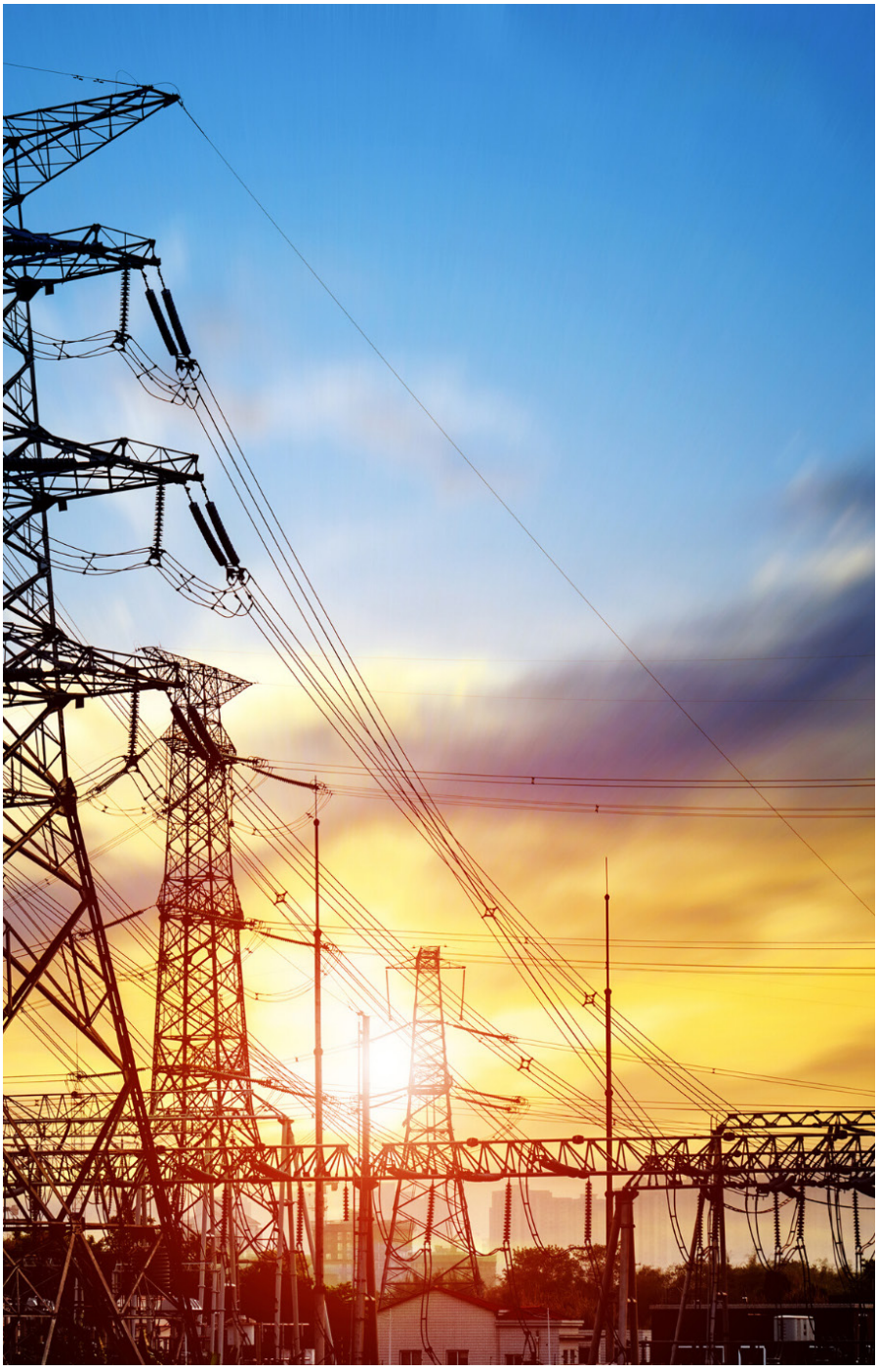
July 2020

ELECTRICITY SECTOR: LEBANON NEEDS AN IMMEDIATE ACTION PLAN AND A NEW APPROACH



ELECTRICITY SECTOR:
LEBANON NEEDS AN IMMEDIATE ACTION PLAN AND A NEW APPROACH

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Lebanon's Electricity Sector Needs an Immediate Action Plan and a New Approach Based on Transparent and Efficient Governance Towards a Greener Model

