kreditanstalt für Wiederaufbau
kV	Kilovolt
kWh	Kilowatt-hour
M&E	Monitoring and Evaluation
MEMD	Ministry of Energy and Mineral Development
MTR	Midterm Review
MW	Megawatt (million Watts)
NDP	National Development Plan

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SUMMARY

Sector overview and background

In 2005, Uganda descended into a power crisis with a sharp decline in hydropower generation output that dropped to half the electricity demand, leading to a period of long power outages and load shedding. The 2005 power crises changed the planning mindset and the government embarked on a power sector expansion program with significant private capital investment. This development took place in the framework of a new global paradigm for power sector reform was put forward that emphasized the restructuring of utilities, the creation of regulators, the participation of the private sector, and the establishment of competitive power markets.

Uganda completed vertical unbundling of the national utility and split into three utilities for generation, transmission and distribution with the established an independent sector regulator (ERA). To have a viable power sector, the government has strived for having cost-reflective tariffs since 2012. Private sector participation has been encouraged in both the electricity distribution and generation segments through private-public partnerships. Hydropower has played an important role in this transition. This started with the construction of the 250 MW Bujagali hydropower plant (HPP) during 2007-2012, later followed by smaller hydropower (private) plants. This facilitated Uganda's transitioned from a supply deficit to a surplus, in which generation capacity more than tripled over the past decade. At the same time, the transmission network was extended, losses in the transmission system were reduced, while electrification rates went up.

However, the national electrification rate of about 30% is still quite low, while losses in the distribution are still high. In general, growth in electricity consumption has not kept up with the impressive capacity expansion and has led to a situation of a large power surplus capacity. Since investments have been realized, whether private or public, these have to be paid for, either by the customer (through higher tariffs) or by the taxpayer (through increased taxes).

This poses difficult choices for the government. Electricity is not only a commercial good, it is a social good. Hence, tariffs need to be kept affordable by a mix of private and public investments. The government has resorted again to large public funding of generation projects (e.g., Isimba and Karuma hydropower projects). The payments for the loans come from tax revenues and the government may be tempted not to have these fully reflected in the energy tariffs. Hiding the real costs may lead the sector into a vicious circle of underfunding and debt that in the long run may bring the country back to where it started decades ago, that is, with a crisis. A better way is to try to boost power sales by extending the transmission and distribution network, reduce distribution network losses and accelerate electrification and by building interconnections for export to countries in the region.

Lessons learned on public-private partnerships

PPP can offer a win-win situation for both the public and the private sectors in electricity generation basing on this case study. PPP has proved to be a unique opportunity for the two diverse sectors to learn how to work together. For the private sector, sharing risks and securing guarantees are important benefits. For the government, private sector investments supplement the limited resources available for government in technology, finance and management. Nonetheless, the experience with Bujagali illustrates also some governance challenges associated with the IPP model. Costs can still be significant even when the procurement process is carefully structured and transaction costs ate high. Private investors will require significant compensation for the associated risks. Such experiences have led the government to move back towards public procurement processes, such as the two large hydro projects at Karuma (600 MW) and Isimba (183 MW).

Advancing electricity access was not given sufficient attention in the early years of reform. Once the reforms were implemented the expectation that small-scale private rural concessionaires would invest in rural electrification proved to be overoptimistic. Planning and procurement capabilities are essential to the functioning of the sector. However, strengthening planning and procurement capabilities, to ensure that projects can be procured at least-cost and matching supply with project demand, did not feature as a key part of the reform agenda in Uganda. With the unbundling, of UEB, responsibility for power generation, transmission and distribution was scattered over multiple public agencies and private companies. There has been a lack of coordination among various entities in the quite complex institutional framework for the electricity sector, particularly on the distribution side.

Uganda's experience illustrates the complexity of power sector reform and the need for all the different parts of the sector, from generation to distribution, from planning to regulation, to function effectively in tandem. This makes a case for greater pluralism of approaches going forward and that reform efforts need to be shaped by both the political and economic context of the host country.

1. SECTOR AND PROJECT BACKGROUND

1.1. Sector context

1.1.1. Institutional setup

The power supply industry until 2001 only encompassed the Uganda Electricity Board (UEB) which was the state-owned, vertically integrated utility (since its establishment in 1948). UEB was a monopoly industry whose performance was perceived to be inadequate, was underfinanced and delivering poor quality of service to its customers. To deal with this crisis, starting in the late 1990s, the Government of Uganda embarked on a power sector reform program. The sector was liberalized through the unbundling of UEB, through the 1999 Electricity Act. The state chose to retain full control over the transmission sector, through the state-owned *Uganda Electricity Transmission Company Ltd (UETCL).* The generation and distribution sectors however were opened up to private-sector participation. In energy generation, there is the *Uganda Electricity Generation Company Ltd (UEGCL)*[1] as well as *independent power producers (IPPs)*[2] that both sell their generated electricity to UETCL.

UETCL is the single buyer of electricity from generators and sole wholesaler to all distribution companies and the only entity presently licensed to import and export power from and to other countries. UETCL makes either capacity payments (fixed payments, not fluctuating with the amount of electricity purchased by UETCL) or energy payments (a price per kWh of electricity that is purchased by UETCL) to the IPPs. The mutual obligations for these transactions are detailed in power purchase agreements (PPAs). Finally, the distributors sell the electricity to consumers according to the approved tariff schedule. Rates differ according to the type of consumer (e.g., domestic, commercial and industrial), the level of voltage (medium/high or low), and time of demand (peak, shoulder or off-peak).

The *Uganda Electricity Distribution Company Limited (UEDCL)* is a holding company for state-owned distribution assets and currently owns distribution assets that are operated by UMEME Limited[3] under a concession agreement for 20-years that was executed in 2005. UEDCL also

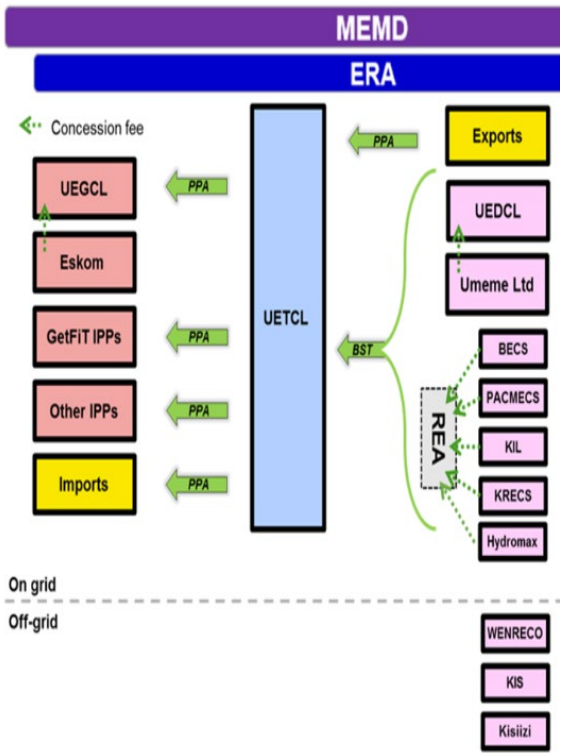
[1] Currently, it owns power generation assets operated under a 20-year concession agreement (for operation and maintenance) by Eskom Uganda Limited, a subsidiary of South Africa's utility giant, Eskom Holdings (namely Nalubaale and Kiira hydropower stations). UEGCL, in addition of reviewing the operation and maintenance of generation complex by Eskom, currently owns and operates the Isimba hydropower station and oversees the ongoing construction of Karuma hydropower project.

[2] The largest of the IPPs is Bujagali Energy Limited and Achwa II, alongside 27 IPPs supplying power to the grid in 2019 which include: 18 small hydro plants, 2 thermals/HFO, 4 solar PV, and 3 co-generation/bagasse plants (status as of 2019).

[3] In addition to UMEME, there are five other Service Providers for the on-grid (UEDCL, Bundibugyo Energy Co-Operative Society (BECS), Kilembe Investment Limited (KIL), Kyegegewa Rural Electricity Cooperative Society (KRECS) and Pader Abim Community Multipurpose Electric Cooperative Society Limited (PACMECS)), called Small Service Providers, which operate smaller distribution networks connected to the transmission system

operates a small number of mini grids that are constructed by the Rural Electrification Agency (REA). More than 90 percent of the market is controlled by Umeme Ltd. The distributors sell the electricity to consumers according to the approved tariff schedule. Rates differ according to the type of consumer (e.g., domestic, commercial and industrial), the level of voltage (medium/high or low), and time of demand (peak, shoulder or off-peak).

Figure 1 Power sector setup



Source: ERA website

The *Electricity Regulatory Authority (ERA)* is the independent regulator that supervises the generation, transmission and distribution of energy, and oversees Uganda's energy import and export. The Authority is also responsible for the issuance of licenses, license terms and conditions, and regular review of the tariff structure.

Rural electrification is promoted through the *Rural Electrification Agency*. *(REA)*. Next to government contributions as appropriated by Parliament, the fund consists of external contributions (donations, grants and loans) and income from a levy on energy sales collected by the Electricity Regulatory Authority.

