National Electric Power Company
Hashemite Kingdom of Jordan

Project for the Study
on
the Electricity Sector Master Plan
in
the Hashemite Kingdom of Jordan

Final Report
(Appendix)

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Japan International Cooperation Agency (JICA)

JERA Co., Inc.
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Appendix

Chapter 4 Power Demand Forecasts

4.1 Result of Macro Method Power Demand Forecast (2015 - 2040) [Appendix-1]

Table 1 (Appendix of Table 4.3-5 ~ Table 4.3-7) Result of Macro Method Power Demand Forecast (2015 - 2040)

		2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Purchased Energy																											
High Case	(GWh)	18,390	19,528	20,729	22,010	23,361	24,783	26,289	27,878	29,531	31,308	33,186	35,163	37,254	39,460	41,786	44,239	46,815	49,531	52,383	55,398	58,574	61,922	65,451	69,169	73,083	77,194
Medium Case	(GWh)	17,898	18,622	19,375	20,164	20,987	21,837	22,725	23,649	24,584	25,588	26,635	27,721	28,852	30,029	31,252	32,524	33,837	35,201	36,607	38,077	39,603	41,190	42,842	44,556	46,334	48,170
Low Case	(GWh)	17,638	18,204	18,790	19,398	20,032	20,682	21,361	22,062	22,762	23,518	24,304	25,115	25,956	26,828	27,729	28,663	29,623	30,614	31,629	32,689	33,783	34,918	36,094	37,308	38,563	39,849
High Case		2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
1) Power Consumption of Distribution Companies	(GWh)	15,709	16,710	17,768	18,887	20,069	21,319	22,639	24,034	25,507	27,063	28,706	30,440	32,272	34,205	36,245	38,397	40,669	43,065	45,593	48,260	51,072	54,037	57,163	60,460	63,935	67,597
2) Sales Energy to Large Consumer	(GWh)	1,209	1,229	1,245	1,309	1,342	1,372	1,403	1,434	1,464	1,495	1,527	1,555	1,586	1,617	1,648	1,681	1,698	1,716	1,734	1,751	1,769	1,788	1,807	1,826	1,846	1,884
3) Power Selling to Overseas	(GWh)	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39
4) T/L Loss	(GWh)	341	361	382	405	430	451	474	497	528	560	595	631	670	711	755	801	842	884	918	963	1,011	1,061	1,114	1,169	1,226	1,285
5) D/L Loss	(GWh)	1,092	1,189	1,295	1,370	1,481	1,602	1,734	1,874	1,993	2,151	2,319	2,498	2,687	2,888	3,099	3,321	3,567	3,827	4,099	4,385	4,683	4,997	5,328	5,675	6,037	6,389
Total		18,390	19,528	20,729	22,010	23,361	24,783	26,289	27,878	29,531	31,308	33,186	35,163	37,254	39,460	41,786	44,239	46,815	49,531	52,383	55,398	58,574	61,922	65,451	69,169	73,083	77,194
Medium Case		2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
1) Power Consumption of Distribution Companies	(GWh)	15,331	15,920	16,531	17,164	17,821	18,502	19,207	19,939	20,697	21,483	22,298	23,143	24,018	24,925	25,865	26,839	27,849	28,895	29,979	31,102	32,266	33,472	34,722	36,017	37,358	38,748
2) Sales Energy to Large Consumer	(GWh)	1,099	1,117	1,132	1,190	1,220	1,247	1,275	1,304	1,331	1,359	1,388	1,414	1,442	1,470	1,498	1,528	1,544	1,560	1,576	1,592	1,608	1,625	1,643	1,660	1,678	1,713
3) Power Selling to Overseas	(GWh)	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35
4) T/L Loss	(GWh)	341	361	382	405	430	451	474	497	528	560	595	631	670	711	755	801	842	884	918	963	1,011	1,061	1,114	1,169	1,226	1,285
5) D/L Loss	(GWh)	1,092	1,189	1,295	1,370	1,481	1,602	1,734	1,874	1,993	2,151	2,319	2,498	2,687	2,888	3,099	3,321	3,567	3,827	4,099	4,385	4,683	4,997	5,328	5,675	6,037	6,389
Total		17,898	18,622	19,375	20,164	20,987	21,837	22,725	23,649	24,584	25,588	26,635	27,721	28,852	30,029	31,252	32,524	33,837	35,201	36,607	38,077	39,603	41,190	42,842	44,556	46,334	48,170
Medium Case		2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
1) Power Consumption of Distribution Companies	(GWh)	15,184	15,617	16,062	16,520	16,991	17,475	17,973	18,485	19,011	19,552	20,109	20,681	21,269	21,874	22,495	23,134	23,792	24,467	25,162	25,876	26,610	27,365	28,141	28,938	29,758	30,601
2) Sales Energy to Large Consumer	(GWh)	989	1,005	1,019	1,071	1,098	1,122	1,148	1,174	1,198	1,223	1,249	1,273	1,298	1,323	1,348	1,375	1,390	1,404	1,418	1,433	1,447	1,463	1,479	1,494	1,510	1,542
3) Power Selling to Overseas	(GWh)	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32
4) T/L Loss	(GWh)	341	361	382	405	430	451	474	497	528	560	595	631	670	711	755	801	842	884	918	963	1,011	1,061	1,114	1,169	1,226	1,285
5) D/L Loss	(GWh)	1,092	1,189	1,295	1,370	1,481	1,602	1,734	1,874	1,993	2,151	2,319	2,498	2,687	2,888	3,099	3,321	3,567	3,827	4,099	4,385	4,683	4,997	5,328	5,675	6,037	6,389
Total		17,638	18,204	18,790	19,398	20,032	20,682	21,361	22,062	22,762	23,518	24,304	25,115	25,956	26,828	27,729	28,663	29,623	30,614	31,629	32,689	33,783	34,918	36,094	37,308	38,563	39,849

Source: JICA Study Team

4.2 Result of Micro Method Power Demand Forecast (2015 - 2040) [Appendix -2]

Table 2 (Appendix of Table 4.3-28 ~ Table 4.3-30) Result of Micro Method Power Demand Forecast (2015 - 2040)

		2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Purchased Energy																											
High Case	(GWh)	19,802	20,863	21,777	22,874	24,056	25,271	26,571	27,683	29,389	30,943	32,610	34,352	36,224	38,221	40,349	42,621	45,028	47,601	50,306	53,217	56,330	59,666	63,244	67,076	71,181	75,573
Medium Case	(GWh)	18,655	19,583	20,370	21,309	22,317	23,343	24,434	25,581	26,759	28,026	29,372	30,762	32,241	33,804	35,449	37,187	39,004	40,923	42,912	45,028	47,262	49,626	52,130	54,777	57,574	60,520
Low Case	(GWh)	17,508	18,306	18,968	19,758	20,606	21,459	22,361	23,302	24,254	25,275	26,353	27,452	28,614	29,829	31,095	32,420	33,789	35,220	36,682	38,222	39,830	41,512	43,274	45,114	47,033	49,023
High Case		2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
1. Sales Energy	(GWh)	17,122	18,046	18,816	19,751	20,764	21,808	22,922	23,839	25,366	26,699	28,131	29,629	31,242	32,967	34,809	36,780	38,882	41,135	43,517	46,080	48,829	51,782	54,956	58,367	62,034	65,976
1) Domestic	(GWh)	6,070	6,235	6,397	6,556	6,712	6,873	7,033	7,193	7,352	7,512	7,671	7,831	7,990	8,151	8,312	8,472	8,627	8,780	8,931	9,080	9,227	9,371	9,513	9,651	9,787	9,919
2) Commercial	(GWh)	2,497	2,703	2,925	3,170	3,457	3,770	4,131	4,257	4,961	5,436	5,957	6,528	7,154	7,840	8,591	9,415	10,317	11,306	12,359	13,527	14,805	16,205	17,736	19,412	21,246	23,254
3) Industry	(GWh)	4,161	4,482	4,809	5,180	5,587	5,996	6,434	6,905	7,410	7,952	8,534	9,158	9,828	10,547	11,318	12,146	13,034	13,988	15,011	16,109	17,288	18,552	19,909	21,366	22,929	24,606
4) Public	(GWh)	1,311	1,340	1,369	1,398	1,426	1,454	1,482	1,508	1,536	1,562	1,588	1,614	1,640	1,666	1,691	1,716	1,740	1,765	1,789	1,813	1,836	1,860	1,884	1,907	1,928	1,947
5) Water Pumping	(GWh)	2,734	2,935	2,963	3,092	3,225	3,356	3,481	3,613	3,742	3,871	4,012	4,128	4,258	4,389	4,521	4,654	4,784	4,915	5,043	5,165	5,286	5,405	5,523	5,639	5,750	5,854
6) Street Lighting	(GWh)	349	351	353	355	357	359	361	363	364	366	368	370	372	374	376	378	379	381	383	385	387	389	391	392	394	396
2. Sales Energy to Large Consumer	(GWh)	1,209	1,229	1,245	1,309	1,342	1,372	1,403	1,434	1,464	1,495	1,527	1,555	1,586	1,617	1,648	1,681	1,698	1,716	1,734	1,751	1,769	1,788	1,807	1,826	1,846	1,884
3. Power Selling to Overseas	(GWh)	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39
4. T/L Loss	(GWh)	341	361	382	405	430	451	474	497	528	560	595	631	670	711	755	801	842	884	918	963	1,011	1,061	1,114	1,169	1,226	1,285
5. D/L Loss	(GWh)	1,092	1,189	1,295	1,370	1,481	1,602	1,734	1,874	1,993	2,151	2,319	2,498	2,687	2,888	3,099	3,321	3,567	3,827	4,099	4,385	4,683	4,997	5,328	5,675	6,037	6,389
Total	(GWh)	19,802	20,863	21,777	22,874	24,056	25,271	26,571	27,683	29,389	30,943	32,610	34,352	36,224	38,221	40,349	42,621	45,028	47,601	50,306	53,217	56,330	59,666	63,244	67,076	71,181	75,573
Medium Case		2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
1. Sales Energy	(GWh)	16,088	16,881	17,526	18,309	19,151	20,008	20,916	21,871	22,872	23,921	25,035	26,184	27,407	28,700	30,062	31,502	33,016	34,617	36,284	38,053	39,925	41,908	44,010	46,238	48,598	51,098
1) Domestic	(GWh)	5,518	5,669	5,816	5,960	6,102	6,248	6,394	6,539	6,684	6,829	6,974	7,119	7,264	7,410	7,556	7,702	7,843	7,982	8,119	8,255	8,388	8,519	8,648	8,774	8,897	9,017
2) Commercial	(GWh)	2,466	2,636	2,818	3,015	3,247	3,497	3,785	4,097	4,434	4,799	5,195	5,622	6,085	6,587	7,129	7,716	8,352	9,039	9,759	10,550	11,404	12,328	13,327	14,406	15,573	16,834
3) Industry	(GWh)	4,109	4,371	4,633	4,929	5,250	5,564	5,897	6,250	6,624	7,021	7,441	7,886	8,358	8,858	9,389	9,950	10,546	11,177	11,846	12,555	13,307	14,103	14,947	15,842	16,790	17,795
4) Public	(GWh)	1,192	1,218	1,245	1,271	1,296	1,322	1,347	1,371	1,396	1,420	1,444	1,467	1,491	1,514	1,537	1,560	1,582	1,604	1,627	1,648	1,669	1,691	1,713	1,733	1,752	1,770
5) Water Pumping	(GWh)	2,485	2,668	2,694	2,811	2,932	3,051	3,165	3,284	3,402	3,519	3,647	3,753	3,871	3,990	4,110	4,231	4,349	4,468	4,584	4,696	4,805	4,913	5,021	5,126	5,227	5,322
6) Street Lighting	(GWh)	318	319	321	323	324	326	328	330	331	333	335	336	338	340	341	343	345	347	348	350	352	353	355	357	358	360
2. Sales Energy to Large Consumer	(GWh)	1,099	1,117	1,132	1,190	1,220	1,247	1,275	1,304	1,331	1,359	1,388	1,414	1,442	1,470	1,498	1,528	1,544	1,560	1,576	1,592	1,608	1,625	1,643	1,660	1,678	1,713
3. Power Selling to Overseas	(GWh)	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35
4. T/L Loss	(GWh)	341	361	382	405	430	451	474	497	528	560	595	631	670	711	755	801	842	884	918	963	1,011	1,061	1,114	1,169	1,226	1,285
5. D/L Loss	(GWh)	1,092	1,189	1,295	1,370	1,481	1,602	1,734	1,874	1,993	2,151	2,319	2,498	2,687	2,888	3,099	3,321	3,567	3,827	4,099	4,385	4,683	4,997	5,328	5,675	6,037	6,389
Total	(GWh)	18,655	19,583	20,370	21,309	22,317	23,343	24,434	25,581	26,759	28,026	29,372	30,762	32,241	33,804	35,449	37,187	39,004	40,923	42,912	45,028	47,262	49,626	52,130	54,777	57,574	60,520
Low Case		2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
1. Sales Energy	(GWh)	15,054	15,719	16,241	16,881	17,566	18,253	18,974	19,725	20,504	21,310	22,159	23,019	23,927	24,875	25,862	26,892	27,959	29,073	30,215	31,410	32,657	33,960	35,322	36,744	38,228	39,776
1) Domestic	(GWh)	4,967	5,102	5,234	5,364	5,491	5,623	5,754	5,885	6,016	6,146	6,276	6,407	6,538	6,669	6,800	6,931	7,058	7,184	7,307	7,429	7,550	7,667	7,783	7,897	8,007	8,115
2) Commercial	(GWh)	2,435	2,570	2,712	2,866	3,048	3,241	3,465	3,703	3,958	4,231	4,522	4,833	5,166	5,522	5,902	6,308	6,742	7,207	7,683	8,202	8,756	9,347	9,978	10,651	11,370	12,137
3) Industry	(GWh)	4,057	4,263	4,461	4,686	4,930	5,159	5,399	5,650	5,913	6,189	6,477	6,778	7,094	7,424	7,770	8,131	8,510	8,906	9,321	9,754	10,209	10,684	11,181	11,702	12,246	12,816
4) Public	(GWh)	1,072	1,096	1,120	1,144	1,166	1,190	1,213	1,234	1,257	1,278	1,300	1,320	1,342	1,363	1,383	1,404	1,424	1,444	1,464	1,483	1,502	1,522	1,542	1,560	1,577	1,593
5) Water Pumping	(GWh)	2,237	2,401	2,424	2,530	2,638	2,746	2,848	2,956	3,062	3,167	3,283	3,378	3,484	3,591	3,699	3,808	3,914	4,021	4,126	4,226	4,325	4,422	4,519	4,614	4,705	4,790
6) Street Lighting	(GWh)	286	287	289	291	292	294	295	297	298	300	301	303	304	306	307	309	310	312	313	315	317	318	320	321	323	324
2. Sales Energy to Large Consumer	(GWh)	989	1,005	1,019	1,071	1,098	1,122	1,148	1,174	1,198	1,223	1,249	1,273	1,298	1,323	1,348	1,375	1,390	1,404	1,418	1,433	1,447	1,463	1,479	1,494	1,510	1,542
3. Power Selling to Overseas	(GWh)	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32
4. T/L Loss	(GWh)	341	361	382	405	430	451	474	497	528	560	595	631	670	711	755	801	842	884	918	963	1,011	1,061	1,114	1,169	1,226	1,285
5. D/L Loss	(GWh)	1,092	1,189	1,295	1,370	1,481	1,602	1,734	1,874	1,993	2,151	2,319	2,498	2,687	2,888	3,099	3,321	3,567	3,827	4,099	4,385	4,683	4,997	5,328	5,675	6,037	6,389
Total	(GWh)	17,508	18,306	18,968	19,758	20,606	21,459	22,361	23,302	24,254	25,275	26,353	27,452	28,614	29,829	31,095	32,420	33,789	35,220	36,682	38,222	39,830	41,512	43,274	45,114	47,033	49,023

