

Sector: Power
Sub-Sector / Technically Autonomous Unit (Network, basin, ..): National

Component	Present Situation Sp	Target Situation St	Projects AS	Technical Constraints		Characteristics							Impact	Uncertainty (High, Medium, Low)	Priority
				Description	Min. delay to start (Year)	Min. constr. period (Year)	Investment (in Million US\$)	Land value / expro (a')	Yearly maintenance cost (b) %	Major rehab/replac. cost (c) %	Span for rehab/reple (d)	Yearly operation cost (e) %			
Physical Stock															
A. Generation															
A1. Combustibles															
	Three steam plants running on heavy fuel Zouk, efficiency at 35%	One steam plant running on heavy fuel None (Zouk is expected to be decommissioned)													
	Jieh, efficiency at under 30%	Jieh will run on natural gas as a combined cycle or steam plant	Construct gas infrastructure from Selaata southwards up to Zaharani with branch to Jieh	This project should precede construction of new Jieh power plant, but it may follow construction of new LNG plant at Selaata	5	3	\$198	\$0.00	2.00%	20.00%	30.00	0.50%	30%	Medium	3
			Construct gas infrastructure from Zaharani northwards up to Jieh	This project should precede construction of new Jieh power plant, and it should be executed only if the arrival of gas through the floating terminal or westwards from Damascus at Zaharani is imminent, and it won't be necessary if the project above is executed	5	2	\$36	\$0.00	3.00%	20.00%	30.00	0.50%	20%	High	3
	Two combined cycle plants running on diesel Deir Ammar, efficiency at 50%	Two combined cycle plants running on natural gas Deir Ammar will run on natural gas	Arab gas line will have reached Homs in Syria by late 2007 (externally funded project)												
			Construction of new LNG terminal at location of new power plant, Selaata one likely location	This project is related to the timely arrival of natural gas at Deir Ammar (and onward to Selaata), and it should cater for all plants with natural gas, and its construction dictates the presence of the North-South gas infrastructure	4	2	\$300	\$0.00	5.00%	40.00%	30.00	20.00%	30%	High	2
			Construction of gas infrastructure between Deir Ammar and Selaata	This project should precede construction of LNG terminal and power plant at Selaata, but it is justified even if LNG were not constructed, as it may be able to transmit gas in the southward direction through the Arab Line source	1	2	\$24	\$0.00	2.00%	20.00%	30.00	0.50%	20%	Low	1
	Zahrani, efficiency at 50%	Zahrani will run on natural gas	Coastal Line project mentioned above	See above											
			Completion of gas infrastructure from the Syrian border westwards up to Zahrani	This project is dependent upon implementation of the gas infrastructure project in the Syrian territory and political developments, and it won't be necessary if the North-South gas infrastructure alternative is adopted	5	3	\$120	\$0.00	3.00%	20.00%	30.00	2.00%	25%	High	3
			Obtain floating LNG tanker for Zahrani	This project may also benefit from the presence of the North-South gas infrastructure and cater for all coastal power plants	1	1	\$70	\$0.00	5.00%	0.00%	---	10.00%	25%	Low	1
	Open cycle plants running on diesel as base plants Baalbeck, 70/30 MW, efficiency at 30% Tyre, 70/30 MW, efficiency at 30%	Open cycle plants running on diesel as peak plants Baalbeck will run on diesel but as a peak plant Tyre will run on diesel but as a peak plant													
	Installed/Actual generation capacity is 2,334/1,685 MW	Installed generation capacity should become 2,900 MW													
A2. Electrical Characteristics															
	Steam plants: 1,013/765 MW Zouk, 607/475 MW	Steam plants: 75 MW Zouk is out of service and a new plant is constructed elsewhere	Construction of new 1,000 MW CC plant	None											
	3*145 MW +1*172 MW turbines, whose retirement date is on 2015 or before			Commission first phase before 2010	1	3	\$250	\$0.00	3.00%	40.00%	30.00	45.00%	20%	Low	1