The *Uganda Energy Credit Capitalization Company (UECC)*: was operationalized in 2009 to manage and administer the Uganda Energy Credit Capitalization Trust. A major objective of the Trust is to provide financial, technical and other support to unlock renewable energy and/or rural electrification projects for development. Credit-enhancement and support instruments are available to the private sector for both grid-connected and off-grid projects via the government-owned Uganda Energy Credit Capitalisation Company (UECCC). Support includes technical assistance for early-stage grid-scale project development and working capital for pay-as-you-go off-grid solar providers.

The power sector is overseen by the *Ministry of Energy and Mineral Development (MEMD)*, providing overall policy direction and guidance in the development and exploitation of energy, mineral, oil and gas resource.

1.1.2. Short overview of power generation and distribution

In 2005, Uganda descended into a power crisis with a sharp decline in hydropower generation output that dropped to half the electricity demand, leading to a period of long power outages and

load shedding[4]. Droughts had affected water levels in Lake Victoria led to a drop in production at the Naluballe Power station (180 MW), which could only partly met be by the country's other large Kiira hydropower plant (200 MW). The crisis was worsened by poor maintenance of the power facilities and delayed capacity additions in the country's power system.

The 2005 power crises changed the planning mindset and the government embarked on a power sector expansion program with significant private capital investment. Thus, Uganda transitioned from a supply deficit to a surplus, in which generation capacity tripled to about 1,270 megawatts (MW) in 2020 and is set to increase to 1,800 MW by the end of 2021. For Uganda, continuing economic development with power sector investment is no longer a question of supply but a question of how to take advantage of a surplus of generation. Hydropower has played an important role in this transition. This started with the construction of the 250 MW Bujagali hydropower plant (HPP) during 2007-2012, followed by the construction of Isimba HPP during 2013-2019. In addition, over 20 mini-hydropower plants were added, varying between 3 and 20 MW that took advantage of favourable feed-in tariffs. The small HPP Achwa II (42 MW) was added in 2019.

Also, in other aspects of the power sector Uganda achieved notable progress in the past two decades:

a) Capacity diversified from the sole dependence on large hydro (and expensive thermal stations) to adding small hydro, solar, thermal and cogeneration plants (increasing from four plants in 2001 to 44 by 2020)
b) Lower power distribution losses (from 38% in 2005, to 27% in 2011 and 17% by 2019),
c) Extension of the transmission network from 1300 km in 2010 to 2989 km in 2020[5]
c) Increased grid coverage (41% more consumers added between 2006 and 2011; consumers increased from 801,667 in 2015/16 to 1,620,505 in 2019/2020[6]). Distribution network length is over 50,000 km (2020).
d) Electrification up from 10% in 2006 to 14% in 2012 to about 28% in 2019[7].
e) Electricity consumption per capita increased from 69 kilowatt-hours (kWh) per capita in 2009 to 80 kWh per capita in 2012 and 100 kWh in 2019[8]. The installed power capacity was about

4 Power shortage of 40% with an effective output of 120 MW and peak demand of 260 MW. Source: IFC

5 See ERA website

6 Majority of the consumers on the network are classified as domestic (92%), with the other consumer categories including commercial, industrial and street lighting combined constituting about 8%. Ironically, industry consumes about 66%, domestic and commercial consume about 22% and 13%, respectively of the total electricity. Source: NDP III

7 NDP II, NDP III. This low compared to Africa's average of 42% in 2019. However, the ERA website claims national energy access at 51% (based on UBOS statistics)

8 NDP II, NDP III. This is lower than the Africa's average of 578 kWh

1,236 MW in 2019. Large hydro provided the bulk (855 MW), followed by small hydro (152 MW), thermal (HFO)[9], 92 MW, grid-connected solar (60 MW)[10] and cogeneration (59 MW[11]).

[9] Two heavy fuel oil thermal power stations exist in the country, the Namanve Power Station (50 MW) plant owned by Jacobsen Electricity Company (Uganda) and the Tororo Power Station (owned by Electro-Mexx). Namanve and Tororo are used as stand-by power sources to avoid load-shedding when hydropower generation fails to meet demand. Five sugar manufacturers in Uganda have total cogeneration capacity of about 110 megawatts, of which about 50 percent is available for sale to the national grid.

[10] There are four IPP solar grid-connected power stations (Soroti, Tororo, Kabulasoke and Mayuge) with a combined installed capacity of 50 MW. New solar power stations are planned with a combined capacity of 100 MW (Nkonge, Namugora).

[11] Excluding own use, 19 MW. https://www.era.go.ug/index.php/stats/generation-statistics/installed-capacity

Figure 2 Installed power capacity and electric energy production (2020)

Installed power capacity and sources of power

The total installed capacity as at end of December 2020 was 1,268.9MW of which 1,236.3MW supplies the main grid, 13.9MW is off the main grid and 18.7 MW is for own consumption which is mainly by the bagasse cogeneration plants. During the reporting period, a total of 8MW of Electromaxx was moved to Arua to supplement the dispatch from Nyangak-I in order to meet the growing demand of the region. Download Detailed Statistics Here

Grid Supply	Offgrid Supply	Own Use Only	Total
1,236.3 MW	13.9 MW	18.7 MW	1,268.9 MW

Technology	Grid supply	Own Use generation	Off Grid generation	Total
Large Hydro	855	0	0	855
Small Hydro	151.8	0	3.9	155.7
Thermal (HFO)	92	0	8	100
Solar	60	0	0.8	60.8
Cogeneration	77.5	18.7	0	96.2
Diesel	0	0	1.1	1.1
Biomass	0	0	0	0
Total	1236.3	18.7	13.9	1,268.90

Key Stakeholders in the Electricity Supply Industry

Uganda's current Electricity supply industry constitutes of 41 electricity generation companies (of which 33 export to the national grid and 6 Offgrid), one (1) transmission company (selling power to 7 domestic distributors and 4 foreign countries). As of the end of June 2020, the distribution companies (on-grid and off grids) served a total customer base of 1,463,288.

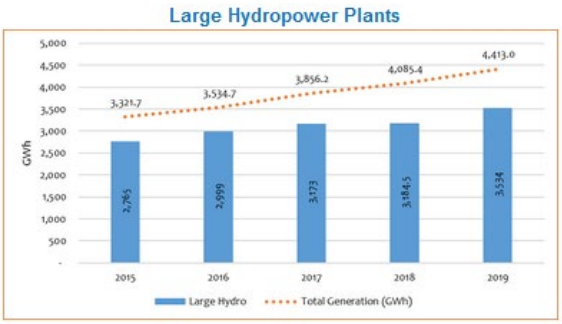
GENERATION	
Grid Supply and Own Use	
Technology	No
Large Hydro	4
Small Hydro	19
Bagasse	5
Solar PV	5
Thermal	2
Offgrid Supply	6
Total	41

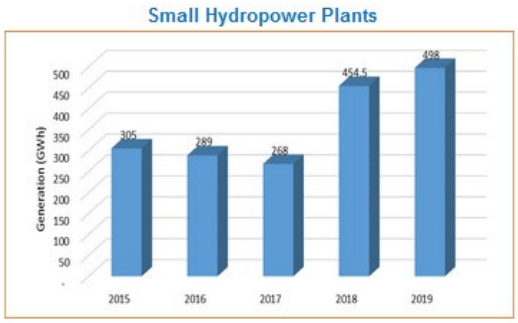
TRANSMISSION			
PURCHASES		SALES	
Source	No	Source	No
Large Hydro	4	Distribution	7
Small Hydro	19		
Bagasse	3		
Solar PV	5		
Thermal	2		
Imports	2	Exports	4

DISTRIBUTION (June, 2020)			
Category	Grid	Offgrid	Total
Domestic	1,527,269	22,279	1,549,548
Commercial	89,464	479	89,943
Medium industrial	2,925	21	2,946
Large Industrial	563	4	567
Extra Large Industrial	52	4	56
Street Lights	232	-	232
Total	1,620,505	22,783	1,643,288

Electricity production

A total of thirty-three (33) power plants currently dispatch power to the national grid. These included four (4) large hydropower plants, Nineteen (19) small hydropower plants, two (2) thermal (Heavy Fuel Oil – HFO) power plants, three (3) bagasse-based cogeneration power plants, and five (5) Solar PV power plants. **Click here for Detailed Statistics**





Source: ERA website

Off-grid generation was 14 MW[12]. Sales of electric energy were 3,786 GWh in 2019/20, mainly to large industrial customers (52%), medium industrial (15%), commercial (11%) and domestic customers. Umeme reported power distribution losses of 16.6% in 2019/20. The Ugandan power transmission network (2,989 km) consists primarily of 132 kV lines (1,946 km in 2020) and 220 kV lines with total transmission to the various load centres, where power is distributed to the 11 kV and 33 kV distribution network. The transmission backbone runs from Jinja, where the Nalubaale, Kiira and Bujagali hydropower plants are situated, to Kampala. Future plans call for a regional 220 kV network around Lake Victoria.