Source: JICA Study Team

4.3 Result of Peak Demand Forecast (LF=0.69) [Appendix -3]

Table 3 (Appendix of Table 4.3-32) Result of Peak Demand Forecast (LF=0.69)

		2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Purchased Energy																											
High Case	(GWh)	19,802	20,863	21,777	22,874	24,056	25,271	26,571	27,683	29,389	30,943	32,610	34,352	36,224	38,221	40,349	42,621	45,028	47,601	50,306	53,217	56,330	59,666	63,244	67,076	71,181	75,573
Medium Case	(GWh)	18,655	19,583	20,370	21,309	22,317	23,343	24,434	25,581	26,759	28,026	29,372	30,762	32,241	33,804	35,449	37,187	39,004	40,923	42,912	45,028	47,262	49,626	52,130	54,777	57,574	60,520
Low Case	(GWh)	17,508	18,306	18,968	19,758	20,606	21,459	22,361	23,302	24,254	25,275	26,353	27,452	28,614	29,829	31,095	32,420	33,789	35,220	36,682	38,222	39,830	41,512	43,274	45,114	47,033	49,023
Peak Demand																											
High Case	(MW)	3,276	3,452	3,603	3,784	3,980	4,181	4,396	4,580	4,862	5,119	5,395	5,683	5,993	6,323	6,675	7,051	7,450	7,875	8,323	8,804	9,319	9,871	10,463	11,097	11,776	12,503
Medium Case	(MW)	3,086	3,240	3,370	3,525	3,692	3,862	4,042	4,232	4,427	4,637	4,859	5,089	5,334	5,593	5,865	6,152	6,453	6,770	7,099	7,450	7,819	8,210	8,625	9,062	9,525	10,013
Low Case	(MW)	2,897	3,029	3,138	3,269	3,409	3,550	3,699	3,855	4,013	4,182	4,360	4,542	4,734	4,935	5,144	5,364	5,590	5,827	6,069	6,324	6,590	6,868	7,159	7,464	7,781	8,111
Load Factor	-	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69

Source: JICA Study Team

4.4 Result of Peak Demand Forecast (LF=0.64) [Appendix -4]

Table 4 (Appendix of Table 4.3-33) Result of Peak Demand Forecast (LF=0.64)

		2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Purchased Energy																											
High Case	(GWh)	19,802	20,863	21,777	22,874	24,056	25,271	26,571	27,683	29,389	30,943	32,610	34,352	36,224	38,221	40,349	42,621	45,028	47,601	50,306	53,217	56,330	59,666	63,244	67,076	71,181	75,573
Medium Case	(GWh)	18,655	19,583	20,370	21,309	22,317	23,343	24,434	25,581	26,759	28,026	29,372	30,762	32,241	33,804	35,449	37,187	39,004	40,923	42,912	45,028	47,262	49,626	52,130	54,777	57,574	60,520
Low Case	(GWh)	17,508	18,306	18,968	19,758	20,606	21,459	22,361	23,302	24,254	25,275	26,353	27,452	28,614	29,829	31,095	32,420	33,789	35,220	36,682	38,222	39,830	41,512	43,274	45,114	47,033	49,023
Peak Demand																											
High Case	(MW)	3,532	3,721	3,884	4,080	4,291	4,508	4,739	4,938	5,242	5,519	5,817	6,127	6,461	6,817	7,197	7,602	8,032	8,490	8,973	9,492	10,047	10,642	11,281	11,964	12,696	13,480
Medium Case	(MW)	3,327	3,493	3,633	3,801	3,981	4,164	4,358	4,563	4,773	4,999	5,239	5,487	5,751	6,030	6,323	6,633	6,957	7,299	7,654	8,032	8,430	8,852	9,298	9,771	10,269	10,795
Low Case	(MW)	3,123	3,265	3,383	3,524	3,676	3,828	3,988	4,156	4,326	4,508	4,701	4,897	5,104	5,320	5,546	5,783	6,027	6,282	6,543	6,818	7,104	7,404	7,719	8,047	8,389	8,744
Load Factor	-	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64

Source: JICA Study Team

Chapter 5 Power System Plan

5.1 BSP Analysis by the BSP Grouping Method

(1) BSP Analysis for JEPCO

Table 1 BSP Analysis by the BSP Grouping Method for JEPCO in 2016

(1) Year 2016

i) No countermeasure

BSP Grouping	BSP (Substation)	No. of TR's						Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
										Peak Demand 2016		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
										[MVA]	%					
1	ABDOON	80	80	80				240	160	120.9	50%		0.0	48.0	OK	
1	AMMAN S	45	45	45				135	90	109.2	81%	76%	19.2	41.6	OK	
1	AMMAN S NEW	80	80					160	80	168.7	105%		88.7	63.2	No	
1	ASHRFIA	63	63					126	63	104.1	83%		41.1	51.3	OK	
2	MANARAH	80	80	80				240	160	54.4	23%		0.0	49.0	OK	
2	SAHAB	63	63	63				189	126	138.1	73%	41%	12.1	25.0	OK	
2	MWQAR	80	80					160	80	51.5	32%		0.0	24.0	OK	
3	ABDALI	40	40	40				120	80	67.9	57%		0.0	18.0	OK	
3	ABDALI NEW	80	80					160	80	143.2	89%		63.2	25.0	No	
3	HIZAM	80	80	80				240	160		0%	45%	0.0	36.0	OK	NEPCO ongoing project
3	ZERQA	30	30	30	40			130	90	93.0	72%		3.0	18.8	OK	
3	ZERQA TR5	63						63	0	24.0	38%		24.0	27.0	OK	
3	DHULEIL	80	80					160	80	61.3	38%		0.0	23.1	OK	
4	CITY CENTER	80	80	80				240	160	127.0	53%		0.0	111.6	OK	
4	MARQA	45	63	80				188	108	181.4	97%	64%	73.4	49.5	No	
4	TAREQ	80	80	80				240	160	121.3	51%		0.0	80.2	OK	
5	BAYADER	80	80	80				240	160	198.2	83%		38.2	79.2	OK	
5	New BAYDER	80	80					160	80		0%		0.0	24.0	OK	NEPCO ongoing project
5	SALT	80	80					160	80	173.4	108%	68%	93.4	29.5	No	
5	UNIVERSITY	80	80	80				240	160	178.6	74%		18.6	85.2	OK	
5	SUBEIHI	63	63	63				189	126	123.8	65%		0.0	5.2	OK	
6	QAIA	45	45					90	45	14.5	16%		0.0	24.5	OK	
6	QAIA New	80	80					160	80	102.3	64%	45%	22.3	24.0	OK	
6	MADABA SOUTH	80	80	80				240	160	103.9	43%		0	35.0	OK	
										Average		57%				