				Commission second phase before 2015	4	2	\$170		3.00%	40.00%	30.00	45.00%	20%	Low	2
				Commission third phase before 2020	10	2	\$130		3.00%	40.00%	30.00	45.00%	20%	Low	3
	Jieh, 331/240 MW	New 435 MW power plant at Jieh	Construction of new 435 MW combined cycle plant at Jieh after 2010	Unavailability of natural gas at Zaharani or infeasibility of coastal line may result in maintaining Jieh as a steam plant											
	2*62 MW turbines, which have reached the end of their life	Around 40% of Jieh's output is expected to be lost in 2006	Perform basic rehabilitation measures on the 2*62 MW turbines to extend their life to the best extent possible	None	0	1	\$15	\$0.00	1.00%	---	10.00	60.00%	50%	Low	1
	3*69 MW turbine, whose retirement date is expected on 2010	100% of Jieh's output is expected to be lost in 2010	Install the new plant equipment and commission the new plant	None	4	2	\$200	\$0.00	3.00%	40.00%	30.00	45.00%	30%	Low	2
	Hreiche, 75/50 MW 1*75 MW turbine, whose retirement date is expected on 2015	New steam plant at Hreiche with 75 MW capacity	Construction of new 75 MW steam plant prior to 2015	None	7	2	\$53	\$0.00	3.00%	40.00%	40.00	60.00%	20%	Low	3
	Combined cycle plants: 870/820 MW	Combined cycle plants: 3,175 MW (incl Jieh)	Expansion of Deir Ammar and Zahrani												
	Deir Ammar, 435/410 MW	Expanded Deir Ammar with 870 MW capacity	Addition of two gas and one steam turbine at Deir Ammar	None	2	2	\$139	\$0.00	2.00%	40.00%	30.00	45.00%	15%	Low	2
	2*145 MW gas turbines + 1*145 MW steam turbine		Addition of step-up transformers and associated electrical systems	None	2	2	\$35	\$0.00	0.50%	100.00%	40.00	5.00%	15%	Low	2
	Zahrani, 435/410 MW	Expanded Zahrani with 870 MW capacity	Addition of two gas and one steam turbine at Zahrani	None	5	2	\$139	\$0.00	2.00%	40.00%	30.00	45.00%	15%	Low	2
	2*145 MW gas turbines + 1*145 MW steam turbine		Addition of step-up transformers and associated electrical systems	None	5	2	\$35	\$0.00	0.50%	100.00%	40.00	5.00%	15%	Low	2
	Open cycle plants: 140/60 MW	Open cycle plants: 0 Base MW													
	Baalbeck, 70/30 MW	None (plant should play its role as peak rather than base plant)													
	Tyre, 70/30 MW	None (plant should play its role as peak rather than base plant)													
	Hydroelectric plants: 221/40 MW, and efficiency at 80%	Hydroelectric plants: 221/40 MW													
	Litani plants, 190/35 MW Awak, 3*36 MW or 108 MW Jom, 2*24 MW or 48 MW Abdel Aul, 2*17 MW or 34 MW	Same but with maintained capacity and improved performance	Rehabilitation of the Litani plants		1	1	\$7	\$0.00	1.00%	100.00%	60.00	5.00%	10%	Low	2
	Al Bared, 17 MW	None													
	Al Bared 1, 3*4.5 MW or 13.5 MW	None													
	Al Bared 2, 1*1.2 MW + 1*2.5 MW or 3.7 MW	None													
	Richmaya, 13 MW	None													
	Richmaya, 1*3.3 MW + 6.8 MW	None													
	Kadisha, 25 MW	None													
	Summary	Summary													
	765 MW steam plants + 820 MW combined cycle plants + 60 MW open cycle plants + 40 MW hydroelectric plants = 1,685 MW	75 MW steam plants + 3,175 MW combined cycle plants + 0 MW open cycle plants + 40 MW hydroelectric plants = 3,290 MW (Base power) or (3,430 MW Peak power) - Max Demand estimated at 2,900 MW by 2025 (refer to Maximum Demand Sheet)													
	Total for Generation Projects Required Within Short Term						\$359								
	Total for Generation Projects Required Within Medium and Long Term						\$1,406								
	Grand Total						\$0								

Component	Present Situation Sp	Target Situation St	Projects AS	Characteristics											Priority	
				Technical Constraints		Cost						Impact	Uncertainty (High, Medium, Low)			
				Description	Min. delay to start (Year)	Min. constr. period (Year)	Investment (in Million US\$)	Land value / expro (a')	Yearly maintenance cost (b) %	Major rehab/replac. cost (c) %	Span for rehab/reple (d)			Yearly operation cost (e) %		Uncertainty