The 100 days' grace-period that the government asked for has long passed and yet, we have not realized any change or diversion in the policy-making and governance pathways of the energy sector to regain part of the Lebanese people's trust or any concrete proposal that tackles their daily concerns in this regard. Lebanon's power sector has long been at the center of the country's economic and fiscal challenges as it adds to the high fiscal and trade deficits, requiring significant government subsidies due to inefficient high costs due to:

- High generation costs (primarily due to continuing reliance on temporary generation solutions, such as the power barges, and consuming expensive heavy fuel oil and diesel oil instead of gas for the existing power plants);

- The sector's operational inefficiency (primarily due to high network technical losses, non-technical losses and billing/ collection challenges);

- Lack of proper governance and the cost of corruption.

The electricity sector is both a main symptom of our dysfunctional power system and a key contributor to the economic, fiscal and financial crisis. Substantial reliance on fuel oil, high network losses, and financial constraints result in high government subsidies. Its annual financial losses were estimated at $150 million in 1996[1]; back then, around-the-clock electricity supply was provided until late 1990s[2] where the government decided, prior to Paris I, to restrict capital investments due to lack of fiscal space. In 2018, annual losses reached $1.8 billion. Lebanon is facing inadequate electricity generation capacity, rolling blackouts, and reliance on expensive and polluting private diesel generation.

The needs of Lebanon's electricity sector have been extensively studied, but the political will remains the key missing ingredient in implementing the most suitable solutions. The electricity sector is in dire need of reform. A new approach to the management of the sector has become a necessity to regain the trust of the Lebanese – households and businesses – who have been deprived for more than 25 years of an affordable basic public service and suffered severe damages to their health and the environment. But, even more pressingly, the shortage of dollars in Lebanon now is such that fuel supply is in jeopardy, hence generation of electricity itself, whether by EDL or private generators.

Lebanon needs an immediate action plan to manage the electricity sector in the coming months and a new strategic vision for the next 20 years that opens the door for a new energy model to spur growth and fiscal stability. Today, Lebanon has an opportunity to immediately leapfrog into the green energy revolution by leveraging its current natural renewable resources (sun, wind and water) in order to generate sustainable electrical power.

The transition for a new energy model for Lebanon will lead to a reduction in thermal generation, a substantial ramp up in renewables and distributed energy with increased demand side management and network interconnection EDL must therefore provide a more reliable, secure, smarter, competitive and flexible transmission and distribution system required to meet the challenges of the energy transition.

[1] World Bank Report No. 15478-LE, November 1996 http://documents.worldbank.org/curated/en/938971468772462743/text/multi-page.txt

[2] And financial equilibrium in EDL budget was reached, according to an interview with Ex-Minister of Finance (1998-2000) George Corm.

EDL will need to develop smart grids, digital technologies and innovative systems not only to solve network constraint issues and the injection of variable power but also to integrate Distributed Energy Resources ('DERs') such as distributed generation, storage, smart charging electrical vehicles and demand response. Doing so will unlock new and efficient ways to manage the grid and increase the integration and flexibility of power systems at a lower cost.

EDL must also become more independent, to improve governance and investment decision-making and promote new markets. New Electricity Regulation must facilitate the integration of Distributed Energy Resources, optimize local generation and consumption to boost grid flexibility and reduce network investment needs. It must also promote increased competition in generation and in the management of the network.