*FUHEIS, HASHIMIYA and MWQAR IND are excluded due to an exclusive use for large industries.

ii) After countermeasures

BSP Grouping	BSP (Substation)	No. of TR's						Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
										Peak Demand 2016		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
										[MVA]	%					
1	ABDOON	80	80	80				240	160	136.9	57%		0.0	48.0	OK	From Amman S New
1	AMMAN S	45	45	45				135	90	109.2	81%	71%	19.2	41.6	OK	
1	AMMAN S NEW	80	80					160	80	120.7	75%		40.7	63.2	OK	To New Bayader 20%(32MVA), Abdoon 10%(16MVA)
1	ASHRFIA	63	63					126	63	104.1	83%		41.1	51.3	OK	
2	MANARAH	80	80	80				240	160	54.4	23%		0.0	49.0	OK	
2	SAHAB	63	63	63				189	126	138.1	73%	41%	12.1	25.0	OK	
2	MWQAR	80	80					160	80	51.5	32%		0.0	24.0	OK	
3	ABDALI	40	40	40				120	80	67.9	57%		0.0	18.0	OK	
3	ABDALI NEW	80	80					160	80	79.2	49%		0.0	25.0	OK	To HIZAM 40%(64MVA)
3	HIZAM	80	80	80				240	160	120.4	50%	51%	0.0	36.0	OK	From ABDLAI NEW, Marqa
3	ZERQA	30	30	30	40			130	90	93.0	72%		3.0	18.8	OK	
3	ZERQA TR5	63						63	0	24.0	38%		24.0	27.0	OK	
3	DHULEIL	80	80					160	80	61.3	38%		0.0	23.1	OK	
4	CITY CENTER	80	80	80				240	160	127.0	53%		0.0	111.6	OK	
4	MARQA	45	63	80				188	108	125.0	67%	56%	17.0	49.5	OK	To HIZAM 30%(56.4MVA)
4	TAREQ	80	80	80				240	160	121.3	51%		0.0	80.2	OK	
5	BAYADER	80	80	80				240	160	198.2	83%		38.2	79.2	OK	
5	New BAYDER	80	80					160	80	80.0	50%		0.0	24.0	OK	From AMMAN SNEW, Salt
5	SALT	80	80					160	160	125.4	78%	71%	0.0	29.5	OK	To New Bayder 30%(48MVA)
5	UNIVERSITY	80	80	80				240	160	178.6	74%		18.6	85.2	OK	
5	SUBEIHI	63	63	63				189	126	123.8	65%		0.0	5.2	OK	
6	QAIA	45	45					90	45	14.5	16%		0.0	24.5	OK	
6	QAIA New	80	80					160	80	102.3	64%	45%	22.3	24.0	OK	
6	MADABA SOUTH	80	80	80				240	160	103.9	43%		0.0	35.0	OK	
										Average		56%				

*FUHEIS, HASHIMIYA and MWQAR IND are excluded due to an exclusive use for large industries.

Source: JICA Study Team

Table 2 BSP Analysis by the BSP Grouping Method for JEPCO in 2017

i) No countermeasure

BSP Grouping	BSP (Substation)	No. of TR's						Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
										Peak Demand 2017		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
										[MVA]	%					
1	ABDOON	80	80	80				240	160	149.0	62%		0.0	48.0	OK	
1	AMMAN S	45	45	45				135	90	118.7	88%	77%	28.7	41.6	OK	
1	AMMAN S NEW	80	80					160	80	131.1	82%		51.1	63.2	OK	
1	ASHRFIA	63	63					126	63	108.4	86%		45.4	51.3	OK	
2	MANARAH	80	80	80				240	160	58.8	24%		0.0	49.0	OK	
2	SAHAB	63	63	63				189	126	145.0	77%	44%	19.0	25.0	OK	
2	MWQAR	80	80					160	80	55.5	35%		0.0	24.0	OK	
3	ABDALI	40	40	40				120	80	73.8	61%		0.0	18.0	OK	
3	ABDALI NEW	80	80					160	80	86.0	54%		6.0	25.0	OK	
3	HIZAM	80	80	80				240	160	126.8	53%		0.0	36.0	OK	
3	ZERQA	30	30	30	40			130	90	100.8	78%	55%	10.8	18.8	OK	
3	ZERQA TR5	63						63	0	26.0	41%		26.0	27.0	OK	
3	DHULEIL	80	80					160	80	67.2	42%		0.0	23.1	OK	
4	CITY CENTER	80	80	80				240	160	138.2	58%		0.0	111.6	OK	
4	MARQA	45	63	80				188	108	128.6	68%	59%	20.6	49.5	OK	
4	TAREQ	80	80	80				240	160	130.5	54%		0.0	80.2	OK	
5	BAYADER	80	80	80				240	160	214.8	89%		54.8	79.2	OK	
5	New BAYDER	80	80					160	80	86.7	54%		6.7	24.0	OK	
5	SALT	80	80					160	80	139.5	87%	78%	59.5	29.5	No	NEPCO Commiitted project
5	UNIVERSITY	80	80	80				240	160	194.9	81%		34.9	85.2	OK	
5	SUBEIHI	63	63	63				189	126	132.9	70%		6.9	5.2	No	
6	QAIA	45	45					90	45	16.0	18%		0.0	24.5	OK	
6	QAIA New	80	80					160	80	113.1	71%	49%	33.1	24.0	No	
6	MADABA SOUTH	80	80	80				240	160	111.9	47%		0	35.0	OK	
										Average		60%				

*FUHEIS, HASHIMIYA and MWQAR IND are excluded due to an exclusive use for large industries.

ii) After countermeasures

BSP Grouping	BSP (Substation)	No. of TR's						Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
										Peak Demand 2017		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
										[MVA]	%					
1	ABDOON	80	80	80				240	160	149.0	62%		0.0	48.0	OK	
1	AMMAN S	45	45	45				135	90	118.7	88%	77%	28.7	41.6	OK	
1	AMMAN S NEW	80	80					160	80	131.1	82%		51.1	63.2	OK	
1	ASHRFIA	63	63					126	63	108.4	86%		45.4	51.3	OK	
2	MANARAH	80	80	80				240	160	58.8	24%		0.0	49.0	OK	
2	SAHAB	63	63	63				189	126	145.0	77%	44%	19.0	25.0	OK	
2	MWQAR	80	80					160	80	55.5	35%		0.0	24.0	OK	
3	ABDALI	40	40	40				120	80	73.8	61%		0.0	18.0	OK	
3	ABDALI NEW	80	80					160	80	86.0	54%		6.0	25.0	OK	
3	HIZAM	80	80	80				240	160	126.8	53%		0.0	36.0	OK	
3	ZERQA	30	30	30	40			130	90	100.8	78%	55%	10.8	18.8	OK	
3	ZERQA TR5	63						63	0	26.0	41%		26.0	27.0	OK	
3	DHULEIL	80	80					160	80	67.2	42%		0.0	23.1	OK	
4	CITY CENTER	80	80	80				240	160	138.2	58%		0.0	111.6	OK	
4	MARQA	45	63	80				188	108	128.6	68%	59%	20.6	49.5	OK	
4	TAREQ	80	80	80				240	160	130.5	54%		0.0	80.2	OK	
5	BAYADER	80	80	80				240	160	214.8	89%		54.8	79.2	OK	
5	New BAYDER	80	80					160	80	86.7	54%		6.7	24.0	OK	
5	SALT	80	80	80				240	160	167.8	70%	72%	7.8	29.5	OK	From Subeihi
5	UNIVERSITY	80	80	80				240	160	194.9	81%		34.9	85.2	OK	
5	SUBEIHI	63	63	63				189	126	104.6	55%		0.0	5.2	OK	To Salt 15%(28.4MVA)
6	QAIA	45	45					90	45	16.0	18%		0.0	24.5	OK	
6	QAIA New	80	80					160	80	81.1	51%	49%	1.1	24.0	OK	To Madaba South 20%(32MVA)
6	MADABA SOUTH	80	80	80				240	160	143.9	60%		0.0	35.0	OK	From QAIA New
										Average		59%				

*FUHEIS, HASHIMIYA and MWQAR IND are excluded due to an exclusive use for large industries.

Source: JICA Study Team

Table 3 BSP Analysis by the BSP Grouping Method for JEPCO in 2018

i) No countermeasure

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2017		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	ABDOON	80	80	80			240	160	149.0	62%		0.0	48.0	OK	
1	AMMAN S	45	45	45			135	90	118.7	88%	77%	28.7	41.6	OK	
1	AMMAN S NEW	80	80				160	80	131.1	82%		51.1	63.2	OK	
1	ASHRFIA	63	63				126	63	108.4	86%		45.4	51.3	OK	
2	MANARAH	80	80	80			240	160	58.8	24%		0.0	49.0	OK	
2	SAHAB	63	63	63			189	126	145.0	77%	44%	19.0	25.0	OK	
2	MWQAR	80	80				160	80	55.5	35%		0.0	24.0	OK	
3	ABDALI	40	40	40			120	80	73.8	61%		0.0	18.0	OK	
3	ABDALI NEW	80	80				160	80	86.0	54%		6.0	25.0	OK	
3	HIZAM	80	80	80			240	160	126.8	53%		0.0	36.0	OK	
3	ZERQA	30	30	30	40		130	90	100.8	78%	55%	10.8	18.8	OK	
3	ZERQA TR5	63					63	0	26.0	41%		26.0	27.0	OK	
3	DHULEIL	80	80				160	80	67.2	42%		0.0	23.1	OK	
4	CITY CENTER	80	80	80			240	160	138.2	58%		0.0	111.6	OK	
4	MARQA	45	63	80			188	108	128.6	68%	59%	20.6	49.5	OK	
4	TAREQ	80	80	80			240	160	130.5	54%		0.0	80.2	OK	
5	BAYADER	80	80	80			240	160	214.8	89%		54.8	79.2	OK	
5	New BAYDER	80	80				160	80	86.7	54%		6.7	24.0	OK	
5	SALT	80	80				160	80	139.5	87%	78%	59.5	29.5	No	NEPCO Commiitted project
5	UNIVERSITY	80	80	80			240	160	194.9	81%		34.9	85.2	OK	
5	SUBEIHI	63	63	63			189	126	132.9	70%		6.9	5.2	No	
6	QAIA	45	45				90	45	16.0	18%		0.0	24.5	OK	
6	QAIA New	80	80				160	80	113.1	71%	49%	33.1	24.0	No	
6	MADABA SOUTH	80	80	80			240	160	111.9	47%		0	35.0	OK	
									Average		60%				

*FUHEIS, HASHIMIYA and MWQAR IND are excluded due to an exclusive use for large industries.