1.1.3. Challenges and opportunities in the power sector

For Uganda, continuing economic development with power sector investment is no longer a question of supply but a question of how to take advantage of a surplus of generation. The situation of over-capacity has actually come with a number of **challenges[13].**

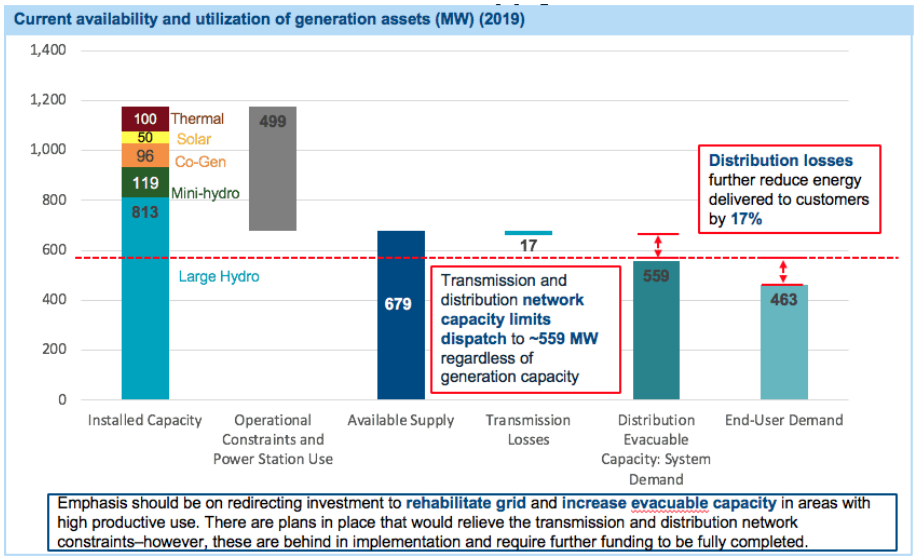
a) Energy supply-demand imbalance
The main grid power generation installed capacity of around 1,240 MW is sufficient to meet demand, including appropriate reserve levels for reliability purposes and dry (rainfall) year margins. A comparison between the grid electricity peak demand and the total grid generation capacity shows that the available grid supply has surpassed the grid peak demand by 522.7.8 MW, i.e., generation capacity is 172% greater than the peak demand (including the exports to neighbouring countries). The large Karuma HPP, ready by 2021-22, will add 600 MW to the grid system, while production of the small hydropower Achwa I will add 41 MW in 2022. A further hydropower expansion of about 1010 MW is planned (including the large Ayaho HPP, 800 MW), grid-connected solar (50 MW) and new geothermal 250 MW). This would bring total installed power capacity to over 3,000 MW. Without corresponding plans in stimulating the increase of power demand and export, the additional capacity will only further increase the surplus generation capacity. Because supply must be paid for regardless of whether or not it is used, the surplus can be expensive; for example, a USD 0.10 per kWh take-or-pay power purchase agreement can manifest as USD 0.20/kWh if only half the power is used.

The investment costs of the (excess) capacity must either be covered by (higher) tariffs, paid for by the utility's clients, or through subsidies to keep the electricity affordable (thus ultimately paid for by the taxpayer). The Isimba and Karuma hydropower projects are funded through Government. The payments for the government loans come from tax revenues so is a distortion of the energy market if these costs are not reflected in the energy tariffs. Whatever the modality, the Government will be obligated to pay for much more electricity than it effectively can dispatch.

[12] West Nile Rural Electrification Company Limited (WENRECO) and Kalangala Infrastructure Services (KIS) Limited are the leading Off-Grid (generate and sell) Electricity Distributors in Uganda. KIS operates a Hybrid Electricity Generation Plant comprising of 1.0 MW of Diesel and 0.6 MW of Solar PV.

[13] Description of the challenges sector is based on the AfDB case study *Uganda's Power Sector Reform: Long Journey and Mixed Results* as well as *An overview of recent developments and the current state of the Ugandan energy sector* (IGC 2020), *Final Energy report Uganda* (RVO, 2018), *Uganda Power Sector Diagnostic* (RMI, 2018)

Figure 3 Evacuation of generated electric energy



Source: Uganda Power Sector Diagnostic (RMI, 2018

Constraints in transmission and distribution systems and their interconnection limit the use of existing supply to 679 MW regardless of the installed capacity, suppressing demand of about 450-500 MW in 2019

b) High tariffs

Ramping up generation in isolation has had a price, notably a high tariff. In order to further attract private sector investment, Uganda has implemented incentives including Renewable Energy Feed-In- Tariff (RE-FiT) for small-scale projects up to 20 MW generation capacity. The feed-in-tariff program has had quite an impact on enhancing renewable energy projects, but also encouraged the escalating capital costs for renewable energy technologies[14].

Uganda has some of the highest electricity tariffs in the region. Additionally, the generation costs have been largely recovered through the retail end-user electricity tariff. High marginal domestic

Table 1 Electricity end-user tariffs (2020)

End-User Retail Electricity Tariffs (UGX/kWh)							
	Domestic (Residential)	Commercial	Medium Industrial	Large Industrial	Extra Large	Street Lights	Weighted Average
Q4 2019 Approved Tariff	769.0 (250 for first 15 kWh, lifeline tariff)	684.8	613.2	377.7	311.9	751.1	500.3
2020 Approved Base Tariffs (for Q1)	751.7 (250 for first 15 kWh, lifeline tariff)	648.4	575.2	362.4	302.2	370.0	494.3

Source: https://www.era.or.ug/index.php/tariffs/tariff-schedules

[14] Until end of 2019, the GET-FiT program had added 122 MW generation capacity (renewable) to the grid, 17 projects with PPAs signed and 453 million USD investments leveraged. Source:

(residential household) tariffs for consumption above the lifeline (15 kWh/month) have formed a major constraint on growing the power demand for households, productive and social uses.

c) Demand-side imitations

According to recent studies[15], there has been a focus on expanding generation capacity rather than on focus on stimulating demand by increasing access and productive use of electricity and lack of sufficient investment in evacuating power to customers as well as for export.

c1) Transmission and distribution

The overall electricity grid transmission and distribution (T&D) losses, prior to the unbundling of UEB, were about 39% in 2005. The transmission losses decreased from 5.7% in 2005 to 3.6% in 2019. The distribution losses did also decrease over time from 38% in 2005 to 17.3% in 2019 but are still relatively high. Uganda's Third National Development Plan (NDP-III, 2019/20-2024/25), for example, mentions that "electricity distribution is characterized by a dilapidated network, multiple and uncoordinated players and use of distribution network for transmission over long distances".

c2) Domestic energy consumption

For example, between 2008 and 2016 installed capacity grew by 140% but domestic energy consumption per household fell by 37%, although over the past 5 years the total electricity consumption increased by an average of 7.6% per year.

While energy access has improved very much, compared to a decade ago, at 28% it still quite low compared to the Sub-Saharan Africa average of 42%[16]. Moreover, differences between cities and rural areas are significant: 57% of households in cities have access to the grid compared to 10% in rural areas. Additionally, regional differences are large. While in Kampala 86% of the households have grid-energy lighting, only 1% do so in the Karamoja sub-region. Most of the energy generation plants are located along the river Nile, as the focus so far of the government has been on large-scale generation projects. To encourage electrification, a new Connection Policy was approved in 2018, which introduces a subsidy approach as a major financing mechanism for single-phase connections, to enable many rural Ugandans to connect to electricity faster; and increase the number of customers to the grid. In the last five years, the strong Government support to the electrification program contributed to the connection of additional 869,148 customers between 2015–2019, supported by development partners.

However, the barrier remains of connecting 80% of the unserved rural households to the grid, which requires large investment at high costs for both distribution lines and networks, given the fact that the majority of Ugandans (70%) live in rural and remote areas, spread-out over the country in dispersed settlements[17]. Unfortunately, less focus has been given by government policy to local (off-grid) solutions, while the latter can be more cost-effective for rural areas than

[15] For example, Rocky Mountain Institute, *Achievements and Challenges of Uganda's Power Sector* (2020); AfDB *Uganda's Power Sector Reform: Long Journey and Mixed Results* (2020)

[16] World Bank *Energy Outlook* (2018). Uganda *draft Energy Policy* (2019). AfDB *Uganda's Power Sector Reform: Long Journey and Mixed Results* (2020). Only 8% of rural residences have grid connectivity, 3% have solar home systems, 28% rely on solar lighting systems or solar lanterns and less than 1% are electrified through mini grids

[17] *An overview of recent developments and the current state of the Ugandan energy sector*, by Van der Ven, International Growth Institute (2020)

grid extension in remote areas. The current institutional arrangement for the distribution sector is overly complex with several key players. There exists significant geographical overlap of distribution companies operating in the same area creating confusion to households to seek a connection from the network and there is and there is a lack of project implementation capacity at REA[18],

c3) Export
Uganda is a member country of the Nile Basin Initiative (NBI), Eastern Africa Power Pool (EAPP), and the Interconnection of Electric Grids of the Nile Equatorial Lakes Countries under the Nile Equatorial Lakes Subsidiary Action Program (NELSAP). In the last ten years, the country is implementing several interconnection projects such as the new 220 kV Uganda–Kenya Interconnection line, and the 220 kV Uganda–Rwanda interconnection. Currently, the 400kV Uganda–Tanzania interconnection, 220 kV Uganda–DRC interconnection and 400 kV Uganda–South Sudan interconnection are planned. Unfortunately, the Rwanda and Kenya interconnection projects have suffered from long delays, due to weak management, land acquisition issues, problems in concluding power purchase agreements (PPAs). For the near future, it is not clear how much surplus power neighbouring countries will take from Uganda, under what terms and conditions such power trading will take place (as they rapidly develop their own generating capacity) and power demand situations, the willingness to pay for imported power (in particular regarding the high cost of Uganda's power generation), and inter-country and regional political factors[19].

d) *Institutional constraints*
After the unbundling of former UEB, the responsibility of coordination and resource planning for generation, transmission expansion and demand creation has weakened. There has been a lack of coordination among various entities in the quite complex institutional framework for the electricity sector, particularly on the distribution side. Inadequate coordination and information sharing among the various government institutions, projects and the private sector result in inconsistent energy data and hinders sector-wide planning. Enhanced structures and systems for integrated power sector planning and monitoring of projects that consider government generation and energy consumption gals and regional energy commitments are necessary[20].