This new strategic vision needs a decision-making process based on public consultations, clear communication, transparent actions, and an efficient regulatory framework. The latter is the precondition any investments and to reactivate the flow of capital (be it equity or debt) that is needed to rebuild the sector.

This report gives a brief round-up on our approach to Lebanon's electricity sector: 1) On the immediate term: assessment of the post-crisis new starting point for the sector and optimization of foreign exchange allocation to this vital service 2) Our recommendations on the sector's main pillars: Rule of Law & Governance, Generation, Transmission, Distribution.

We strongly believe that there is no place for half-ways or half-solutions anymore. The Government's handling of the electricity file is further evidence that the current political establishment is neither capable of enacting real reforms nor willing of managing important files to overcome the major economic crisis that Lebanon is facing. A rapid political transition is therefore urgently needed, starting with the formation of an independent government capable of carrying out the necessary reforms for all vital sectors, chief among them the electricity sector.

I. THE FINANCIAL CRISIS AND SEVERE SHORTAGE IN US DOLLAR SUPPLY ARE A GAME CHANGER ON ALL FRONTS

Current Situation

• Lebanon's economy is now in a situation of sudden stop. A sudden stop in *capital flows* is defined as a sudden slowdown in private capital inflows into the economy. Sudden stops are usually followed by a sharp decrease in *output, private spending* and credit to the private sector, and *real exchange rate* depreciation. This is exactly what we've been witnessing for the past few months, as Lebanon is facing a deep accumulation of interrelated political, social, economic, financial, sovereign default and environmental crises, mutually feeding at each other's at different level creating a perfect storm. The import /export imbalance is creating current account deficits of around 25% of GDP. Lebanon macroeconomic fundamentals are the worst among previous crises-stricken countries. It is the third most indebted country in the world, after Japan and Greece, with a Debt-to- GDP ratio in 2018 of 150% and currently at 156% according to the International Monetary Fund and a gross public debt of US$ 87 billion.

• The combined crisis has short and long-term effects on its energy sector. The drop in dollar liquidity will lead to a drop in imports as private suppliers access to dollars has decreased drastically and as the Central bank's FX reserves will no longer be enough to guarantee the same level of fuel imports for EDL.

• The reduction of fuel imports will lead to rationing electricity at the national level. Even private generators will not be able to fill the EDL gap anymore.

• As for investments in the electricity sector, the crisis means that securing internal financing is and will remain out of reach in the short term. Meanwhile, external financing will be hard to secure for IPPs since investors will be reluctant to invest in such a high-risk environment. The only options left for Lebanon are bilateral or multilateral credit lines for public investment in its infrastructure. But unless authorities implement a credible macro-fiscal-monetary plan, public debt and bank restructuring, no external financing will be available for these projects.

Recommendations

• Assess the new starting point of the sector post-crisis, especially from a fiscal and a balance of payment perspective, also taking into account the fluctuation in oil prices.

• Define the volume of FX that are still available at the macro-economic level and those allocated to fuel supplies in specific in line with a macro-financial rescue plan and capital controls law.

• Limit the subsidy to imports through maintaining the currency peg to identified licensed importers based on a new transparent framework for fuel procurement contracts (private and public).

• Measures to fight smuggling should also be enhanced.

• Revise tariffs structure and level with the dual objective of reducing the fiscal burden of subsidies without aggravating the dire situation of the most vulnerable groups.

• Allocate the combustible to the most efficient means of production (highest production of kWh per energy unit/power plant) and seize the opportunity to promote green sustainable solutions and phase out private diesel generators.

• Encourage the substitution of private diesel generators by renewable energy production when possible as soon as funding is available.