B. Transmission																
Overhead Lines		Increased Lengths of the 66 kV systems														
30 km double circuit 400 kV overhead lines		Same														
380 km, double circuit 220 kV overhead lines (except for Deir Nhoth - Tartous line which is single circuit)		Expanded system as necessary	Installation of roughly 80 km of new 220 kV lines		1	2	\$35	\$3.30	1.00%	20.00%	50.00	2.00%	20%	High	3	
		Upgraded Deir Nhoth - Deir Ammar line	Upgrading of 30 km of 220 kV overhead lines		1	2	\$2	\$0.00	1.00%	20.00%	50.00	2.00%	50%	Low	1	
180 km, double circuit 150 kV overhead lines		Same, to be gradually phased out														
755 km, 66 kV single and double circuit overhead lines		1,000 km, 66 kV single and double circuit overhead lines	Installation of roughly 80 km of new 220 kV lines		2	4	\$30	\$8.19	1.00%	20.00%	50.00	2.00%	20%	Low	2	
			Second phase before 2020		6	8	\$44	\$9.06	1.00%	20.00%	50.00	2.00%	20%	Low	3	
Underground Cables																
100 km, 220 kV XLPE insulated 3*single core underground cables (minor extensions for Beirut, new Pins-Aramoun circuit and connection to Ashrafieh)		Installation of 40 km, 220 kV XLPE insulated 3*single core underground cables	Installation of 40 km, 220 kV XLPE insulated 3*single core underground cables	None	5	1	\$78	\$0.00	1.00%	100.00%	50.00	2.00%	20%	Low	2	
11 km, 150 kV 2*3-core oil filled underground cables (Jambour-Basta)		150 kV oil filled cables replaced by 220 kV XLPE circuits	Installation of 22 km, 220 kV XLPE insulated 3*single core underground cables	None	4	1	\$44	\$0.00	1.00%	100.00%	50.00	2.00%	20%	Low	2	
17 km, 150 kV XLPE insulated 3*single core underground cables (Aramoun-Basta)		150 kV oil filled cables replaced by 220 kV XLPE circuits	Installation of 17 km, 220 kV XLPE insulated 3*single core underground cables	None	6	1	\$34	\$0.00	1.00%	100.00%	50.00	2.00%	20%	Low	2	
14.5 km, 66 kV 2*3-core oil filled underground cables																
7.5 km, 66 kV 3*3-core oil filled underground cables																
19 km, 66 kV XLPE insulated 3*single core underground cables		None (66 kV underground system for Beirut is expected to become obsolete)														
22 km, 66 kV XLPE insulated 6*single core underground cables																
6 km, 66 kV XLPE insulated 15*single core underground cables																
Substations include																
(1) 400/220 kV substation (Ksara)																
(1) 220/150 kV 120 MVA, 220/66 100 MVA, 150/66 30 MVA, 66/MV 40 MVA (Deir Nhoth)																
(1) 220/150 kV 200 MVA, 150/66 200 MVA, 66/MV 40 MVA (Bealim)																
(1) 220/150 kV 100 MVA, 150/MV 140 MVA (Aramoun)		(5) substations in total and with some upgrades to existing	Construction of Tripoli and a further substation in the Provinces, and performance of upgrades (addition of transformers, switchgear etc on 220 kV substations)	To be performed on as needed basis	5	5	\$80	\$2.25	1.00%	100.00%	50.00	5.00%	50%	Medium	3	
(1) 220/66 170 MVA, 220/MV 70 MVA (Deir Ammar)																
(3) 220/66 510 MVA, 66/MV 250 MVA (Zahrani, Ksara, and Halate)																
(1) 220/MV 240 MVA, 66/MV 80 MVA (Commerciale)																
(4) 220/MV 560 MVA (Mkallès, Ras Beirut, Pins, and Saïda)		(5) 220/MV substations	Construction of Ashrafieh GIS substation and Baalbeck conventional substation		4	2	\$50	\$32.00	1.00%	100.00%	50.00	5.00%	50%	Low	1	
(1) 150/66 160 MVA, 66/MV 110 MVA (Zouk)		To be taken out of service	Dismantlement of all equipment and delivery to EDL stores	None												
(2) 150/66 600 MVA, 66/MV 140 MVA (Jambour and Basta)		Jambour and Basta will be equipped with 220 kV system	Add 220 kV switchgear in Jambour and 220 kV GIS in Basta	None	7	2	\$50	\$0.00	1.00%	100.00%	40.00	5.00%	50%	Low	2	
(1) 150/66 80 MVA (Jeh)		220/66 kV Switchyard	Installation of new 220 kV equipment	In parallel with the Jeh project	5	2	\$5	\$0.00	1.00%	100.00%	50.00	5.00%	50%	Low	2	