Opportunities

Addressing the above-described challenges offer also opportunities:

a) Delay construction of new (large) power stations to balance grid supply and demand at least cost and put more emphasis on transmission[21] and distribution[22] investments to enable evacuation of power and serve latent demand;

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18 *Uganda's Power Sector Reform: Long Journey and Mixed Results* (AfDB case study)

19 Ibid.

20 Ibid.

21 The *Grid Development Plan (2018-2040*) is UETCL's new transmission system planning document that details the national load growth, generation developments, and proposed regional interconnection requirements through 2040

22 The *Electricity Connections Policy (2018-2027)* targets to increase the access to electricity to 60% through provision of subsidies as a major financing strategy for single phase connections for houses located 60 meters from an electricity pole, and to increase the number of connections from approximately 70,000 per year to about 300,000 connections per year;

b) Encourage energy access by distributed generation, mini-grids and solar PV, and reduce costs by improving energy efficiency in the distribution system;
c) Develop domestic demand (residential, industrial, commercial)[23];
d) Strengthening the inter-connection with the Kenyan and Rwandan power grids, as well as establishing new grid connections with other neighbouring countries;
e) Enhance capacity to drive coordinated sector planning in investments and competitive processes to improve the efficiency of the sector while also helping to drive it towards the Government's electricity access and power sales targets.

1.1.4. Policy and planning in the power sector

Vision 2040 and National Development Plans

Uganda's planning framework consists of a 30-year vision (the so-called Vision 2040), Vision 2040 covers ambitious plans of the government for the energy sector with a target to generate 41,738 MW of energy by 2040 (from 1,254 MW in December 2019)[24]. This increased capacity is judged as necessary to achieve the vision's other economic development and industrialization targets. Furthermore, the Vision aims to increase access to the national grid to 80% of the population by 2040. The document further refers to using to the fullest the hydropower potential as well as geothermal and renewable energy potential.

Vision 2040 is to be realized through six five-year national development plans, sector investment plans, local government development plans, annual work plans, and budgets. The National Planning Authority coordinates the production of these documents. The first National Development Plan (2010/11-2014/15) stressed the importance of 'energy' (in fact, electric energy) for 'industrial and commercial production'. At the time of formulation, the NDP I document, installed power was (only) 425 MW, thus proposed interventions focussed and capacity expansion: a) construction of large hydropower (and thermal) power plants through public and private investment (starting with the 250 MW Bujagali HPP), b) mini-hydropower plants (aiming at 150 MW), c) extending transmission lines (from 1,300 km to 2,750 km), d) accelerate rural electrification, e) reduce losses in the power system from 40% (!) to 16%, and f) strengthen the policy-legal-regulatory framework, g) promote alternative sources of energy.

The second NDP (2014/15-2019/20) identifies several priority development areas, a) agriculture, b) tourism, c) minerals, oil and gas resource development, d) infrastructure (transport, power, oil & gas, ICT, water), e) human capital development. Regarding 'power' the plan aims to expand the capacity of 850 MW in 2013 to 2,500 MW in 2020 (Including the construction of large HPPs, such as Karuma, 600 MW, Isimba, 183 MW and Ayago, 600 MW) as well as the further extension of the transmission network.

[23] The NDP-III the target is increasing population with access to electricity to 60% and electricity consumption per capita to 578 kWh; and reduction in the cost of electricity to US$ cents 5 per kWh for all processing and manufacturing enterprises.
[24] Electricity Regulatory Authority and Vision 2040

In general, one can say that the NDPs' development objectives for the energy sector, in terms of generation facility construction, transmission network extension, the promotion of energy efficiency in the supply side, the strengthening of the institutional and regulatory framework for energy, and the promotion of renewable energy. The new third NDP (2019/20-2024/25) continues these objectives (as indicated in Table 13).

Energy Policy 2002

This Energy Policy 2002 for Uganda is to meet the energy needs of the population for social and economic development in an environmentally sustainable way. Therefore, the Policy calls to increase access to modern and reliable energy services. Specific objectives under the energy policy include assessing the availability and demand of energy resources in the country, improving energy service access to reduce poverty, and improving governance in the energy sector.

A new draft Energy Policy is under formulation[25]. The revised policy considers the aspirations and targets of the Vision 2040 (2012), the SEforAll initiative (2012), Sustainable Development Goals (2015), the Paris Agreement (2016), etc. It also reflects the evolution in the electricity sector from generation capacity shortages between 2002 and 2012 to the current surplus of power generation compared to demand.

The Renewable Energy Policy 2007 aims to provide a framework to expand the contribution of renewable energy in the energy mix. The Policy promotes power generation from mini and small hydropower schemes, biomass, co-generation, wind, solar, geothermal and peat. There are plans to include nuclear power generation in the power mix. The Policy establishes a Standardized Power Purchase Agreement and Feed-in Tariffs for renewable energy generation projects. It introduces favourable financial and fiscal regimes for RETs, including: a) preferential tax treatment or tax exemption, b) accelerated depreciation, c) provision of risk mitigation mechanisms and credit enhancement instruments, d) credit mechanisms for renewable energy consumers. Independent Power Producers (IPPs) enter a Purchase Power Agreement (PPA) with the UETCL. A FiT structure for renewable energy power plants of up to 20MW and first published it in 2007. The latest FiT for renewable energy power generation effective since March 2014[26]. Small-scale renewable energy generation projects in an advanced planning status and with a valid development permit by ERA can apply for premium payments under the GET FiT program through participation in a competitive Request for Proposal and the subsequent evaluation process. So far, three rounds of Requests for Proposals have been carried out. The program was officially launched in 2013. It has been jointly developed by the Government of Uganda, ERA and KfW and is designed to leverage private investment into renewable energy generation projects. The Premium Payments constitute a result-based incentive grant designed to enhance the financial viability of the selected projects[27].By 2020, the programme had supported about 17

[25] Available in draft form at: http://www.energyandminerals.go.ug/site/assets/files/1081/draft_revised_energy_policy_-_11_10_2019-1_1.pdf

[26] See www.era.go.ug/index.php

[27] With UK-DFID, Norway and EU support. The tariffs depend on the technology. For example, hydro) receive a premium of USD 0.085 on top of the ReFiT tariffs of USD 0.085/kWh (9><=20 MW) and USD 0.115-0.085 *(1<=8.9 MW). Solar PV ReFiT tariff is USD 0.362/kWh (with no GETFiT premium) and other technologies have other tariff arrangements

renewable energy projects with a total installed capacity of 160MW, generating about 770 GWh of renewable energy.

However, the reliance upon REFiT and acceptance of high tariffs from IPP project developers have also contributed to an increase in overall generation costs and finally the end-user tariff. Uganda has decided to maintain the REFiT by limiting eligible technologies (hydro and biomass) while other (solar PV) will fall under a competitive tendering in an auction system.

Private sector involvement in public-private partnerships

Uganda was one of the few sub-Saharan countries to have liberalized its energy market; generation, transmission and supply were unbundled in 2001. As part of the sector reform, the government adopted a policy in 2010 involving the private sector in the provision of public services by means of "public-private partnerships (PPPs). The PPP is an arrangement between governments and the private sector in the provision of public infrastructure (including power) and related services aimed at obtaining better quality services at competitive prices, mobilizing private sector finance and investment (while reducing the risks inherent in infrastructure projects development and service delivery).

The 250 MW Bujagali hydropower plant (HPP) was the first independent power project (IPP) in Uganda, and the largest mobilization of private financing for a power project in Africa. The initiation and implementation of this project made it a good example of how various international financial institutions, including AfdB, can work together with private sector project sponsors to address their financing and risk mitigation concerns, and meet the client country's (in this Uganda) development objectives through a PPP scheme. Hence, the Bujagali scheme is chosen as main object for case study for the power sector as part of the AfDB CSP in Uganda, alongside the smaller-sized Achwa II and Buseruka HPPs, in the framework of the above-sketched developments over the past decade in Uganda's power sector.

These PPPs have offered an opportunity for the two diverse sectors, public and private, to work together. For the public sector, shifting risks and securing financing are important benefits. As is described in Section 3.5, an increasing role of public financing of power sector developments can be observed in Uganda with the aim of increasing affordability for the electricity end-users.

2. DESCRIPTION OF SELECTED PROJECTS

2.1. Bujagali Hydropower

The Bank has been involved in discussing the Bujagali project since 1999. The government of Uganda, at that time, lacked the necessary technical expertise and financing to initiate, implement and complete the project on its own. Private sector participation was sought to fill the gap. However, AES Nile Power (AESNP) was intended to be the first company to undertake the project, but AES pulled out of the project in 2002, and as a result, the dam project stalled for five years.