ii) After countermeasures

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2017		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	ABDOON	80	80	80			240	160	149.0	62%		0.0	48.0	OK	
1	AMMAN S	45	45	45			135	90	118.7	88%	77%	28.7	41.6	OK	
1	AMMAN S NEW	80	80				160	80	131.1	82%		51.1	63.2	OK	
1	ASHRFIA	63	63				126	63	108.4	86%		45.4	51.3	OK	
2	MANARAH	80	80	80			240	160	58.8	24%		0.0	49.0	OK	
2	SAHAB	63	63	63			189	126	145.0	77%	44%	19.0	25.0	OK	
2	MWQAR	80	80				160	80	55.5	35%		0.0	24.0	OK	
3	ABDALI	40	40	40			120	80	73.8	61%		0.0	18.0	OK	
3	ABDALI NEW	80	80				160	80	86.0	54%		6.0	25.0	OK	
3	HIZAM	80	80	80			240	160	126.8	53%		0.0	36.0	OK	
3	ZERQA	30	30	30	40		130	90	100.8	78%	55%	10.8	18.8	OK	
3	ZERQA TR5	63					63	0	26.0	41%		26.0	27.0	OK	
3	DHULEIL	80	80				160	80	67.2	42%		0.0	23.1	OK	
4	CITY CENTER	80	80	80			240	160	138.2	58%		0.0	111.6	OK	
4	MARQA	45	63	80			188	108	128.6	68%	59%	20.6	49.5	OK	
4	TAREQ	80	80	80			240	160	130.5	54%		0.0	80.2	OK	
5	BAYADER	80	80	80			240	160	214.8	89%		54.8	79.2	OK	
5	New BAYDER	80	80				160	80	86.7	54%		6.7	24.0	OK	
5	SALT	80	80	80			240	160	167.8	70%	72%	7.8	29.5	OK	From Subeihi
5	UNIVERSITY	80	80	80			240	160	194.9	81%		34.9	85.2	OK	
5	SUBEIHI	63	63	63			189	126	104.6	55%		0.0	5.2	OK	To Salt 15%(28.4MVA)
6	QAIA	45	45				90	45	16.0	18%		0.0	24.5	OK	
6	QAIA New	80	80				160	80	81.1	51%	49%	1.1	24.0	OK	To Madaba South 20%(32MVA)
6	MADABA SOUTH	80	80	80			240	160	143.9	60%		0.0	35.0	OK	From QAIA New
									Average		59%				

*FUHEIS, HASHIMIYA and MWQAR IND are excluded due to an exclusive use for large industries.

Source: JICA Study Team

Table 4 BSP Analysis by the BSP Grouping Method for JEPCO in 2019

i) No countermeasure

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2019		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	ABDOON	80	80	80			240	160	199.3	83%		39.3	48.0	OK	
1	AMMAN S	45	45	45			135	90	106.2	79%	86%	16.2	41.6	OK	
1	AMMAN S NEW	80	80				160	80	149.6	94%		69.6	63.2	No	
1	ASHRFIA	63	63				126	63	113.7	90%		50.7	51.3	OK	
2	MANARAH	80	80	80			240	160	69.1	29%		0.0	49.0	OK	
2	SAHAB	63	63	63			189	126	156.4	83%	49%	30.4	25.0	No	
2	MWQAR	80	80				160	80	63.4	40%		0.0	24.0	OK	
3	ABDALI	40	40	40			120	80	84.1	70%		4.1	18.0	OK	
3	ABDALI NEW	80	80				160	80	98.1	61%		18.1	25.0	OK	
3	HIZAM	80	80	80			240	160	140.7	59%		0.0	36.0	OK	
3	ZERQA	30	30	30	40		130	90	86.9	67%	49%	0.0	18.8	OK	
3	ZERQA TR5	63					63	0	16.0	25%		16.0	27.0	OK	
3	New ZERQA	80	80	80			240	160	41.7	17%		0.0	36.0	OK	
3	DHULEIL	80	80				160	80	80.3	50%		0.3	23.1	OK	
4	CITY CENTER	80	80	80			240	160	161.5	67%		1.5	111.6	OK	
4	MARQA	45	63	80			188	108	132.1	70%	74%	24.1	49.5	OK	
4	TAREQ	80	80	80			240	160	197.8	82%		37.8	80.2	OK	
5	BAYADER	80	80	80			240	160	193.1	80%		33.1	79.2	OK	
5	New BAYDER	80	80				160	80	98.9	62%		18.9	24.0	OK	
5	SALT	80	80	80			240	160	202.5	84%	78%	42.5	29.5	No	
5	UNIVERSITY	80	80	80			240	160	227.6	95%		67.6	85.2	OK	
5	SUBEIHI	63	63	63			189	126	111.8	59%		0.0	5.2	OK	
6	QAIA	45	45				90	45	19.4	22%		0.0	24.5	OK	
6	QAIA New	80	80				160	80	98.0	61%	58%	18.0	24.0	OK	
6	MADABA SOUTH	80	80	80			240	160	164.4	69%		4.4	35.0	OK	
									Average		66%				

*FUHEIS, HASHIMIYA and MWQAR IND are excluded due to an exclusive use for large industries.

ii) After countermeasures

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2019		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	ABDOON	80	80	80			240	160	199.3	83%		39.3	48.0	OK	
1	AMMAN S	45	45	45			135	90	106.2	79%	77%	16.2	41.6	OK	
1	AMMAN S NEW	80	80				160	80	117.6	74%		37.6	63.2	OK	To Manara 20%(32MVA)
1	ASHRFIA	63	63				126	63	88.5	70%		25.5	51.3	OK	To Manara 20%(25.2MVA)
2	MANARAH	80	80	80			240	160	126.3	53%		0.0	49.0	OK	From Amman S New and Ashrafia
2	SAHAB	63	63	63			189	126	118.6	63%	59%	0.0	25.0	OK	To Muwaqar 20%(37.8MVA)
2	MWQAR	80	80				160	80	101.2	63%		21.2	24.0	OK	From Sahab
3	ABDALI	40	40	40			120	80	84.1	70%		4.1	18.0	OK	
3	ABDALI NEW	80	80				160	80	98.1	61%		18.1	25.0	OK	
3	HIZAM	80	80	80			240	160	140.7	59%		0.0	36.0	OK	
3	ZERQA	30	30	30	40		130	90	86.9	67%	49%	0.0	18.8	OK	
3	ZERQA TR5	63					63	0	16.0	25%		16.0	27.0	OK	
3	New ZERQA	80	80	80			240	160	41.7	17%		0.0	36.0	OK	
3	DHULEIL	80	80				160	80	80.3	50%		0.3	23.1	OK	
4	CITY CENTER	80	80	80			240	160	185.5	77%		25.5	111.6	OK	From University
4	MARQA	45	63	80			188	108	132.1	70%	77%	24.1	49.5	OK	
4	TAREQ	80	80	80			240	160	197.8	82%		37.8	80.2	OK	
5	BAYADER	80	80	80			240	160	202.7	84%		42.7	79.2	OK	From Salt
5	New BAYDER	80	80				160	80	103.7	65%		23.7	24.0	OK	From Salt
5	SALT	80	80	80			240	160	188.1	78%	76%	28.1	29.5	OK	To Bayader and New Bayader 6%(14.4MVA)
5	UNIVERSITY	80	80	80			240	160	203.6	85%		43.6	85.2	OK	To City Center 10%(24MVA)
5	SUBEIHI	63	63	63			189	126	111.8	59%		0.0	5.2	OK	
6	QAIA	45	45				90	45	19.4	22%		0.0	24.5	OK	
6	QAIA New	80	80				160	80	98.0	61%	58%	18.0	24.0	OK	
6	MADABA SOUTH	80	80	80			240	160	164.4	69%		4.4	35.0	OK	
									Average		66%				

*FUHEIS, HASHIMIYA and MWQAR IND are excluded due to an exclusive use for large industries.

Source: JICA Study Team

Table 5 BSP Analysis by the BSP Grouping Method for JEPCO in 2020

i) No countermeasure

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2020		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	ABDOON	80	80	80			240	160	209.6	87%		49.6	48.0	No	
1	AMMAN S	45	45	45			135	90	111.7	83%	81%	21.7	41.6	OK	
1	AMMAN S NEW	80	80				160	80	123.7	77%		43.7	63.2	OK	
1	ASHRFIA	63	63				126	63	88.5	70%		25.5	51.3	OK	
2	MANARAH	80	80	80			240	160	133.0	55%		0.0	49.0	OK	
2	SAHAB	63	63	63			189	126	121.2	64%	61%	0.0	25.0	OK	
2	MWQAR	80	80				160	80	107.5	67%		27.5	24.0	No	
3	ABDALI	40	40	40			120	80	88.6	74%		8.6	18.0	OK	
3	ABDALI NEW	80	80				160	80	103.3	65%		23.3	25.0	OK	
3	HIZAM	80	80	80			240	160	148.3	62%		0.0	36.0	OK	
3	ZERQA	30	30	30	40		130	90	91.8	71%	52%	1.8	18.8	OK	
3	ZERQA TR5	63					63	0	16.9	27%		16.9	27.0	OK	
3	New ZERQA	80	80	80			240	160	44.0	18%		0.0	36.0	OK	
3	DHULEIL	80	80				160	80	86.2	54%		6.2	23.1	OK	
4	CITY CENTER	80	80	80			240	160	196.0	82%		36.0	111.6	OK	
4	MARQA	45	63	80			188	108	131.4	70%	80%	23.4	49.5	OK	
4	TAREQ	80	80	80			240	160	205.7	86%		45.7	80.2	OK	
5	BAYADER	80	80	80			240	160	213.2	89%		53.2	79.2	OK	
5	New BAYDER	80	80				160	80	109.1	68%		29.1	24.0	No	
5	SALT	80	80	80			240	160	203.8	85%	80%	43.8	29.5	No	
5	UNIVERSITY	80	80	80			240	160	216.3	90%		56.3	85.2	OK	
5	SUBEIHI	63	63	63			189	126	115.4	61%		0.0	5.2	OK	
6	QAIA	45	45				90	45	21.0	23%		0.0	24.5	OK	
6	QAIA New	80	80				160	80	106.5	67%	61%	26.5	24.0	No	
6	MADABA SOUTH	80	80	80			240	160	173.4	72%		13.4	35.0	OK	
									Average		69%				

*FUHEIS, HASHIMIYA and MWQAR IND are excluded due to an exclusive use for large industries.

ii) After countermeasures

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2020		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	ABDOON	80	80	80			240	160	190.4	79%		30.4	48.0	OK	To Ashrafia 8%(19.2MVA)
1	AMMAN S	45	45	45			135	90	111.7	83%	81%	21.7	41.6	OK	
1	AMMAN S NEW	80	80				160	80	123.7	77%		43.7	63.2	OK	
1	ASHRFIA	63	63				126	63	107.7	85%		44.7	51.3	OK	From Abdoon
2	MANARAH	80	80	80			240	160	149.0	62%		0.0	49.0	OK	From Muwaqar
2	SAHAB	63	63	63			189	126	121.2	64%	61%	0.0	25.0	OK	
2	MWQAR	80	80				160	80	91.5	57%		11.5	24.0	OK	To Manarah 10%(16MVA)
3	ABDALI	40	40	40			120	80	88.6	74%		8.6	18.0	OK	
3	ABDALI NEW	80	80				160	80	103.3	65%		23.3	25.0	OK	
3	HIZAM	80	80	80			240	160	148.3	62%		0.0	36.0	OK	
3	ZERQA	30	30	30	40		130	90	91.8	71%	52%	1.8	18.8	OK	
3	ZERQA TR5	63					63	0	16.9	27%		16.9	27.0	OK	
3	New ZERQA	80	80	80			240	160	44.0	18%		0.0	36.0	OK	
3	DHULEIL	80	80				160	80	86.2	54%		6.2	23.1	OK	
4	CITY CENTER	80	80	80			240	160	196.0	82%		36.0	111.6	OK	
4	MARQA	45	63	80			188	108	131.4	70%	80%	23.4	49.5	OK	
4	TAREQ	80	80	80			240	160	205.7	86%		45.7	80.2	OK	
5	BAYADER	80	80	80			240	160	198.8	83%		38.8	79.2	OK	
5	New BAYDER	80	80	80			240	159	181.1	75%		22.1	36.0	OK	Addition of 80MVA transformer
5	SALT	80	80	80			240	160	167.8	70%	75%	7.8	29.5	OK	
5	UNIVERSITY	80	80	80			240	160	194.7	81%		34.7	85.2	OK	
5	SUBEIHI	63	63	63			189	126	115.4	61%		0.0	5.2	OK	
6	QAIA	45	45				90	45	21.0	23%		0.0	24.5	OK	
6	QAIA New	80	80	80			240	80	106.5	44%	53%	26.5	36.0	OK	Addition of 80MVA transformer
6	MADABA SOUTH	80	80	80			240	160	173.4	72%		13.4	35.0	OK	
									Average		67%				

*FUHEIS, HASHIMIYA and MWQAR IND are excluded due to an exclusive use for large industries.