II. LEBANON NEEDS AN AMBITIOUS ENERGY TRANSITION

1- ELECTRICITY SECTOR LEGAL FRAMEWORK

Current Situation

• The electricity sector is governed by Law 462/2002 "Organization of the electricity sector". It is an umbrella law that seeks to:

› Establish an independent Electricity Regulatory Authority (ERA) to provide technical oversight, grant licensing and put in place the general plan for the sector especially in generation, distribution and transmission fields;

› Restructure the utility;

› Unbundle the electricity sector through private sector participation in distribution and generation;

› Under the law, transmission services shall remain owned by the transmission company (pubic utility).

• Amendments to this law were recently submitted to the Council of Ministers (CoM) which transferred them to a ministerial committee; they aim at limiting the role and mandate of the ERA and keep it under the authority of the Minister.

• In 2011, Law 181 was ratified by the Parliament following the approval of the 2010 Policy Paper and has been considered as the necessary legal pathway to implement the plan and secure its financial needs specifically to build power plants that generates 700 MW and transmit and distribute the generated power. In addition, this law stipulated upon appointing EDL board members within a period of four months from law ratification and amending law 462/2002 if deemed necessary within a maximum period of three months and appointed ERA board members. None of the prerequisites of law 181/2011 were implemented except for consultancy services and addition of engines to the power plants in Zouk and Jieh.

• Law 288/2014 amends article 7 of law 462/2002 and gives authority to the CoM which is allowed to issue permits and licences to private sector based on the proposal of the Minister of Energy and Water and the Minister of Finance to generate electricity for a duration of two years (from April 2014 to April 2016) and until the members of the ERA have been appointed.

• The MoEW did not grant any permits under law 288. Law 54/2015 therefore extended Law 288 till 2018. Under this law, no licenses were issued except for a renewable energy project, the first wind project in Lebanon where three private companies were granted licenses.

In 2019, Law 129 has again allowed to extend law 288 until 2021, moreover, it sets additional requirements for the construction of projects that use the build-operate-transfer model under conditions to be specified and inserting all its administrative, technical and financial details in a special tender book set by the Ministry of Energy and Water. Conducting tenders through the application of public accounting law and other related laws.

• The CoM permitted in March 2020 the Minister of Energy and water to conduct bilateral negotiations with international private companies. This act breaches all legislations specifically law 48/2017 (PPP law) and law 129/2019.

• On July 7, 2020, the CoM appointed six out of seven members of EDL's Board of Directors. At a time when the government should be focused on restoring confidence and credibility to the sector, this long-awaited appointment of EDL's board members proved a missed opportunity to do so. The process lacked transparency and clarity and abided by the principle of sectarian quotas in contradiction to the Constitution. In addition, the general director who is in place since 2002 and plays a main role regarding EDL activities has not been replaced.

Recommendations

• Immediately proceed with the full application of Law 462/2002 without any amendments

• Proceed with the transparent appointment of the independent Electricity Regulatory Authority based on merit and qualifications and a transparent mechanism, contrary to what happened with EDL board members nominations.

• When law 462/2002 is implemented, conduct a mandatory audit over EDL as per this law.

• Freeze, review and undertake forensic audits of all electricity contracts including those that did not reach financial closure -Audits should cover contracts in the procurement of fuels, solar and wind projects, IPPs/BOTs proposed projects such as the Deir Amar Power Plants, FSRUs ongoing tenders as well as all EDL operations and maintenance contracts.

• Stop immediately any negotiations that do not abide by international public procurement standard procedure.

• Prepare secondary legislations under 462/2002 as required per law.

• Prepare legislations that address the renewable energy sector, energy efficiency and energy conservation.

• Respect for transparent procurements through solid frameworks.

• Suspend immediately bilateral gre-a-gre negotiations that the MoEW is conducting with manufacturers .