In 2005, the project was restarted by the Government with the support of the AfDB, World Bank Group (WBG) and the European Investment Bank (EIB), consisting of two parts:

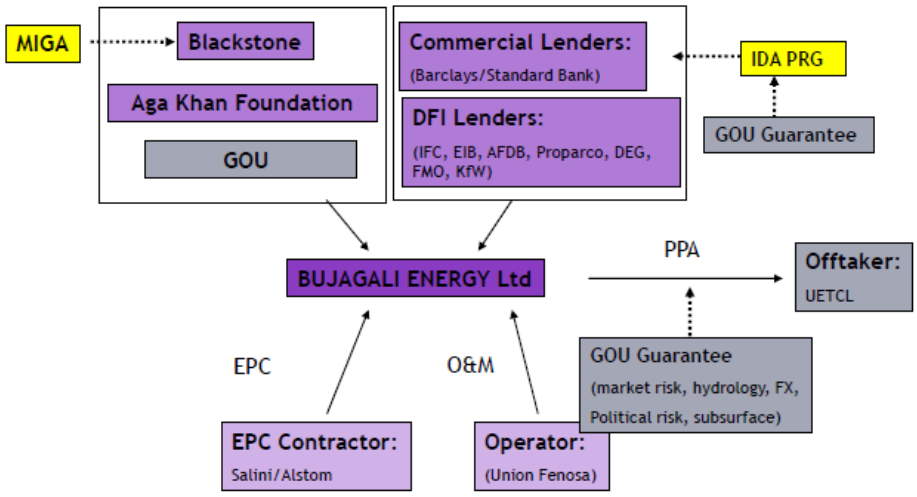
- The Bujagali Hydropower Project commissioning Bujagali Energy Limited (BEL) to construct and operate the dam and power plant, financed by AfDB), WB and other lenders;
- The Bujagali Interconnection Project) under the responsibility of the Uganda Electricity Transmission Company Ltd. (UETCL), financed by AfDB (African Development Fund) and the Japanese Bank for International Cooperation

Following a competitive international bidding process, the consortium formed by Industrial Promotion Services (IPS) and Sithe Global Bujagali Holdings (SGBH) was selected. A special-purpose company, Bujagali Energy Limited (BEL), was created by SG Bujahali Holdings (an affiliate of the US-based Sithe Global Power LLC, itself 99% owned by Blackstone) and Industrial Promotion Services (Kenya) Ltd (a division of the Aga Khan Fund for Economic Development), and was tasked with developing the project. In 2018, Sithe exited the BEL company and was replaced by the Norwegian SN Power AS[28]. The Bujagali project was developed, financed, constructed, and maintained by BEL on a BOOT (build, own, operate and transfer) basis. BEL also manages the construction of the Bujagali Interconnection Project on behalf of UECTL, which was to own and operate the project. The Interconnection Project involved the construction of about 100 kilometres (km) of high voltage electrical transmission line to interconnect the power generation facility (the Bujagali project) to the national electric grid. Structured as IPP, BEL then was to sell the electricity to UETCL, under a 30-year Power Purchase Agreement (PPA). Under the agreement, BEL will transfer ownership of the station to the Government of Uganda thereafter.

The 250 MW run-of-the-river hydroelectric power plant has been constructed on the Victoria–Nile on Dumbbell Island, Jinja, Uganda. Its associated reservoir inundates an area of 388 ha extending back to the tailrace areas of the Nalubaale and Kiira Hydropower facilities. The Plant comprises spillway and intake structures as well as a powerhouse containing five 50 MW Kaplan turbines. Other facilities which are part of Bujagali include a substation and associated transmission equipment, a control room, relay rooms, telecommunications facilities, service station, battery room, standby diesel generator, workshop and storage facilities, offices and operator facilities.

[28] Ownership in 2020: SN Power AS (55.45%), AKFED (16.31%), Jubilee Investment (18.24%) and GoU (10%)

Figure 4 Contractual and financial structure, Bujagali HPP



Source: *Bujagali Hydropower project: A Case Study on Risk Mitigation through PPP Structuring* (IFC, 2011)

The government of Uganda provided an in-kind equity contribution of $20 million. The equity financing was shared by the sponsors, IPS (K) and SG Bujagali Holdings Ltd, on a pro rata basis. The debt was being financed by loans from the group of lenders, the World Bank group providing about USD 360 million (USD 128 million loan from IFC, USD 115 million partial-risk guarantee from International Development Association to commercial lenders, and USD 115 investment guarantee from Multilateral Investment Guarantee (MIGA) to cover the equity position of SG Bujagali Holding Ltd. AfDB provided a USD 110 million senior loan to the Project, along with USD 590 million from other development banks and agencies (AFD, DEG, FMO, KfW, Proparco) and commercial banks (ABSA, BNP Paribas, Standard Chartered and Nedbank) .

Restructuring amount is USD 405 million, of which USD 105 senior loan AfDB, USD 100 million WB-IFC and other lenders (FMO, Proparco, DEG, IFC, CDC). AFD and the commercial banks did not participate in restructuring.

Instrument	Lenders at COD debt	Amount at COD, Aug 2012 (USD million)	Outstanding amount as at end of November 2017 (USD million)	Planned Maturity	Lenders participating in the restructuring	Expected restructuring amount (USD million)
Senior debt	AfDB	110	68	2023	AfDB	[105]
	IFC	98	61	2023	IFC	[100]
	FMO	55	33	2023	FMO	[60]
	AFD	13	8	2023		
	Proparco	49	30	2023	Proparco	[40]
	KfW	15	27	2023		
	DEG	44	9	2023	DEG	[40]
	EIB	136	83	2023		
	Commercial Banks / PRG[5]	115	71	2023		
					IFC MCPP	[75]
					CDC	[80]
Subordinated debt	IFC	30	27	2027		
	FMO	28	25	2027		
	Proparco	10	9	2027		
Total debt		**703**	**451**			**[405]**
Total equity		**200**				
Total financing		**903**				

Source: AfDB *Project Appraisal Report , Bujagali Energy Limited 2* (Oct 2017)

The project achieved its financial closing in December 2007 and was commissioned in 2012. In 2005, the Ugandan power sector was facing a severe crisis (see Section 2.1. The supply shortage had to be mitigated by expensive thermal power (at a cost of more than USD 0.25/kWh), The commissioning of Bujagali nearly doubled Uganda's peak electricity supply, eliminating daily load-shedding and providing a reliable solution to meet the country's increasing power demand. The power plant has been producing about providing close to 1,400 GWh annually. Generating about 30% of Uganda's power at that time and with a generation tariff of about US 0.113 /kWh, Bujagali managed the reduce the marginal cost of power of the national grid by USD 0.24/kWh by 66%. However, this was only partly reflected in the end-user user tariffs, which were raised at the same time as part of the 2012 policy to have a cost-reflective tariff structure.

Over time, BEL's tariff (to UETCL) of 11.3 US cents/kWh in 2017 was scheduled to rise to 13.3 US cents/kWh in 2018 and to 14.7 US cents /kWh in 2023 owing to (i) the expiry of a tax benefit and (ii) accommodate current debt amortization. This would have raised the end-user tariff of the national grid, already considered as high compared to end-user tariffs in neighbouring countries,

Restructuring of debt

In September 2016, the government of Uganda began negotiations with equity partners and lenders to restructure the financing of the dam to reduce the cost to the end-user to about USD 0.072 per kWh. In December 2017, the Ugandan government reached a consensus with the power station's financiers on restructuring the loans and waiving taxes on the power generated, to enable the cost of power to the consumer to reduce. In July 2018, with about USD 450 million of the USD 900 million construction loan repaid, the remaining loan was restructured and extended for another 15 years, thereby lowering the loan payments and related electricity tariff (see Table 5). AfDB has supported this through project P-UG-FAB-008. Because of the 2018 restructuring, the annual debt repayments reduced from USD 32.35 million to USD 23.46 million, resulting in n a reduction of about 5 US cents/kWh (from 2018 to 2023) in the current tariff that UETCL pays to the project company.

Table 2 Impact of debt restructuring on electricity tariffs

	Estimated average tariffs for the period 2018-2023			
(US cent/kWh)	Bujagali	Uganda production cost	End-user tariff	Large industrial tariff
Before restructuring	14.0	7.5	15.0	11.6
Restructuring +5-yr tax benefit	9.0	6.1	13.6	10.2
Actual tariff in 2020/21	9.0		19.0	16.0

Source: Bujagali Energy Ltd, Project Appraisal report
https://www.globalpetrolprices.com/Uganda/electricity_prices/

The project has also received criticism from environmentalists and other groups regarding the potential impact of the project as well as the management of the resettlement. hydrologists and climatologists argued that the project would make Uganda more vulnerable to drought, as the

dam would increase Uganda's dependence on a short stretch of the Nile for all of its electricity for some time to come[29].

The dam lake submerged productive agricultural land as well as islands that supported valuable natural habitats. The area around the Bujagali Falls supported a substantial number of subsistence and commercial fishermen. An AfDB compliance review report (2008)[30] mentions that “approximately 8,700 people (about 1,288 households) had either been resettled or had lost assets for which they were entitled to compensation because of the project. Neither all of these people nor all of the affected villages have yet received all the compensation that they were promised”. Some of them sought legal compensation and others looked for an out-of-court settlement with the government[31].

The Project preparation documents mention that the Bujagali hydropower facility, by using the same waters turbined by existing dams, will ease the pressure on Victoria Lake waters and lead to more sustainable flows from the Lake. However, future climatic variations have a bearing on the levels of Lake Victoria and the ability of the power plant to generate the projected amount of power. Overdrawing of the water for the cascade of dams will affect the dam operation[32].