Source: JICA Study Team

Table 6 BSP Analysis by the BSP Grouping Method for JEPCO in 2021

i) No countermeasure

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2021		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	ABDOON	80	80	80			240	160	204.5	85%		44.5	48.0	OK	
1	AMMAN S	45	45	45			135	90	119.7	89%	86%	29.7	41.6	OK	
1	AMMAN S NEW	80	80				160	80	132.6	83%		52.6	63.2	OK	
1	ASHRFIA	63	63				126	63	110.7	88%		47.7	51.3	OK	
2	MANARAH	80	80	80			240	160	162.5	68%		2.5	49.0	OK	
2	SAHAB	63	63	63			189	126	126.4	67%	66%	0.4	25.0	OK	
2	MWQAR	80	80				160	80	96.9	61%		16.9	24.0	OK	
3	ABDALI	40	40	40			120	80	95.2	79%		15.2	18.0	OK	
3	ABDALI NEW	80	80				160	80	110.9	69%		30.9	25.0	No	
3	HIZAM	80	80	80			240	160	156.2	65%		0.0	36.0	OK	
3	ZERQA	30	30	30	40		130	90	98.2	76%	56%	8.2	18.8	OK	
3	ZERQA TR5	63					63	0	18.1	29%		18.1	27.0	OK	
3	New ZERQA	80	80	80			240	160	47.1	20%		0.0	36.0	OK	
3	DHULEIL	80	80				160	80	93.5	58%		13.5	23.1	OK	
4	CITY CENTER	80	80	80			240	160	212.4	88%		52.4	111.6	OK	
4	MARQA	45	63	80			188	108	133.5	71%	85%	25.5	49.5	OK	
4	TAREQ	80	80	80			240	160	219.1	91%		59.1	80.2	OK	
5	BAYADER	80	80	80			240	160	213.1	89%		53.1	79.2	OK	
5	New BAYDER	80	80	80			240	160	194.1	81%		34.1	36.0	OK	
5	SALT	80	80	80			240	160	185.1	77%	80%	25.1	29.5	OK	
5	UNIVERSITY	80	80	80			240	160	210.3	88%		50.3	85.2	OK	
5	SUBEIHI	63	63	63			189	126	119.0	63%		0.0	5.2	OK	
6	QAIA	45	45				90	45	23.1	26%		0.0	24.5	OK	
6	QAIA New	80	80	80			240	160	117.0	49%	57%	0.0	36.0	OK	
6	MADABA SOUTH	80	80	80			240	160	186.2	78%		26.2	35.0	OK	
									Average		72%				

*FUHEIS, HASHIMIYA and MWQAR IND are excluded due to an exclusive use for large industries.

ii) After countermeasures

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2021		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	ABDOON	80	80	80			240	160	204.5	85%		44.5	48.0	OK	
1	AMMAN S	45	45	45			135	90	119.7	89%	86%	29.7	41.6	OK	
1	AMMAN S NEW	80	80				160	80	132.6	83%		52.6	63.2	OK	
1	ASHRFIA	63	63				126	63	110.7	88%		47.7	51.3	OK	
2	MANARAH	80	80	80			240	160	162.5	68%		2.5	49.0	OK	
2	SAHAB	63	63	63			189	126	126.4	67%	66%	0.4	25.0	OK	
2	MWQAR	80	80				160	80	96.9	61%		16.9	24.0	OK	
3	ABDALI	40	40	40			120	80	95.2	79%		6.1	43.0	OK	Linkling of 33kV buses of Abdali and Abdali New
3	ABDALI NEW	80	80				160	80	110.9	69%					
3	HIZAM	80	80	80			240	160	156.2	65%		0.0	36.0	OK	
3	ZERQA	30	30	30	40		130	90	98.2	76%	56%	8.2	18.8	OK	
3	ZERQA TR5	63					63	0	18.1	29%		18.1	27.0	OK	
3	New ZERQA	80	80	80			240	160	47.1	20%		0.0	36.0	OK	
3	DHULEIL	80	80				160	80	93.5	58%		13.5	23.1	OK	
4	CITY CENTER	80	80	80			240	160	212.4	88%		52.4	111.6	OK	
4	MARQA	45	63	80			188	108	157.3	84%	85%	49.3	49.5	OK	From Tareq
4	TAREQ	80	80	80			240	160	195.4	81%		35.4	80.2	OK	To Marqa 10%(23.8MVA)
5	BAYADER	80	80	80			240	160	213.1	89%		53.1	79.2	OK	
5	New BAYDER	80	80	80			240	160	194.1	81%		34.1	36.0	OK	
5	SALT	80	80	80			240	160	185.1	77%	80%	25.1	29.5	OK	
5	UNIVERSITY	80	80	80			240	160	210.3	88%		50.3	85.2	OK	
5	SUBEIHI	63	63	63			189	126	119.0	63%		0.0	5.2	OK	
6	QAIA	45	45				90	45	23.1	26%		0.0	24.5	OK	
6	QAIA New	80	80	80			240	160	117.0	49%	57%	0.0	36.0	OK	
6	MADABA SOUTH	80	80	80			240	160	186.2	78%		26.2	35.0	OK	
									Average		72%				

*FUHEIS, HASHIMIYA and MWQAR IND are excluded due to an exclusive use for large industries.

Source: JICA Study Team

Table 7 BSP Analysis by the BSP Grouping Method for JEPCO in 2022

i) No countermeasure

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis: Peak Demand 2022 [MVA]	Normal State Analysis: Peak Demand 2022 %	Normal State Analysis: Group Operating rate (%)	Contingency State Analysis: Load Transfer MVA Necessary for N-1 Observation	Contingency State Analysis: Possible Load Transfer MVA	Contingency State Analysis: N-1 Observation Check	Contingency State Analysis: Load Transfer between BSPs
1	ABDOON	80	80	80	0	0	240	160	213.9	89%		53.9	48.0	No	
1	AMMAN S	45	45	45	0	0	135	90	125.2	93%	89%	35.2	41.6	OK	
1	AMMAN S NEW	80	80	0	0	0	160	80	138.6	87%		58.6	63.2	OK	
1	ASHRFIA	63	63	0	0	0	126	63	110.7	88%		47.7	51.3	OK	
2	MANARAH	80	80	80	0	0	240	160	171.6	71%		11.6	49.0	OK	
2	SAHAB	63	63	63	0	0	189	126	128.1	68%	68%	2.1	25.0	OK	
2	MWQAR	80	80	0	0	0	160	80	102.3	64%		22.3	24.0	OK	
3	ABDALI	40	40	40	0	0	120	80	99.3	83%		15.1	43.0	OK	
3	ABDALI NEW	80	80	0	0	0	160	80	115.8	72%					
3	HIZAM	80	80	80	0	0	240	160	164.5	69%		4.5	36.0	OK	
3	ZERQA	30	30	30	40	0	130	90	102.5	79%	58%	12.5	18.8	OK	
3	ZERQA TR5	63	0	0	0	0	63	0	18.9	30%		18.9	27.0	OK	
3	New ZERQA	80	80	80	0	0	240	160	49.2	20%		0.0	36.0	OK	
3	DHULEIL	80	80	0	0	0	160	80	100.8	63%		20.8	23.1	OK	
4	CITY CENTER	80	80	80	0	0	240	160	224.0	93%		64.0	111.6	OK	
4	MARQA	45	63	80	0	0	188	108	156.5	83%	87%	48.5	49.5	OK	
4	TAREQ	80	80	80	0	0	240	160	202.4	84%		42.4	80.2	OK	
5	BAYADER	80	80	80	0	0	240	160	222.9	93%		62.9	79.2	OK	
5	New BAYDER	80	80	80	0	0	240	160	203.0	85%		43.0	36.0	No	
5	SALT	80	80	80	0	0	240	160	198.7	83%	84%	38.7	29.5	No	
5	UNIVERSITY	80	80	80	0	0	240	160	221.8	92%		61.8	85.2	OK	
5	SUBEIHI	63	63	63	0	0	189	126	122.6	65%		0.0	5.2	OK	
6	QAIA	45	45	0	0	0	90	45	24.9	28%		0.0	24.5	OK	
6	QAIA New	80	80	80	0	0	240	160	126.2	53%	61%	0.0	36.0	OK	
6	MADABA SOUTH	80	80	80	0	0	240	160	194.0	81%		34.0	35.0	OK	
									Average		75%				

*FUHEIS, HASHIMIYA and MWQAR IND are excluded due to an exclusive use for large industries.

ii) After countermeasures

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis: Peak Demand 2022 [MVA]	Normal State Analysis: Peak Demand 2022 %	Normal State Analysis: Group Operating rate (%)	Contingency State Analysis: Load Transfer MVA Necessary for N-1 Observation	Contingency State Analysis: Possible Load Transfer MVA	Contingency State Analysis: N-1 Observation Check	Contingency State Analysis: Load Transfer between BSPs
1	ABDOON	80	80	80	0	0	240	160	165.9	69%		5.9	48.0	OK	
1	AMMAN S	45	45	45	0	0	135	90	98.2	73%		8.2	41.6	OK	
1	AMMAN S NEW	80	80	0	0	0	160	80	114.6	72%	65%	34.6	63.2	OK	
1	New BSP	80	80	80			240	160	117.9	49%		0.0	36.0	OK	New BSP
1	ASHRFIA	63	63	0	0	0	126	63	91.8	73%		28.8	51.3	OK	
2	MANARAH	80	80	80	0	0	240	160	171.6	71%		11.6	49.0	OK	
2	SAHAB	63	63	63	0	0	189	126	128.1	68%	68%	2.1	25.0	OK	
2	MWQAR	80	80	0	0	0	160	80	102.3	64%		22.3	24.0	OK	
3	ABDALI	40	40	40	0	0	120	80	99.3	83%		15.1	43.0	OK	
3	ABDALI NEW	80	80	0	0	0	160	80	115.8	72%					
3	HIZAM	80	80	80	0	0	240	160	164.5	69%		4.5	36.0	OK	
3	ZERQA	30	30	30	40	0	130	90	102.5	79%	58%	12.5	18.8	OK	
3	ZERQA TR5	63	0	0	0	0	63	0	18.9	30%		18.9	27.0	OK	
3	New ZERQA	80	80	80	0	0	240	160	49.2	20%		0.0	36.0	OK	
3	DHULEIL	80	80	0	0	0	160	80	100.8	63%		20.8	23.1	OK	
4	CITY CENTER	80	80	80	0	0	240	160	212.0	88%		52.0	111.6	OK	To Tareq 5% (12MVA)
4	MARQA	45	63	80	0	0	188	108	156.5	83%	87%	48.5	49.5	OK	
4	TAREQ	80	80	80	0	0	240	160	214.4	89%		54.4	80.2	OK	From City Center
5	BAYADER	80	80	80	0	0	240	160	174.9	73%		14.9	79.2	OK	To New BSP
5	New BAYDER	80	80	80	0	0	240	160	167.0	70%		7.0	36.0	OK	To New BSP
5	SALT	80	80	80	0	0	240	160	167.5	70%	70%	7.5	29.5	OK	To New BSP
5	UNIVERSITY	80	80	80	0	0	240	160	173.8	72%		13.8	85.2	OK	To New BSP
5	New BSP	80	80	80			240	160	163.2	68%		3.2	36.0	OK	New BSP
5	SUBEIHI	63	63	63	0	0	189	126	122.6	65%		0.0	29.5	OK	
6	QAIA	45	45	0	0	0	90	45	24.9	28%		0.0	24.5	OK	
6	QAIA New	80	80	80	0	0	240	160	126.2	53%	61%	0.0	36.0	OK	
6	MADABA SOUTH	80	80	80	0	0	240	160	194.0	81%		34.0	35.0	OK	
									Average		68%				

*FUHEIS, HASHIMIYA and MWQAR IND are excluded due to an exclusive use for large industries.