(54) 66/MV 2,400 MVA (several substations)		(62) 66/MV substations	Construction and/or upgrading of (14) 66/MV conventional substations, in the Provinces	First phase before 2014	2	2	\$24	\$1.50	1.00%	100.00%	30.00	5.00%	50%	Low	2	
				Second phase before 2020	5	10	\$60	\$4.50	1.00%	100.00%	60.00	5.00%	50%	Low	3	
Summary	Summary	Summary														
220, 150, and 66 kV systems	Expanded 220 kV and 66 kV systems															
Total for Transmission Projects Required Within Short Term							\$52									
Total for Transmission Projects Required Within Medium and Long Term							\$484									
Grand Total							\$535									
C. Distribution																
C1. Medium and Low Voltage Network																
Medium Voltage System includes approximately		Medium Voltage System to be increased by roughly 40%														
15,000 transformers		21,000 transformers	Installation of 7,000 transformers	First phase before 2012	0	4	\$36	\$0.00	1.00%	100.00%	40.00	2.00%	30%	Low	2	
				Second phase before 2020	4	10	\$48	\$0.00	1.00%	100.00%	40.00	2.00%	30%	Low	3	
12,000 km of overhead and underground cables, with the following voltages		Most of 11 kV systems to become 20 kV														
11 kV (in Beirut)		To be replaced by 20 kV cables	Installation of 700 km of 20 kV cables in Beirut	First phase before 2010	1	5	\$30	\$0.00	1.00%	100.00%	40.00	2.00%	20%	Low	1	
			Replacement of a few power transformers and distribution transformers in Beirut	Second phase before 2015	6	8	\$40	\$0.00	1.00%	100.00%	40.00	2.00%	20%	Low	2	
			Replacement of insulators of overhead lines and replacement of some poles in the provinces		0	2	\$40	\$0.00	1.00%	100.00%	40.00	2.00%	50%	Low	2	
33 kV (limited parts in the North)		To be replaced by 20 kV lines. Al Ouyon 33 kV substation will become a 66 kV substation.	Replacement of a few power transformers and distribution transformers in the provinces		5	10	\$10	\$0.00	1.00%	100.00%	40.00	2.00%	50%	Low	3	
20 kV (downtown Beirut, Zouk, and Beiteddine)					5	10	\$10						50%	Low	3	
15 kV (in the provinces)			Installation of 3,000 km 20 kV new overhead lines	First phase before 2012	1	5	\$30	\$0.50	1.00%	20.00%	40.00	2.00%		Low	2	
5 kV (limited parts in the North)				Second phase before 2020	6	8	\$60	\$1.00	1.00%	20.00%	40.00	2.00%		Low	3	
Radial MV system		Loop MV system	Upgrade to loops where possible		1	5	\$15	\$0.00	1.00%	20.00%	40.00	2.00%	50%	Low	1	
Distribution in Zable, Jbeil, and Aley are undertaken by independent concession	Same															
Low Voltage System includes approximately		Low Voltage System includes approximately														
18,000 km of overhead and underground cables		25,000 km of overhead and underground cables, at 220/380 V	Installation of 7,000 km LV overhead lines and cables	First phase before 2012	0	5	\$45	\$0.00	1.00%	30.00%	40.00	2.00%	20%	Low	2	
				Second phase before 2020	5	10	\$60	\$0.00	1.00%	30.00%	40.00	2.00%	20%	Low	3	
Summary	Summary	Summary														
Multiple voltage system with increased losses	Unified 20 kV system with reduced losses															
C2. Consumer Connections																
There are presently 1,100,000 subscribers (out of which are only 2,000 MV and 2 HV subscribers)		Subscribers to increase by 40% (average 2.5% annually) and reach 1,500,000														
1,100,000 subscribers		1,500,000 subscribers	Perform 400,000 new LV consumer connections with digital meters	First phase before 2010	0	5	\$20	\$0.00	1.00%	40.00%	20.00	2.00%	50%	Low	1	
				Second phase before 2020	5	10	\$60	\$0.00	1.00%	40.00%	20.00	2.00%	50%	Low	3	
All LV subscribers are equipped with analog meters		Most LV subscribers are equipped with digital meters	Replacement of meters by digital systems on a gradual basis (project should be financed from O&M budget)		1	15								Medium	3	
Total for Distribution Projects Required Within Short Term							\$65									
Total for Distribution Projects Required Within Medium and Long Term							\$439									
Grand Total							\$504									