The Project was criticized for being a questionable investment given the expense. One source mentions that “electricity prices in the country actually increased. Unfortunately, the expected reduction in electricity costs has not been realised and instead the average cost of electricity increased after commissioning [the] dam, to be the highest average cost of hydro in Africa, thus making it unaffordable for many Ugandans”. Indeed, the cost of production was 11.3 cents/kWh in 2017, already one of the highest for hydropower in Eastern Africa. However, the project’s costs are higher than the average for a large hydropower plant in developing countries, driven by complex logistics and the difficult geology of the site. The BEL tariff would have increased to 14.7 US cents /kWh in 2023 without the debt restructuring. The project cost doubled from the time the project was first proposed, reported to be USD 430 million until it was approved in 2007, to about USD 900 million. This significant cost overrun in the design may indicate that the financial feasibility of the project had not been adequately assessed initially[33].

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[29] The dam project was investigated four times, twice by the Inspection Panel of The World Bank, by The African Development Bank’s Independent Review Mechanism (IRM), and by The European Investment Bank’s Compliance Review. A number of cases were opened by the IFCs Compliance Advisor Ombudsman. Citizens groups in Uganda like the National Association of Professional Environmentalists (NAPE), Save Bujagali Crusade, and other international groups like International Rivers Network (IR), and Counter Balance played an important role in raising the potential social, economic and environmental impacts of the project in the public domain and prompted the lenders to investigate. Source: *Unsettling business, social consequences of the Bujagali hydropower project,* FIVAS, NAPE (2014)

[30] *Compliance Review Report on the Bujagali Hydropower and Interconnection Projects;* AfDB, Independent Review

[31] http://www.eib.org/attachments/complaints/complaint-bujagali-hydro-project.pdf

[32] *Unsettling business, social consequences of the Bujagali hydropower project,* FIVAS, NAPE (2014)

[33] www.internationalrivers.org/where-we-work/africa/, quoted in www.centreforpublicimpact.org/case-study/bujagali-dam-project-uganda

Box 1 Risk mitigation, Bujagali

The project's significant debt financing mostly comes as long maturity senior loans provided by public development financial institutions (IFC, EIB and AfDB) with a group of European financiers (about USD 580 million). The long maturity of these loans allowed the national utility (and ultimately the government) to spread the significant project costs over many years and made it affordable for the country's budget.

Risk mitigation instruments were instrumental in raising private finance from both equity sponsors and commercial lenders. Two commercial banks (Standard Chartered Bank and ABSA Bank) jointly provided a senior loan under with the same long-term maturity of the public loans (16 years) made possible by an IDA partial guarantee, covering both interest and principal repayment for the entire debt amount (average maturity from private lenders in the region ranges from just two to five years). The PRG contractually links the Ugandan government directly to IDA via a (counter) guarantee in the form of an indemnity agreement: if the PRG payments are triggered, any amount paid by IDA to the commercial banks would need to be reimbursed to IDA by the government. MIGA's insurance covers the equity holder Sithe Global should the state-owned off-taker (or the government as a guarantor) not comply with its obligations arising from the implementation and the power purchase agreements

The main source of revenues for the private investor is the payments from the power off-taker – the national utility company (UETCL) – stated in the Power Purchase Agreement (PPA). The contract sets a monthly capacity payment denominated in USD. Payment is not linked to the power produced but only conditional on a certain minimum capacity being made available by the project company to the grid. These capacity payments have been set to ensure the project can repay its debt, its operating costs and remunerate equity sponsors with a regulated annual rate of return

Bujagali offers a unique opportunity to assess the effectiveness of these instruments in supporting private renewable energy investments in high-risk environments (such as many developed countries) and to consider their potential for replication at scale. However, the high transaction costs has implied that a similar complex equity and financial structure has only been applied by the World Bank Group in a limited number of large projects that were often deemed of critical importance by a country's government

Source : *Risk Mitigation Instruments for Renewable Energy in Developing Countries: A Case Study on Hydropower in Africa*, Climate Policy Initiative (2015)

2.2. Buseruka hydropower

The project involves the construction and operation of a mini-hydropower plant in Buseruka located in Hoima District to the West of Uganda (near Lake Albert). The plant has a capacity of 9 MW. The major component of works involves the construction of: (i) a 150,000 m³ capacity dam, (ii) a 1.4 km long power channel and fore bay, (iii) the 1.1 km long penstock, a power house and (iv) electro-mechanical works.

It also involves the erection of a 46-km 33 kV evacuation line for grid connection as well as the extension of transmission and distribution networks to areas that are currently not served by the national utility company, Uganda Electric Transmission Company Ltd (UETCL). Preparations for the projects started in 2005, construction started in 2009 and was completed in January 2013. The hydropower facility is operated under a 30-year BOO concession by Hydromax and project sponsor is Dott Services Ltd. After construction, the plant is also referred to as **Kabalega** Hydroelectric Power Station. The development objectives originate from the provision of electricity to underserved communities in rural Uganda as well as the induced positive environmental effects. The project beneficiaries have been the entire population of Uganda, rural communities in Hoima District, and Uganda Electric Transmission Company Ltd (UETCL).

The original Project cost was USD 27.22 million and comprised of USD 19 million in senior debt corresponding to a debt-to-equity ratio of 70:30. Following the cost overruns that saw the project cost increase by USD 13.88 million to USD 41.4 million. The structure of the senior debt comprises

Table 3 Financing of Buseruka Hydropower project

Instrument	Source	Amount at Appraisal	Amount after Restructuring	% of Total after Restructuring
Senior Debt	AfDB	9	13	31.6%
	PTA Bank	10	10	24.3%
Subordinated Debt	Dott Services	0	3	7.3%
Grant	REA	--	2.3	5.6%
Equity	Sponsors	8.22	12.8	31.1%
Total		**27.22**	**41.1**	**100.0 %**

Source: Buseruka Hydropower Project, Appraisal report

a loan of USD 10 million from PTA bank that will have a grace period of 2 years and a final maturity of 12 years and a total loan of USD 13 million from AfDB (which was USD 9 million at appraisal) which will have a tenor of 15 years, including a grace period of 2 years.

2.3. Achwa II Hydropower project

The project aims to meet the growing demand for electricity in Uganda, the need to reduce the cost of electricity produced, and the need to provide clean energy, thereby supporting economic growth as well as social development in northern Uganda. This project will benefit mainly Uganda Electricity Transmission Company Limited (UETCL), the Government and the people of Uganda. This power station is one in a cascade of five power stations planned on the Achwa River totalling 109 MW (next station in the planning pipeline is Achwa I).

Achwa 2 was the first HPP in Northern Uganda (in Gulu District), an area that succumbed in the past to rebel activity and has been underserved by electricity and infrastructure in general. The project involves the construction and operation of a 42 MW run-of-the-river hydropower plant (Achwa 2 HPP; with an annual output of 162 GWh) and the construction of a 14-km access road, 5 km of service roads. The Achwa-2 power plant will be interconnected via a 180 km transmission

line to the Lira substation, which will be built by Uganda Electricity Transmission Company Limited (UETCL) outside the scope of the project

The total project cost was USD 110.4 million, with a debt-to-equity ratio of approximately 75/25. Debt financing is to be provided by AfDB (USD 17.5-20 million and a DEG-led consortium (Proparco, BIO, EAIF, OFID) which provides up to USD 62.5-65 million. Equity by ARPE Ltd shareholders, currently (AREF, managed by Berkeley Energy, 60%) and PAC SpA (40%). The PPA was signed in January 2016 with an average tariff of 6 US cents/kWh. ARPE Ltd is the special purpose company set up by AREF and Italian PAC and SIMEST.

The financial impact has come in the form of severe cashflow problems. Hydromax is guaranteed payment based on its capacity in its PPA, While Hydromax is paid directly for metered energy sales to UETCL, the deemed energy claims submitted to UETCL have to be approved by ERA and the process is met by delays. In addition, the financial reporting by Hydromax is judged as not be in compliance with covenants, making viability assessments difficult.

Also, the 42 MW Achwa II has been facing difficulties with evacuating power and related UETCL payments. The plant is functioning well and reportedly the hydrology is even better than expected. AfDB's exposure is USD 19.1 million in the form of a senior loan alongside loan of USD 60 million provided by a DEG-led consortium. Until the 140 km 132 kV transmission line will be ready, a part of the power is delivered through a 33 kV distribution line[34], managed by UEDCL for which funding was set aside in 2018 as an interim option. However, the line can only deliver part (5 MW) of the potential power. According to the contract, the government needs to pay for energy that would otherwise have been delivered through the transmission line. The situation is currently being discussed with stakeholders, including the restructuring of the ARPE PPA tariff which will decrease overall deemed energy liability and improve the government's ability to pay deemed energy invoices on a timely basis going forward. As with Buseruka, AfDB project progress reports also flags issues in financial reporting.

The delay in getting transmission lines constructed in time to be connected to new power generation facilities has a number of reasons. One is that the hydropower projects are often located in areas away from the main centers so it requires some effort to convince planners of the need for costly long lines in areas of low energy demand. To this can be added, issues in power distribution planning and coordination (discussed in Sections 2.1.3 and 3.5). Second, Uganda has strict land laws and starting and successfully ending the process of acquiring land for infrastructural works (such as power or roads) can be very time-consuming and is often met with huge delays.