Source: JICA Study Team

Table 8 BSP Analysis by the BSP Grouping Method for JEPCO in 2023

i) No countermeasure

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2023		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	ABDOON	80	80	80	0	0	240	160	176.9	74%		16.9	48.0	OK	
1	AMMAN S	45	45	45	0	0	135	90	105.2	78%		15.2	41.6	OK	
1	AMMAN S NEW	80	80	0	0	0	160	80	122.8	77%	69%	42.8	63.2	OK	
1	New BSP	80	80	80	0	0	240	160	126.4	53%		0.0	36.0	OK	
1	ASHRFIA	63	63	0	0	0	126	63	94.3	75%		31.3	51.3	OK	
2	MANARAH	80	80	80	0	0	240	160	185.1	77%		25.1	49.0	OK	
2	SAHAB	63	63	63	0	0	189	126	133.3	71%	72%	7.3	25.0	OK	
2	MWQAR	80	80	0	0	0	160	80	107.7	67%		27.7	24.0	No	
3	ABDALI	40	40	40	0	0	120	80	106.5	89%		30.8	43.0	OK	
3	ABDALI NEW	80	80	0	0	0	160	80	124.2	78%					
3	HIZAM	80	80	80	0	0	240	160	173.3	72%		13.3	36.0	OK	
3	ZERQA	30	30	30	40	0	130	90	110.0	85%	63%	20.0	18.8	No	
3	ZERQA TR5	63	0	0	0	0	63	0	20.3	32%		20.3	27.0	OK	
3	New ZERQA	80	80	80	0	0	240	160	52.8	22%		0.0	36.0	OK	
3	DHULEIL	80	80	0	0	0	160	80	109.5	68%		29.5	23.1	No	
4	CITY CENTER	80	80	80	0	0	240	160	229.7	96%		69.7	111.6	OK	
4	MARQA	45	63	80	0	0	188	108	159.0	85%	92%	51.0	49.5	No	
4	TAREQ	80	80	80	0	0	240	160	227.1	95%		67.1	80.2	OK	
5	BAYADER	80	80	80	0	0	240	160	187.3	78%		27.3	79.2	OK	
5	New BAYDER	80	80	80	0	0	240	160	178.9	75%		18.9	36.0	OK	
5	SALT	80	80	80	0	0	240	160	184.7	77%		24.7	29.5	OK	
5	UNIVERSITY	80	80	80	0	0	240	160	188.0	78%	75%	28.0	85.2	OK	
5	New BSP	80	80	80	0	0	240	160	176.5	74%		16.5	36.0	OK	
5	SUBEIHI	63	63	63	0	0	189	126	129.8	69%		3.8	29.5	OK	
6	QAIA	45	45	0	0	0	90	45	27.4	30%		0.0	24.5	OK	
6	QAIA New	80	80	80	0	0	240	160	138.9	58%	66%	0.0	36.0	OK	
6	MADABA SOUTH	80	80	80	0	0	240	160	208.1	87%		48.1	35.0	No	
									Average		73%				

*FUHEIS, HASHIMIYA and MWQAR IND are excluded due to an exclusive use for large industries.

ii) After countermeasures

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2023		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	ABDOON	80	80	80	0	0	240	160	176.9	74%		16.9	48.0	OK	
1	AMMAN S	45	45	45	0	0	135	90	105.2	78%		15.2	41.6	OK	
1	AMMAN S NEW	80	80	0	0	0	160	80	122.8	77%	69%	42.8	63.2	OK	
1	New BSP	80	80	80	0	0	240	160	126.4	53%		0.0	36.0	OK	
1	ASHRFIA	63	63	0	0	0	126	63	94.3	75%		31.3	51.3	OK	
2	MANARAH	80	80	80	0	0	240	160	173.1	72%		13.1	49.0	OK	To Mwaqar
2	SAHAB	63	63	63	0	0	189	126	133.3	71%	64%	7.3	25.0	OK	
2	MWQAR	80	80	80	0	0	240	160	119.7	50%		0.0	36.0	OK	Addition of 80MVA transformer
3	ABDALI	40	40	40	0	0	120	80	106.5	89%		30.8	43.0	OK	
3	ABDALI NEW	80	80	0	0	0	160	80	124.2	78%					
3	HIZAM	80	80	80	0	0	240	160	173.3	72%		13.3	36.0	OK	
3	ZERQA	30	30	30	40	0	130	90	110.0	85%	63%	24.3	45.8	OK	Linkling of 33kV buses of Zarqa and Zarqa TR5
3	ZERQA TR5	63	0	0	0	0	63	0	44.3	70%					From Dhuleil
3	New ZERQA	80	80	80	0	0	240	160	52.8	22%		0.0	36.0	OK	
3	DHULEIL	80	80	0	0	0	160	80	85.5	53%		5.5	23.1	OK	To Zerqa TR5 15%(24MVA)
4	CITY CENTER	80	80	80	0	0	240	160	181.7	76%		21.7	111.6	OK	
4	MARQA	45	63	80	0	0	188	108	130.8	70%		22.8	49.5	OK	
4	New BSP	80	80	80			240	160	112.2	47%	68%	0.0	36.0	OK	New BSP
4	TAREQ	80	80	80	0	0	240	160	191.1	80%		31.1	80.2	OK	
5	BAYADER	80	80	80	0	0	240	160	187.3	78%		27.3	79.2	OK	
5	New BAYDER	80	80	80	0	0	240	160	178.9	75%		18.9	36.0	OK	
5	SALT	80	80	80	0	0	240	160	184.7	77%		24.7	29.5	OK	
5	UNIVERSITY	80	80	80	0	0	240	160	188.0	78%	75%	28.0	85.2	OK	
5	New BSP	80	80	80	0	0	240	160	176.5	74%		16.5	36.0	OK	
5	SUBEIHI	63	63	63	0	0	189	126	129.8	69%		3.8	29.5	OK	
6	QAIA	45	45	0	0	0	90	45	27.4	30%		0.0	24.5	OK	
6	QAIA New	80	80	80	0	0	240	160	167.7	70%	66%	7.7	36.0	OK	From Madaba south
6	MADABA SOUTH	80	80	80	0	0	240	160	179.3	75%		19.3	35.0	OK	To QAIA New
									Average		67%				

*FUHEIS, HASHIMIYA and MWQAR IND are excluded due to an exclusive use for large industries.

Source: JICA Study Team

Table 9 BSP Analysis by the BSP Grouping Method for JEPCO in 2024

i) No countermeasure

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2024		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	ABDOON	80	80	80	0	0	240	160	189.6	79%		29.6	48.0	OK	
1	AMMAN S	45	45	45	0	0	135	90	112.8	84%		22.8	41.6	OK	
1	AMMAN S NEW	80	80	0	0	0	160	80	131.7	82%	74%	51.7	63.2	OK	
1	New BSP	80	80	80	0	0	240	160	135.4	56%		0.0	36.0	OK	
1	ASHRFIA	63	63	0	0	0	126	63	96.8	77%		33.8	51.3	OK	
2	MANARAH	80	80	80	0	0	240	160	187.2	78%		27.2	49.0	OK	
2	SAHAB	63	63	63	0	0	189	126	138.5	73%	68%	12.5	25.0	OK	
2	MWQAR	80	80	80	0	0	240	160	128.7	54%		0.0	36.0	OK	
3	ABDALI	40	40	40	0	0	120	80	113.8	95%		46.4	43.0	No	
3	ABDALI NEW	80	80	0	0	0	160	80	132.7	83%					
3	HIZAM	80	80	80	0	0	240	160	182.6	76%		22.6	36.0	OK	
3	ZERQA	30	30	30	40	0	130	90	117.5	90%	67%	34.8	45.8	OK	
3	ZERQA TR5	63	0	0	0	0	63	0	47.3	75%					
3	New ZERQA	80	80	80	0	0	240	160	56.4	23%		0.0	36.0	OK	
3	DHULEIL	80	80	0	0	0	160	80	93.5	58%		13.5	23.1	OK	
4	CITY CENTER	80	80	80	0	0	240	160	196.5	82%		36.5	111.6	OK	
4	MARQA	45	63	80	0	0	188	108	132.8	71%	71%	24.8	49.5	OK	
4	New BSP	80	80	80	0	0	240	160	114.0	47%		0.0	36.0	OK	
4	TAREQ	80	80	80	0	0	240	160	202.7	84%		42.7	80.2	OK	
5	BAYADER	80	80	80	0	0	240	160	200.3	83%		40.3	79.2	OK	
5	New BAYDER	80	80	80	0	0	240	160	191.3	80%		31.3	36.0	OK	
5	SALT	80	80	80	0	0	240	160	203.4	85%	80%	43.4	29.5	No	
5	UNIVERSITY	80	80	80	0	0	240	160	203.5	85%		43.5	85.2	OK	
5	NEW BSP	80	80	80	0	0	240	160	181.4	76%		21.4	36.0	OK	
5	SUBEIHI	63	63	63	0	0	189	126	133.4	71%		7.4	29.5	OK	
6	QAIA	45	45	0	0	0	90	45	30.2	34%		0.0	24.5	OK	
6	QAIA New	80	80	80	0	0	240	160	184.7	77%	71%	24.7	36.0	OK	
6	MADABA SOUTH	80	80	80	0	0	240	160	192.6	80%		32.6	35.0	OK	
									Average		72%				

*FUHEIS, HASHIMIYA and MWQAR IND are excluded due to an exclusive use for large industries.