2- GENERATION

The World Bank has recently mandated EDF to conduct a Least-Cost Generation Plan (LCGP) for Lebanon. This is the first of its kind in 30 years as it evaluates how Lebanon can optimize its energy production, minimize costs and reduce pollution from fossil fuels, based on technical, economic and environmental grounds. The study recommended to significantly increase investments in green energy projects, and to rapidly ramp up green energy generation to 37% of our energy production by 2025 (close to 4400 MW of solar, wind and hydro projects), and to 40% by 2030[3],in parallel to switching existing plants (Deir Aamar & Zahrani) to natural gas and building new units there. Furthermore, the World Bank 's February 2020 Power Sector Emergency Action Plan now recommends that over 4,700 MW of additional RE capacity is needed in the next 10 years to meet the Government's 2030 target to reach 30% of RE generation in line with the IRENA Renewable Energy Outlook.

Current Situation

• Lebanon's demand for electricity peaks at 3,600 MW (24,000 GWH / Year), while the maximum power supply is around 2,200 MW (15,000 GWH / Year)[4]. The energy deficit is around 1,600 MW and a maximum average supply of around 15 over 24 hours.

• Electricity generation in Lebanon relies on imported petroleum products (around 97% of its consumption), and consumes around 50 percent of Lebanon's imports of fossil fuels. The latter is estimated at around 6 billion USD in 2018, around 1.7 billion of which were used by EDL[5], while the rest were distributed for the local market through companies affiliated to the political regime.

• This deficit between supply and demand is due to several factors:

› The lack of investments in new power plants since 1997 which was exacerbated by the freezing of the tariff since 1994 at a level (9.3 cents/kWh) below the average cost of production (20 cents/kWh);

› The cost of operation of old power plants along the coastline burdened by low efficiencies and high operating costs;

› The operation of the Deir Amar and Zahrani plants on diesel instead of gas (which is much cheaper, more efficient, and less polluting);

› High technical losses (around 16%, caused by the old transmission lines)[6];

› Non-technical losses (around 21%, caused by power theft and illegal connections)[7].

• EDL relies on eight old power plants (table 1 addendum) to secure the generated power. Two plants were rehabilitated in 2014 (Zouk-2 and Jieh-2) and are able to shift to Natural Gas when available along with Zahrani I and Der Amar I existing plants, while all of the other work on polluting Heavy Fuel Oil (HFO) and Diesel Oil (DO). In addition, old hydro power plants are operating substantially below their capacity. To reduce the deficit, , two Turkish power barges were also introduced since 2013 as a "temporary solution " (385 MW) to supply the needed deficit until new power plants are built. Yet, those barges are still operating today.

[3] World Bank – EDL – MEW LEAST COST GENERATION PLAN – April 2020

[4] MoEW presentation during CEDRE conference meeting (18-05-2020)

[5] Directorate General of Oil 2018 Data

[6] Updated Policy Paper for the Electricity Sector Ministry of Energy and Water March 2019 https://www.energyandwater.gov.lb/mediafiles/articles/doc-100515-2019_05_21_04_27_25.pdf

[7] Updated Policy Paper for the Electricity Sector Ministry of Energy and Water March 2019 https://www.energyandwater.gov.lb/mediafiles/articles/doc-100515-2019_05_21_04_27_25.pdf

• This leaves the country in front of major environmental and health challenges that threaten the livelihood of all citizens. A recent June 2020 report by Greenpeace[8] ranks Lebanon as having the highest death rate per capita in the MENA region due to fossil fuel energy production.

• Our current RE is around 3.5%[9] of total production provided mainly by hydropower.

Government Proposition

To resolve this challenging and costly situation, the operation of old power plants on expensive HFO and DO, and the incapacity to finance EDL on a regular basis with around1.5 - 2 billion USD/year, the MoEW has approved an Electricity Paper for the Electricity Sector in 2010[10], and updated it subsequently in 2019.

The proposed plan integrates multiple solutions to be implemented in parallel:

• Decrease technical and non-technical losses from 34% in 2019 to 11% in 2026;

• Increase generation capacity, improve efficiency and reduce fuel cost by using Natural Gas. This increase in generation is based, on the long-term, on building 6 new power plants of around 3,100 MW capacity, along with around 1GW of Renewable Energy (mainly solar and wind) between 2019 and 2026, while providing around 1,050 MW of temporary solutions in the short-term to reach 20 hours a day of electricity supply in the majority of the regions.