Here is a **lessons learned** for future power project design. The strength of a chain is in its weakest link. In future appraisal for projects of this nature, the complete linkage of generation, transmission, distribution and delivery to end users must be considered in determining the viability or otherwise of the project. Assumptions must not be based on expectations about any part of the

[34] The transition line is split in two sections, Lira-Gulu and Gulu Agago. The latest update ARPE had was that the EPC contract negotiations on the Lira-Gulu line were concluded and execution of the contract awaited approval. With respect to the Gulu-Agago section, the latest update ARPE had was bid evaluation had been undertaken and negotiations started. Source: Project Status Report, September 2020

chain. The problems that arose related to evacuation infrastructure, poor local demand prospects in the short run and difficulties of Buseruka HPP putting in place a local distribution infrastructure. These translated to inability to wheel energy away from Buseruka to satisfactory levels and very low local demand. These in effect meant that even when energy was generated, only small quantities could be wheeled away, hence the "deemed" energy syndrome (which is discussed further from a broader power sector perspective in the ‘sustainability’ section).

2.4. Sustainability and public-private partnerships

2.4.1. Sustainability challenges

Uganda has moved away from the situation in which there were only a few generation utilities in the hands of a state-owned power utility that did not use the significant subsidy efficiently. Attracting private sector investment in power generation and unbundling of the power sector fitted perfectly in the worldwide trend towards power sector liberalization and national need to supplement the limited government budget for power generation capacity expansion. In general, the outcomes of these reforms have been largely positive in achieving the Government’s stated development goals especially for increased power generation and helped to reduce transmission and distribution network losses, and expanding the transmission network.

Uganda has gone far in implementing the power sector reform model of the 1990s; having completed vertical unbundling of the national utility, established an independent sector regulator (ERA) and near cost-reflective tariffs since 2012. Private sector participation has been encouraged in both the electricity distribution and generation segments through private-public partnerships. In distribution, a concession was given to Umeme Ltd (a joint venture of South Africa’s Eskom and UK’s Globeleq) to operate and manage UECDL’s distribution network for 20 years (expiring in 2024). In generation, Eskom Uganda was awarded a 20-year concession for the operation and maintenance of UEGCL's hydropower plants (Nalubaale, 180 MW, and Kiira, 200 MW). The Bujagali hydropower facility is an example of another form of PPP, namely ‘build-own-operate-transfer BOOT)’.

Given the experience of power shortage and load shedding in the first decade of this century, the focus in that period on rapidly expanding generation capacity can be understood. However, expansion of the T&D network has lagged behind the generation capacity expansion. One challenge is that over 70% of Uganda's population lives in rural areas in predominantly dispersed settlements. The distance between households creates logistical difficulties and high costs for both distribution lines and networks and household connection to the grid. The Umeme concession limits service responsibility to within one kilometre of the network. REA was established to promote rural electrification. Concessions have been awarded to cooperatives and local private sector, referred to as service providers, for operation. Given the small customer base

and low purchasing power of rural areas, these concessions have been struggling to reach commercial viability[35]. But factors, other than geographical, can be attributed as well.

The unbundling also brought a division in the responsibility of coordination and resource planning with respect to generation, transmission expansion and demand creation over various entities. In particular, on the power distribution side, there is confusion and overlap in the roles of REA with ERA, of REA with UECDL, Umeme and other distributors. Investment decisions and processes are uncoordinated – often carried out by individual entities, sometimes leading to sub-par investments as regards timing, location, and technology. This also affects transmission and distribution planning, which is becoming more complex due to the demands of balancing an expanding system. There is no bottom-up power demand or power forecasting methodology in place, including demand forecasts from each power distribution company, that integrates distribution with transmission and generation development plans.[36] Central planning, thus, has remained a weak link. Also, the approval (by MEMD) of power sector plans, such as UETCL's Grid Development Plan (2015-2030) and ERA's Least Cost Generation Plan (2016-2025) have met delays.

In consideration of the planning and coordination challenges, the Government of Uganda has planned to restructure the whole power sector. One proposal suggests merging the three public generation, distribution and transmission utilities into one public company under MEM. This would effectively reverse the unbundling of the former state utility UEB and leave the UEDCL concession (UMEME, up for extension or not in 2014) with an uncertain future. Another proposal is to address the Government's aspirations of increasing electricity access, improving distribution efficiency and reducing the electricity tariff, by having one distribution company for the whole country (It is not clear yet whether such company should be public, pate company or a public-private company).

The power export to other countries has not followed the pace of power capacity expansion. There is potential to export to countries with power needs, such as South Sudan, but power export may be affected by the surplus that many countries in the region are having or will soon have and the cost of Uganda's power vis-à-vis the costs of generation in these countries, especially when Ethiopia's new hydropower facilities (including the 6400 MW New Renaissance plant) become operational at a much lower cost than Uganda's hydropower.

The power surplus capacity has grown that big that it threatens the power sector's viability. Nearly all added generation units since the reform of the power sector and those units currently under construction by private sector developers (IPPs) are based on "take-or-pay" or "availed capacity" power purchase agreements. As a result of failure to have adequate demand growth or export to meet supply capacity, the Government is forced to pay for deemed energy and this is partly responsible for driving up the end-user tariffs. Such deemed energy or capacity payments tend to be controversial in Uganda and the approval process can take a long time, hampering the commercial viability of IPP investments (as evidenced by the experience with the Achwa 2 and Buseruka hydropower facilities, see Section 3.3). This may put the Government in the position of either having to provide direct subsidy support UETCL (or allow UETCL to default on payments

[35] Source*: Learning from Power Sector Reform*, World Bank (2019)
[36] AfDB, *Uganda's Power Sector Reform: Long Journey and Mixed Results*

to the IPPs, which would trigger a call on the sovereign guarantees and discourage future private sector investment in power and infrastructure in general.

In Uganda, recovery of generation costs is in through the end-user retail tariff and this has led to high generation prices. It is often mentioned that these are higher than end-user tariffs in the region, but it is not always fair to make comparisons as many tariff regimes are subsidized, while tariffs in the 2010s in Uganda reflected real costs of power generation and supply[37]. The Umeme concession entailed a fixed rate of return of 20 percent on investments, while the Bujagali Hydro-power project required a power purchase tariff of USD 0.11-.14 per kWh. It should be noted that technical losses fell from 38 percent in 2005 to 17 percent in 2016, making Umeme among the better performing utilities in Sub-Saharan Africa[38]. Nonetheless, high tariffs combined with high connection charges and low access rates have resulted in suppressed electricity demand and deemed energy payments and a vicious circle of low growth of electricity demand and insufficient returns for private sector and public sector investments, leading to higher costs and therefore higher tariffs. The need to recover such costs from consumers was one reason for the 320% increase over the period 2001-2016.

To partly remedy the issue of high tariffs, the Government has resorted again to public funding of large generation projects (with Chinese loans), such as the Isemba and Karuma hydropower plants. The payments for the GoU loans come from tax revenues. This is a distortion of the energy market if these costs are not fully reflected in the energy tariffs. The tariffs have reportedly been set at USD 4.8 and 5.2 cents per kWh respectively (less than half the Bujagali tariff). The true costs are unclear and the viability of these projects is also yet to be proven. The two projects are expected to shift Uganda into a position of even more excess supply. Whatever the investments, by the public or private sector, the Government will be obligated to pay a high price for the electricity that it is not able to dispatch in the current situation of power oversupply.

The question remains open in how far investments and operations are paid for by the customer (through higher tariffs) or by the taxpayer (through increased taxes). But hiding the real costs may lead the sector into a vicious circle of underfunding and debt that in the long run may bring the country back to where it started decades ago, that is with a power crisis

2.4.2. Lessons learned on power sector reform and PPP

PPP can offer a win-win situation for both the public and the private sectors in electricity generation basing on this case study. PPP has proved to be a unique opportunity for the two diverse sectors to learn how to work together. For the private sector, sharing risks and securing guarantees are important benefits. For the government, private sector investments supplement the limited resources available for government in technology, finance and management. By combining resources from private sponsors with DFI financing and risk mitigation tools, Bujagali's financial structure enabled the largest mobilization of private resources among comparable hydro projects in the region (see Box 1).

[37] Ibid.
[38] Ibid.

However, the experience with Bujagali illustrates also some governance challenges associated with the IPP model. The first round in the Bujagali project procurement was met with deficiencies in the process surrounding which implied the delays in project implementation at a time when Uganda would be hit by drought conditions and power shortages in the years 2005-2006[39]. Uganda was successful in capturing a substantial amount of private sector investment both in generation (more than USD 1 billion, including Bujgali) and in distribution (USD 565m by Umeme), thus freeing up significant financial resources for other development goals.

The second round on the project procurement illustrates that costs can still be significant even when the procurement process is carefully structured. Private investment may have brought more efficient business models and plant operation. They also will require significant compensation for the associated risks, even when support by DFIs helped to reduce risks. In the case of Bujagali, the tariff of USD 0.11-0.14 per kWh. Considered relatively high by the standards of hydropower projects in the region (although less of what had hitherto been paid for emergency thermal generation), the tariff reflected the need to provide commercial returns to private investors on a large capital-intensive project of this nature. With Uganda aiming at having a cost-reflective power tariff structure, this implied that the power consumers had to shoulder substantial cumulative tariff increases. These experiences have led the government to move back towards a public procurement process[40] for the two large hydro projects at Karuma (600 MW) and Isimba (183 MW). In power generation, this means a marked shift back to government ownership (from 42% in 2016 to 67% in 2020)[41].