ii) After countermeasures

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2024		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	ABDOON	80	80	80	0	0	240	160	189.6	79%		29.6	48.0	OK	
1	AMMAN S	45	45	45	0	0	135	90	112.8	84%		22.8	41.6	OK	
1	AMMAN S NEW	80	80	0	0	0	160	80	131.7	82%	74%	51.7	63.2	OK	
1	New BSP	80	80	80	0	0	240	160	135.4	56%		0.0	36.0	OK	
1	ASHRFIA	63	63	0	0	0	126	63	96.8	77%		33.8	51.3	OK	
2	MANARAH	80	80	80	0	0	240	160	187.2	78%		27.2	49.0	OK	
2	SAHAB	63	63	63	0	0	189	126	138.5	73%	68%	12.5	25.0	OK	
2	MWQAR	80	80	80	0	0	240	160	128.7	54%		0.0	36.0	OK	
3	ABDALI	40	40	40	0	0	120	80	101.8	85%		40.4	43.0	OK	To Hizam and Abdali New 10%(12MVA)
3	ABDALI NEW	80	80		0	0	160	80	138.7	87%					From Abdali
3	HIZAM	80	80	80	0	0	240	160	188.6	79%		28.6	36.0	OK	From Abdali
3	ZERQA	30	30	30	40	0	130	90	111.0	85%	67%	34.8	45.8	OK	To ZerqaTR5 5%(6.5MVA)
3	ZERQA TR5	63	0	0	0	0	63	0	53.8	85%					
3	New ZERQA	80	80	80	0	0	240	160	56.4	23%		0.0	36.0	OK	
3	DHULEIL	80	80	0	0	0	160	80	93.5	58%		13.5	23.1	OK	
4	CITY CENTER	80	80	80	0	0	240	160	196.5	82%		36.5	111.6	OK	
4	MARQA	45	63	80	0	0	188	108	132.8	71%	71%	24.8	49.5	OK	
4	New BSP	80	80	80	0	0	240	160	114.0	47%		0.0	36.0	OK	
4	TAREQ	80	80	80	0	0	240	160	202.7	84%		42.7	80.2	OK	
5	BAYADER	80	80	80	0	0	240	160	200.3	83%		40.3	79.2	OK	
5	New BAYDER	80	80	80	0	0	240	160	191.3	80%		31.3	36.0	OK	
5	SALT	80	80	80	0	0	240	160	167.4	70%	77%	7.4	29.5	OK	
5	UNIVERSITY	80	80	80	0	0	240	160	203.5	85%		43.5	85.2	OK	
5	NEW BSP	80	80	80	0	0	240	160	181.4	76%		21.4	36.0	OK	
5	SUBEIHI	80	80	80	0	0	240	160	169.4	71%		9.4	29.5	OK	Reinforcement(189→240MVA)
6	QAIA	45	45	0	0	0	90	45	30.2	34%		0.0	24.5	OK	
6	QAIA New	80	80	80	0	0	240	160	184.7	77%	71%	24.7	36.0	OK	
6	MADABA SOUTH	80	80	80	0	0	240	160	192.6	80%		32.6	35.0	OK	
									Average		71%				

*FUHEIS, HASHIMIYA and MWQAR IND are excluded due to an exclusive use for large industries.

Source: JICA Study Team

Table 10 BSP Analysis by the BSP Grouping Method for JEPCO in 2025

i) No countermeasure

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2025		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	ABDOON	80	80	80	0	0	240	160	197.9	82%		37.9	48.0	OK	
1	AMMAN S	45	45	45	0	0	135	90	117.5	87%		27.5	41.6	OK	
1	AMMAN S NEW	80	80	0	0	0	160	80	137.2	86%	77%	57.2	63.2	OK	
1	New BSP	80	80	80	0	0	240	160	141.2	59%		0.0	36.0	OK	
1	ASHRFIA	63	63	0	0	0	126	63	96.8	77%		33.8	51.3	OK	
2	MANARAH	80	80	80	0	0	240	160	197.0	82%		37.0	49.0	OK	
2	SAHAB	63	63	63	0	0	189	126	141.1	75%	71%	15.1	25.0	OK	
2	MWQAR	80	80	80	0	0	240	160	134.7	56%		0.0	36.0	OK	
3	ABDALI	40	40	40	0	0	120	80	106.4	89%		26.4	18.0	No	
3	ABDALI NEW	80	80	0	0	0	160	80	145.0	91%		65.0	25.0	No	
3	HIZAM	80	80	80	0	0	240	160	198.6	83%		38.6	36.0	No	
3	ZERQA	30	30	30	40	0	130	90	116.1	89%	70%	42.3	45.8	OK	
3	ZERQA TR5	63	0	0	0	0	63	0	56.2	89%					
3	New ZERQA	80	80	80	0	0	240	160	58.9	25%		0.0	36.0	OK	
3	DHULEIL	80	80	0	0	0	160	80	99.2	62%		19.2	23.1	OK	
4	CITY CENTER	80	80	80	0	0	240	160	207.0	86%		47.0	111.6	OK	
4	MARQA	45	63	80	0	0	188	108	130.8	70%	73%	22.8	49.5	OK	
4	New BSP	80	80	80			240	160	117.5	49%		0.0	36.0	OK	
4	TAREQ	80	80	80	0	0	240	160	209.0	87%		49.0	80.2	OK	
5	BAYADER	80	80	80	0	0	240	160	209.2	87%		49.2	79.2	OK	
5	New BAYDER	80	80	80	0	0	240	160	199.8	83%		39.8	36.0	No	
5	SALT	80	80	80	0	0	240	160	179.4	75%	81%	19.4	39.5	OK	
5	UNIVERSITY	80	80	80	0	0	240	160	214.4	89%		54.4	85.2	OK	
5	NEW BSP	80	80	80			240	160	191.2	80%		31.2	36.0	OK	
5	SUBEIHI	80	80	80	0	0	240	160	174.0	72%		14.0	39.5	OK	
6	QAIA	45	45	0	0	0	90	45	32.5	36%		0.0	24.5	OK	
6	QAIA New	80	80	80	0	0	240	160	198.3	83%	76%	38.3	36.0	No	
6	MADABA SOUTH	80	80	80	0	0	240	160	200.3	83%		40.3	35.0	No	
									Average		75%				

*FUHEIS, HASHIMIYA and MWQAR IND are excluded due to an exclusive use for large industries.

ii) After countermeasures

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2025		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	ABDOON	80	80	80	0	0	240	160	197.9	82%		37.9	48.0	OK	
1	AMMAN S	45	45	45	0	0	135	90	117.5	87%		27.5	41.6	OK	
1	AMMAN S NEW	80	80	0	0	0	160	80	137.2	86%	77%	57.2	63.2	OK	
1	New BSP	80	80	80	0	0	240	160	141.2	59%		0.0	36.0	OK	
1	ASHRFIA	63	63	0	0	0	126	63	96.8	77%		33.8	51.3	OK	
2	MANARAH	80	80	80	0	0	240	160	197.0	82%		37.0	49.0	OK	
2	SAHAB	63	63	63	0	0	189	126	141.1	75%	71%	15.1	25.0	OK	
2	MWQAR	80	80	80	0	0	240	160	134.7	56%		0.0	36.0	OK	
3	ABDALI	40	40	40	0	0	120	80	94.4	79%		14.4	18.0	OK	To Abdali New
3	ABDALI NEW	80	80	80	0	0	240	160	181.0	75%		21.0	25.0	OK	Addition of 80MVA transformer
3	HIZAM	80	80	80	0	0	240	160	174.6	73%		14.6	36.0	OK	To Abdali New
3	ZERQA	30	30	30	40	0	130	90	116.1	89%	65%	42.3	45.8	OK	
3	ZERQA TR5	63	0	0	0	0	63	0	56.2	89%					
3	New ZERQA	80	80	80	0	0	240	160	58.9	25%		0.0	36.0	OK	
3	DHULEIL	80	80	0	0	0	160	80	99.2	62%		19.2	23.1	OK	
4	CITY CENTER	80	80	80	0	0	240	160	207.0	86%		47.0	111.6	OK	
4	MARQA	45	63	80	0	0	188	108	130.8	70%	73%	22.8	49.5	OK	
4	New BSP	80	80	80	0	0	240	160	117.5	49%		0.0	36.0	OK	
4	TAREQ	80	80	80	0	0	240	160	209.0	87%		49.0	80.2	OK	
5	BAYADER	80	80	80	0	0	240	160	209.2	87%		8.9	115.2	OK	
5	New BAYDER	80	80	80	0	0	240	160	199.8	83%					
5	SALT	80	80	80	0	0	240	160	179.4	75%	81%	19.4	29.5	OK	
5	UNIVERSITY	80	80	80	0	0	240	160	214.4	89%		54.4	85.2	OK	
5	NEW BSP	80	80	80	0	0	240	160	191.2	80%		31.2	36.0	OK	
5	SUBEIHI	80	80	80	0	0	240	160	174.0	72%		14.0	29.5	OK	
6	QAIA	45	45	80	0	0	170	90	80.5	47%		0.0	24.5	OK	Addition of 80MVA transformer
6	QAIA New	80	80	80	0	0	240	160	174.3	73%	66%	14.3	36.0	OK	To QAIA
6	MADABA SOUTH	80	80	80	0	0	240	160	176.3	73%		16.3	35.0	OK	To QAIA
									Average		72%				

*FUHEIS, HASHIMIYA and MWQAR IND are excluded due to an exclusive use for large industries.

Source: JICA Study Team

(2) BSP Analysis for EDCO

Table 11 BSP Analysis by the BSP Grouping Method for EDCO in 2016

i) No countermeasure

BSP Grouping	BSP (Substation)	No. of TR's						Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
										Peak Demand 2016		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
										[MVA]	%					
1	AQ A2	40	40	63	63			206	143	69.7	34%		0.0	25.0	OK	
1	AQ IND	80	80					160	80	31.7	20%	23%	0.0	15.0	OK	
1	AQTH & NEW	63	63	80	80			286	206	46.3	16%		0.0	10.0	OK	
2	QUWEIRA	16	45					61	16	16.0	26%	27%	0.0	6.0	OK	
2	DESI	63	63					126	63	34.5	27%		0.0	6.0	OK	
3	EL_HASA	25	25					50	25	25.9	52%	39%	0.9	5.0	OK	
3	RASHADIA	16	40	40				96	56	31.0	32%		0.0	5.0	OK	
4	KARAK	16	16	25				57	32	45.4	80%	34%	13.4	10.0	No	
4	KARAK SOUTH	80	80					160	80	28.9	18%		0.0	10.0	OK	
5	SUBEIHI	63	63	63				189	126	122.1	65%		0.0	6.0	OK	
5	SWEIMEH	80	80	80				240	160	78.7	33%	55%	0.0	3.0	OK	
5	ISHTAFINA	40	45					85	40	67.8	80%		27.8	3.0	No	
5	WAQAS	63	63					126	63	85.1	68%		22.1	3.0	No	
99	QATRANA	10	10	16				36	20	19.7	55%	55%	0.0	0.0	OK	
99	GHORSAFI	40	40	40	40	40		200	160	60.4	30%	30%	0.0	0.0	OK	
99	MAAN	16	16	16	63	63		174	111	50.6	29%	29%	0.0	0.0	OK	
99	AZRAQ	25	25					50	25	16.2	32%	32%	0.0	0.0	OK	
99	SAFAWI	10						10	0	6.2	62%	62%	6.2	0.0	No	
99	RWESHID	10						10	0	4.3	43%	43%	4.3	0.0	No	
99	RESHA	12.5	12.5					25	12.5	3.8	15%	15%	0.0	0.0	OK	
										Average		37%				