• Increase the tariff in parallel to increasing the generation through the temporary solutions mentioned in point 2 above.

• Supply gas to existing and/or new power plants through 3-Floating Storage and Regasification Units (FSRUs) in Deir Amar, Selaata and Zahrani.

• Target 30% of energy production from renewable sources starting with:

› Tendering 180MW of distributed solar farms (15MW each), in addition to a tender for 300MW solar + storage.

› Signing 226MW Hawa Akkar project operational by 2022 which has been contracted at prices way above market prices for wind[11].

› Launching new Expressions of Interest for 400MW wind farms.

[8] https://www.greenpeace.org/mena/en/appr/

[9] 2017 Solar PV Status Report for Lebanon - UNDP

[10] Electricity Paper for the Electricity Sector in 2010 http://www.databank.com.lb/docs/Policy%20paper%20for%20the%20electricity%20sector%202010.pdf

[11] Latest Wind Bids Prices in Africa and the Middle East ranged between 0.03 and 0.065 c/kWh according to a study conducted by IFI-AUB

Recommendations

• Adopt the general guidelines of the World Bank's Least Cost Generation study prepared by EDF[12], and update the 2019 plan & overall energy mix according to its recommendations.

• Adopt the recommendations of the IRENA June 2020 Renewable Energy Outlook for Lebanon.

• Consequent to the default, review & conduct forensic[13] audit of all contracts signed as well as on-going tenders struggling for financing and those priced above viable market prices (approved Akkar wind farms but not yet reached financial closures) Suspend immediately any gre-a –gre negotiation which breach several laws and the constitution, since it is not a negotiation from state to state as per article 52 and no competitive process which will question the selection criteria.

• Proceed with tendering the two new power plants (Deir Amar, Zahrani) as opposed to gre-a-gre negotiations.

• Stop the development of any new sites on the coast such as in Selaata.

• Re-tender based on selected consortium for 2 FSRU units only in order to switch to natural gas [2020-2021]; and/or look into wheeling power or gas from Egypt and Jordan that currently have significant surpluses. An agreement with Syria would be a prerequisite on the latter issue.

• After implementation of law 462/2002, enable and license state owned land as per LFRE, IFI, and CNRS study for solar & wind farms tenders and auctions according to international benchmarks and best practices[14]].

• Commission an international study to evaluate Lebanon's Pumped Hydro Storage potential and sites.

• All projects will need World Bank Guarantee due to the financial crisis.

• Re-Allocate the CIP funds secured for the Energy sector to fit within this new vision and develop other options such as scaling solar with support from different IFIs[15].

[12] World Bank – EDL – MEW LEAST COST GENERATION PLAN – April 2020

[13] Forensic audit over EDL may take place through a request submitted to CoM – and CoM may abide by this request or not- and then a decision should be awarded in this regard. In addition, a procurement tender shall take place to appoint a forensic auditor.

[14] Latest Solar PV Bids in countries like Jordan, Egypt, KSA, UAE, Tunisia and others have reached prices less than 3 cents/kWh, with the lowest being registered in UAE as the new world record low at 1.6 cents/kWh (according to a study conducted by IFI-AUB).

[15] The electricity sector alone collects $2.2B in investments within the CIP proposed in the CEDRE

3- TRANSMISSION

• EDL's transmission network[16] includes:

› the older 66-kV grid, with country-wide coverage;

› some 150-kV transmission lines in the central coastal area around Beirut ;

› the newer 220-kV network that stretches from north to south in the coastal areas and loops through the northern Bekaa valley toward Beirut area.

• It's been almost 20 years since the last transmission upgrade, and the country has been suffering from several bottlenecks in the grid infrastructure, in addition to technical and non-technical losses.