Advancing access was not given sufficient attention in the early years of reform. Once the reforms were implemented the expectation that small-scale private rural concessionaires would invest in rural electrification proved to be overoptimistic. Turning this around requires a substantial injection of government and donor resources. Apart from the weak financial viability of extending service, high connection charges have formed a barrier. In the new 2018 Electricity Connections Policy, all low voltage consumers who can be connected (either by one pole or no poles) will be eligible to get an electricity connection without paying the connection fee.

Planning and procurement capabilities are essential to the functioning of the sector, yet too often overlooked in power sector reforms. Lack of coordination among various entities in the sector has proved to be a critical issue. Strengthening planning and procurement capabilities, to ensure that projects can be procured at least-cost, matching supply with project demand, did not feature as a key part of the reform agenda in Uganda.

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[39] A privately owned US based consortium, AES Nile Power (AESNP), was commissioned to construct and operate the 250 MW Bujagali power plant. The direct negotiation and contracting process was woefully non-transparent with controversies on environmental and social impacts and complaints of corruption Consequently, the World Bank suspended support in 2002 and AES withdrew from the project altogether in 2003. A new bidding round was organized in 2004, which was won by the BEL consortium in 2005.

[40] Like Bujagali, also these bidding and award processes used of these two public projects a have taken various turns over the past two decades. The government's plans for Karuma were revised many times before a decision was made in 2009/10 to implement it as a public project. After the government decided to increase Karuma's planned capacity to 600 MWand procure a new feasibility study, support from Western donors waned over concerns about the environmental impact of the project, after which the Chinese EximBank was approached

[41] Source: *Learning from Power Sector Reform*, World Bank (2019)

In Uganda, the power sector reform has mixed results. The Bujagali hydropower plant was funded through private sector investments (being among the first large-scale hydropower projects in Africa to be privately financed) and almost doubled Uganda's installed capacity at the time. Its financing and equity structure with multiple private and public entities was a pioneering public-private partnership example. On the distribution side, the concessionaire, Umeme, implemented substantial improvements in operational efficiency and accelerating service coverage. Although the reform model was eventually able to deliver results, the associated cost was comparatively high. Furthermore, the extension of the private concession model to financially unviable rural areas did not prove to be successful. Hence, the role of the public sector has resurfaced both in large power projects and the expansion of rural networks. Planning and procurement capabilities are essential to the functioning of the sector, yet have been overlooked in power sector reforms. Lack of coordination among various entities in the sector has proved to be a critical issue. Deficiencies

During the 1990s, a new paradigm for power sector reform was put forward that emphasized the restructuring of utilities, the creation of regulators, the participation of the private sector, and the establishment of competitive power markets. A recent World Bank report[42] mentions that, two decades, twenty-five years later, a picture of mixed results has appeared. Only a handful of developing countries have fully implemented the reform agenda. The private sector has financed a substantial expansion of generation capacity. Yet, its contribution to power distribution has been much more limited, struggling with cost recovery issues. Private utilities are often praised for better performance on efficiency but this can be matched by well-governed public utilities.

Over the past years, new objectives, apart from the reform agenda's goals of securing supply and fiscal prudence, have appeared on the power agenda, such as global environmental and universal electricity access goals. Some countries that did retain a dominant (but competent state-owned utility and guided by strong policy objectives) have also achieved admirable results. The reforms seem to have worked best in larger middle-income countries with a relatively large power system at a high level of electrification with good operational and financial data and a well-functioning framework of tariff regulation. These findings in the WB report make a case for greater pluralism of approaches going forward and that reform efforts need to be shaped by both the political and economic context of the host country. Uganda's experience illustrates the complexity of power sector reform and the need for all the different parts of the sector, from generation to distribution, from planning to regulation, to function effectively in tandem.

[42] World Bank (2020). *Rethinking Power Sector Reform in the Developing World*

3. RECOMMENDATIONS

The Third National Development Plan lists several interventions to address Uganda's development priorities and challenges in the power sector. This section presents a number of recommended policy actions for the Government.

a) Evacuation of surplus capacity and demand stimulation

While energy access has improved very much, compared to a decade ago, at 28% it is still relatively low, while differences in rural and urban electrification are large. Constraints in transmission and distribution limit the use of existing supply, suppressing energy demand and increasing the cost of electricity service. The country is constrained by limited electricity transmission and distribution infrastructure coverage with relatively high losses in the distribution network. Demand can be increased by keeping tariffs affordable, expand access to electricity (in rural areas) by stimulating industrial-commercial electricity demand. Export and demand stimulation will help address the challenge of the current excess capacity posing a significant risk of future stranded assets (that could limit the public sector's ability to invest in electricity access and transmission infrastructure expansions).

Transmission and distribution network expansion is needed to more efficiently deliver the generated power and increase the national access to electricity. This expansion will require significant new investments in the transmission system, expansion of distribution networks in towns and for industrial parks to create and meet new demand, and speeding up rural electrification to increase access, while further reducing the technical losses in the distribution network. Uganda's central position in the Eastern African region offers cross-border opportunities for power export that may help to reduce the surplus power capacity. All these efforts will need both public and private sector investments that need the continuing support of development finance institutions (such as AfDB) to maintain sustainability until demand and supply are in equilibrium and the institutional-planning framework has been shaped up to meet current and future challenges in the power sector.

b) Expansion of off-grid (mini-grid) power systems

The Government of Uganda has set targets to connect two million new customers by 2025 and to achieve universal access (over five million new connections) by 2030. Achieving five million new connections in five years will require doubling or tripling the current electrification pace. As the majority of the unconnected are in peri-urban or rural areas, the cost to meet targets will become monumental in view of the dispersed rural settlement patterns of the newly connected that often use little power and are served at the lowest tariff (a 'life-line' rate).

Table 4 Energy intervention proposed in NDP III

Objective 1: Increase access and utilization of electricity
1. Rehabilitate the existing transmission network;
2. Expand the transmission network to key growth economic zones
3. Construct transmission lines to the DRC Congo, Northern Tanzania and Southern Sudan
4. Expand and rehabilitate the distribution network (grid expansion and densification, last mile connections, evacuation of small generation plants, quality of supply projects)
5. Develop renewable off-grid energy solutions (Construct 10,000 km of medium voltage networks and 15,000 km of low voltage network).
6. Establish mechanisms to reduce the end-user tariffs.
7. Develop ICT solution to enable efficient and effective cascade management of the dams along the Nile
8. Develop and enforce standards on quality of service in the energy industry
9. Review the existing Acts (Electricity Act, 1999 and Atomic Energy Act, 2008) and develop legislation for geothermal and energy efficiency to provide for emerging issues.
Objective 2: Increase electricity generation capacity
1. Develop medium and small power plants (Muzizi HPP, Nyagak, biogas cogeneration).
2. Undertake preliminary development of large generation plants (construction for Ayago 840 MW, feasibility for Kiba 330 MW and Oriang 392 MW)
3. Finalise approvals for construction of a nuclear power generation plant
Objective 3: Increase adoption and use of clean energy
1. Construct 200 off-grid min-grids based on renewable energies
2. Promote use of new renewable energy solutions (solar water heating, solar drying, solar cookers, wind water pumping solutions, solar water pumping solutions)
3. Adopt the use of electric transport solutions e.g. solar powered motor cycles, bicycles and tricycles
4. Develop a framework for net metering
5. Build local technical capacity in renewable energy solutions
Objective 4: Promote utilization of energy efficient practices and technologies
1. Promote uptake of alternative and efficient cooking technologies (electric cooking, domestic and institutional biogas and LPG)
2. Promote the use of energy efficient equipment for both industrial and residential consumers,
3. Introduce Minimum Performance Standards for selected electrical appliances.

Source: *Third National Development Plan*

The access strategy needs to shift, where feasible, from grid extension to off-grid (mini-grids, solar home system) solutions. Mini-grids can be a cost-effective alternative to grid electricity in remote villages that are far from transmission lines, especially when the economics of such mini-grid can be boosted if connected with an anchor load (such as a communication tower or an agro-processing plant). This strategy shift could be the basis for implementing a program to promote mini-grids and stand-alone energy systems in remote areas, based on solar PV and mini-hydropower.

c) Institutional strengthening and capacity building

in the NDP-III, the Government recognizes the need for fine-tuning the power sector institutional framework and associated policies and regulations. This includes a comprehensive update of the existing 1999 Electricity Act and also the 2012 Energy Policy and a review and revision of the role of government agencies and institutions in power generation, distribution and transmission, and rural electrification.

Too often, new generation projects have been licensed by the regulator without provision for evacuation of the generated power, leaving the sector with heavy bills for deemed energy from the IPPs. There is a need for a regularly updated and coordinated master plan for the entire electricity sector supply chain to optimize the overall expansion of the system to ensure that the new investments meet the sector's growing needs and optimum operation of the T&D networks.

To be able to implement the above-mentioned power sector strategy elements, there is a need for extensive capacity building and training for key governmental institutions in the sector as well as support of better energy sector master planning, power sector forecasting, least-cost expansion planning for both generation and transmission, and updated market design and technical skills enhancement in operation and maintenance of the T&D capacity. The NDP-III provides a list of skills needs for about 3,300 specialists in energy systems, electricity and electric engineering, environmental sciences, thermal energy, renewable energy, clean technologies, IT and computer sciences, and other fields.

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