Government Plan

• EDL's long-term technical strategy is to transition away from the 150-kV voltage network and base the transmission system on 66-kV and 220-kV equipment as standard sub-transmission / transmission voltages. This will require both rehabilitating and strengthening the 66-kV grid, and significantly expanding the 220-kV network to become the country's transmission backbone to meet increasing demand and support the corresponding increasing power generation needs and its shifting technology mix, and the need for stronger regional integration[17].

• Transmission grid reinforcements are needed across the country to accommodate the planned additional generation capacity, and to ensure reliable supply to demand enters. These investments are outlined in the 2019 update to the 2010 Sector Policy, which lists about 40 transmission projects for a total investment of approximately US$470 million. The list is based on transmission studies conducted by Electricité de France (EDF) in 2013 and 2017 and endorsed by the CoM in 2017[18] but still need to be reviewed in light of targeting the integration of the recently announced 30% ratio of renewables.

• The grid reinforcement needed for the accommodation of the planned additional generation entailed the closing of the Mansourieh loop, the completion of the Bikfaya-Faytroun-Halate line in the Jouret Badran area, the Bared-Halba line, the Kobayat-Hermel line and the Sour-Wadi Jilo line. In addition, completion of the Beirut northern loop and the first part of the Beirut southern loop along with other projects are foreseen.

What Has Been Done

• To our knowledge, beside the Mansourieh loop very few projects have only been completed from the government plan.

[16] According to the World Bank Group Lebanon Power Sector Emergency Action Plan – White Paper 2020

[17] According to the World Bank Group Lebanon Power Sector Emergency Action Plan – White Paper 2020

[18] "Republique du Liban, Electricity du Liban (EDL): Etude du Schéma Directeur Transport du Secteur Electrique au Liban, Plan d'Investissement", EdF, Août 2013, Version Finale.
"Republique du Liban, Electricity du Liban (EDL): Update of the Transmission Master Plan", EdF, Final Report, May 2017.

Recommendations

• Immediately proceed with grid rehabilitation into a smart grid allowing integration of 33-40% for RE throughout the country and taking into account storage capacities, through benefiting from the several donors' funds for the transmission sector.

• Proceed with rehabilitations to the transmission network as per the EDF May 2017 Master Plan and the upcoming 2020 updates based on the Least Cost Generation Plan with the exception to upgrades related to any new costal sites such as Selaata.

• Engage discussions with major donors to finance the rehabilitation of the transmission and distribution grids.

4- DISTRIBUTION

Current Situation

• In April 2012, MoEW launched the Distribution Services Providers (DSPs) projects with the aim to reduce the technical/non-technical losses as well as modernizing the grid and metering scheme through moving to smart metering and reliability of data. This project has been one of the few partial public private partnership in Lebanon with a clear objective of fixing and upgrading the distribution network through investments for the implementation of a smart grid, and the improvement of both collection and customer service and the installation of net meters to decrease technical losses.

• Three companies were selected in the 2012 tenders which are: BUS (Nizar Younes, Butec), KVA (joint venture between Arabian Construction Company ACC and Khatib & Alami), and NEUC (Debbas) and were later joined by MRAD for the southern area selected without any tender or competitive process. KVA has a staff of 700 full time employees, BUS 850, and NUE 1,200. The contracts ended in August 2016 and were extended again in 2018 in order to implement their initial plans and targets, and install around 1.1 million smart meters all over the country, and those companies are still in charge of collecting the bills on behalf of EDL, but EDL is still in charge of issuing them and is liable to any risks arising from the collection activity.

• The installation of smart meters at the levels of M1 (generation plant bus bar), M2 (high voltage (HV)/medium voltage (MV) substation), M3 (MV feeders), and private M4 (MV/low voltage (LV) transformers) have already been completed by the DSPs, each in its region[19].

• Several questions are to be raised about the legality and efficiency of these contracts: continuous renewals for the same companies without proving any efficiency and added value of this project, collection revenues were not improved, and few smart meters were installed. It is also not clear how Murad company was awarded a contract without any procurement.

[19] According to the World Bank Group Lebanon Power Sector Emergency Action Plan – White Paper 2020

Pending Issues

• DSP contracts currently expire on December 31, 2021, without as yet a clear frame for re-contracting.

• Since October 2019, collections were stalled & illegal connection to the grid surged which will be pushing non-technical assumed losses upwards.

• Collection from public institutions need to be rescheduled.

Recommendations

• Address the issue of legal framework for contracts with DSP as Law 462/2002 provisions for private sector involvement around EDL's distribution operation (now undertaken by the DSPs), and consequently, allow the DSPs to have more implementation power through the unbundling process, and be fully responsible for the grid and collection process independently of EDL.

• Audit & review current contracts of DSPs.

• Deploy the AMI system (Advanced metering infrastructure) by installing, commissioning and operating remaining components, including smart meters at the public M4 and all M5 public sector customers, and eventually covering the majority of customers by the AMI Program completion level customers, data concentrator units (DCUs), starting from high consumption customers, including public sector customers.

• Conduct transparent and public tenders that avoid political affiliations.

• Develop smart grids, digital technologies and innovative systems to solve network constraint issues, manage the injection of variable power and integrate both Distributed Energy Sources ('DERs') and Electric Service Companies.

• Transition EDL into a Virtual Power Plant ('VPP') model to manage the new energy system.

• Develop new business models that encourage the delivery of cheaper, cleaner and reliable energy supply, promote competition and innovation and empower customers.

ADDENDUM[20]

ELECTRICITY SECTOR: LEBANON NEEDS AN IMMEDIATE ACTION PLAN AND A NEW APPROACH

[20] Updated Policy Paper for the Electricity Sector Ministry of Energy and Water March 2019

Table 1: Generation Capacity and Costs of Existing Power Plants

Name of the Facility	Fuel Type	Installed Capacity	Effective Capacity 2018	Total Cost (c$) with average Barrel cost
		(MW)	(MW)	$71
Existing EDL				2018
Zouk 1 Thermal Power Plant	HFO	607	440	14.75
Jieh 1 Thermal Power Plan	HFO	343	180	19.39
Zouk 2 ICE Power Plant	HFO/NG-Z	198	157	10.83
Jieh 2 ICE Power Plant	HFO/NG-J	78	63	11.19
Zahrani I CCPP	DO/NG-ZAH	469	420	13.62
Deir Ammar I CCPP	DO/NG-DA	464	430	14.96
Baalbeck Open Cycle GT	DO	64	57	20.26
Tyr Open Cycle GT	DO	72	56	21.44
Richmaya-Safa Hydro	-	13	3	3.66
Naameh (Landfill Gas)	-	7	7	1.00
Existing Barges				
Power Barge Zouk	HFO/NG-Z	187	195	13.95
Power Barge Jiyeh	HFO/NG-J	187	195	14.03
Existing IPP's				
Litani Hydro	-	199	47	3.97
Nahr Ibrahim Hydro	-	32	17	2.65
Bared Hydro	-	17	6	2.65
Kadisha Hydro	-	21	15	2.65
Hrayche Thermal Power Plant	HFO	35	46	20.13
Power Wheeling				
Imports from Syria	Syria	276	69	15.35

Table 2: Proposed Time Plan to Reduce Technical and non-Technical Losses

	2018	2019	2020	2021	2022	2023	2024	2025
Technical losses on the transmission network	4%	3.5%	3.5%	3.5%	3%	3%	3%	3%
Technical losses on the distribution network	13%	9.8%	7.2%	6%	5%	5%	5%	5%
Non-Technical losses on the distribution network	21%	14%	7%	3%	3%	3%	3%	3%
Total losses	34%	25%	17%	12%	11%	11%	11%	11%