ii) After countermeasures

BSP Grouping	BSP (Substation)	No. of TR's						Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
										Peak Demand 2016		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
										[MVA]	%					
1	AQ A2	40	40	63	63			206	143	69.7	34%		0.0	25.0	OK	
1	AQ IND	80	80					160	80	31.7	20%	23%	0.0	15.0	OK	
1	AQTH & NEW	63	63	80	80			286	206	46.3	16%		0.0	10.0	OK	
2	QUWEIRA	16	45					61	16	16.0	26%	27%	0.0	6.0	OK	
2	DESI	63	63					126	63	34.5	27%		0.0	6.0	OK	
3	EL_HASA	25	25					50	25	25.9	52%	39%	0.9	5.0	OK	
3	RASHADIA	16	40	40				96	56	31.0	32%		0.0	5.0	OK	
4	KARAK	16	16	25				57	32	35.4	62%	34%	3.4	10.0	OK	To Karak South 17.5%(10MVA)
4	KARAK SOUTH	80	80					160	80	38.8	24%		0.0	10.0	OK	From Karak
5	SUBEIHI	63	63	63				189	126	122.1	65%		0.0	6.0	OK	
5	SWEIMEH	80	80	80				240	160	78.7	33%	50%	0.0	3.0	OK	
5	ISHTAFINA	40	45	63				148	85	67.8	46%		0.0	3.0	OK	NEPCO Committed Project
5	WAQAS	63	63					126	63	85.1	68%		22.1	3.0	No	NEPCO Committed Project
99	QATRANA	10	10	16				36	20	19.7	55%	55%	0.0	0.0	OK	
99	GHORSAFI	40	40	40	40	40		200	160	60.4	30%	30%	0.0	0.0	OK	
99	MAAN	16	16	16	63	63		174	111	50.6	29%	29%	0.0	0.0	OK	
99	AZRAQ	25	25					50	25	16.2	32%	32%	0.0	0.0	OK	
99	SAFAWI	10						10	0	6.2	62%	62%	6.2	0.0	No	NEPCO Committed Project
99	RWESHID	10						10	0	4.3	43%	43%	4.3	0.0	No	NEPCO Committed Project
99	RESHA	12.5	12.5					25	12.5	3.8	15%	15%	0.0	0.0	OK	
										Average		37%				

Source: JICA Study Team

Table 12 BSP Analysis by the BSP Grouping Method for EDCO in 2017

i) No countermeasure

BSP Grouping	BSP (Substation)	No. of TR's	Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
					Peak Demand 2017		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
					[MVA]	%					
1	AQ A2	40 40 63 63	206	143	73.5	36%		0.0	25.0	OK	
1	AQ IND	80 80	160	80	33.4	21%	24%	0.0	15.0	OK	
1	AQTH & NEW	63 63 80 80	286	206	48.7	17%		0.0	10.0	OK	
2	QUWEIRA	16 45	61	16	16.9	28%	28%	0.9	6.0	OK	
2	DESI	63 63	126	63	36.4	29%		0.0	6.0	OK	
3	EL_HASA	25 25	50	25	27.3	55%	41%	2.3	5.0	OK	
3	RASHADIA	16 40 40	96	56	32.6	34%		0.0	5.0	OK	
4	KARAK	16 16 25	57	32	37.3	65%	36%	5.3	10.0	OK	
4	KARAK SOUTH	80 80	160	80	40.9	26%		0.0	10.0	OK	
5	SUBEIHI	63 63 63	189	126	128.6	68%		2.6	6.0	OK	
5	SWEIMEH	80 80 80	240	160	82.9	35%	53%	0.0	3.0	OK	
5	ISHTAFINA	40 45 63	148	85	71.4	48%		0.0	3.0	OK	
5	WAQAS	63 63	126	63	89.6	71%		26.6	3.0	No	
99	QATRANA	10 10 16	36	20	20.8	58%	55%	0.8	0.0	No	
99	GHORSAFI	40 40 40 40 40	200	160	63.6	32%	30%	0.0	0.0	OK	
99	MAAN	16 16 16 63 63	174	111	53.3	31%	31%	0.0	0.0	OK	
99	AZRAQ	25 25	50	25	17.1	34%	34%	0.0	0.0	OK	
99	SAFAWI	10	10	0	6.5	65%	65%	6.5	0.0	No	
99	RWESHID	10	10	0	4.5	45%	45%	4.5	0.0	No	
99	RESHA	12.5 12.5	25	12.5	4.0	16%	16%	0.0	0.0	OK	
					Average		38%				

ii) After countermeasures

BSP Grouping	BSP (Substation)	No. of TR's	Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
					Peak Demand 2017		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
					[MVA]	%					
1	AQ A2	40 40 63 63	206	143	73.5	36%		0.0	25.0	OK	
1	AQ IND	80 80	160	80	33.4	21%	24%	0.0	15.0	OK	
1	AQTH & NEW	63 63 80 80	286	206	48.7	17%		0.0	10.0	OK	
2	QUWEIRA	16 45	61	16	16.9	28%	28%	0.9	6.0	OK	
2	DESI	63 63	126	63	36.4	29%		0.0	6.0	OK	
3	EL_HASA	25 25	50	25	27.3	55%	0%	2.3	5.0	OK	
3	RASHADIA	16 40 40	96	56	32.6	34%		0.0	5.0	OK	
4	KARAK	16 16 25	57	32	37.3	65%	39%	5.3	10.0	OK	
4	KARAK SOUTH	80 80	160	80	50.9	32%		0.0	20.0	OK	From Qatrana
5	SUBEIHI	63 63 63	189	126	128.6	68%		2.6	6.0	OK	
5	SWEIMEH	80 80 80	240	160	82.9	35%	49%	0.0	3.0	OK	
5	ISHTAFINA	40 45 63	148	85	71.4	48%		0.0	3.0	OK	
5	WAQAS	63 63 63	189	126	89.6	47%		0.0	3.0	OK	NEPCO Committed Project
4	QATRANA	10 10 16	36	20	10.8	30%	-	0.0	10.0	OK	New Distribution line to Karak South
99	GHORSAFI	40 40 40 40 40	200	160	63.6	32%	32%	0.0	0.0	OK	
99	MAAN	16 16 16 63 63	174	111	53.3	31%	31%	0.0	0.0	OK	
99	AZRAQ	25 25	50	25	17.1	34%	34%	0.0	0.0	OK	
99	SAFAWI	10 10	20	10	6.5	32%	32%	0.0	0.0	OK	NEPCO Committed Project
99	RWESHID	10 10	20	10	4.5	23%	23%	0.0	0.0	OK	NEPCO Committed Project
99	RESHA	12.5 12.5	25	12.5	4.0	16%	16%	0.0	0.0	OK	
					Average		28%				

Source: JICA Study Team

Table 13 BSP Analysis by the BSP Grouping Method for EDCO in 2018

i) No countermeasure

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2018		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	AQ A2	40	40	63	63		206	143	77.4	38%		0.0	25.0	OK	
1	AQ IND	80	80				160	80	35.2	22%	25%	0.0	15.0	OK	
1	AQTH & NEW	63	63	80	80		286	206	51.3	18%		0.0	10.0	OK	
2	QUWEIRA	16	45				61	16	17.8	29%	30%	1.8	6.0	OK	
2	DESI	63	63				126	63	38.3	30%		0.0	6.0	OK	
3	EL_HASA	25	25				50	25	28.7	57%	43%	3.7	5.0	OK	
3	RASHADIA	16	40	40			96	56	34.4	36%		0.0	5.0	OK	
4	KARAK	16	16	25			57	32	39.3	69%	41%	7.3	10.0	OK	
4	KARAK SOUTH	80	80				160	80	53.6	34%		0.0	20.0	OK	
5	SUBEIHI	63	63	63			189	126	135.5	72%	51%	9.5	6.0	No	
5	SWEIMEH	80	80	80			240	160	87.3	36%		0.0	3.0	OK	
5	ISHTAFINA	40	45	63			148	85	75.3	51%		0.0	3.0	OK	
5	WAQAS	63	63	63			189	126	94.4	50%		0.0	3.0	OK	
4	QATRANA	10	10	16			36	20	11.4	32%	-	0.0	10.0	OK	
99	GHORSAFI	40	40	40	40	40	200	160	67.0	34%	34%	0.0	0.0	OK	
99	MAAN	16	16	16	63	63	174	111	56.1	32%	32%	0.0	0.0	OK	
99	AZRAQ	25	25				50	25	18.0	36%	36%	0.0	0.0	OK	
99	SAFAWI	10	10				20	10	6.8	34%	34%	0.0	0.0	OK	
99	RWESHID	10	10				20	10	4.8	24%	24%	0.0	0.0	OK	
99	RESHA	12.5	12.5				25	12.5	4.2	17%	17%	0.0	0.0	OK	
									Average		33%				

ii) After countermeasures

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2018		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	AQ A2	40	40	63	63		206	143	77.4	38%		0.0	25.0	OK	
1	AQ IND	80	80				160	80	35.2	22%	25%	0.0	15.0	OK	
1	AQTH & NEW	63	63	80	80		286	206	51.3	18%		0.0	10.0	OK	
2	QUWEIRA	16	45				61	16	17.8	29%	30%	1.8	6.0	OK	
2	DESI	63	63				126	63	38.3	30%		0.0	6.0	OK	
3	EL_HASA	25	25				50	25	28.7	57%	21%	3.7	5.0	OK	
3	Tafila	80	80				160	80		0%		0.0	24.0	OK	NEPCO Committed Project
3	RASHADIA	16	40	40			96	56	34.4	36%		0.0	5.0	OK	
4	KARAK	16	16	25			57	32	39.3	69%	41%	7.3	10.0	OK	
4	KARAK SOUTH	80	80				160	80	53.6	34%		0.0	20.0	OK	
5	SUBEIHI	63	63	63			189	126	107.1	57%	48%	0.0	6.0	OK	To Salt 15%(28.4MVA)
5	SWEIMEH	80	80	80			240	160	87.3	36%		0.0	3.0	OK	
5	ISHTAFINA	40	45	63			148	85	75.3	51%		0.0	3.0	OK	
5	WAQAS	63	63	63			189	126	94.4	50%		0.0	3.0	OK	
4	QATRANA	10	10	16			36	20	11.4	32%	-	0.0	10.0	OK	
99	GHORSAFI	40	40	40	40	40	200	160	67.0	34%	34%	0.0	0.0	OK	
99	MAAN	16	16	16	63	63	174	111	56.1	32%	32%	0.0	0.0	OK	
99	AZRAQ	25	25				50	25	18.0	36%	36%	0.0	0.0	OK	
99	SAFAWI	10	10				20	10	6.8	34%	34%	0.0	0.0	OK	
99	RWESHID	10	10				20	10	4.8	24%	24%	0.0	0.0	OK	
99	RESHA	12.5	12.5				25	12.5	4.2	17%	17%	0.0	0.0	OK	
									Average		31%				

Source: JICA Study Team

Table 14 BSP Analysis by the BSP Grouping Method for EDCO in 2019

i) No countermeasure

BSP Grouping	BSP (Substation)	No. of TR's						Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
										Peak Demand 2019		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
										[MVA]	%					
1	AQ A2	40	40	63	63			206	143	81.5	40%		0.0	25.0	OK	
1	AQ IND	80	80					160	80	37.1	23%	26%	0.0	15.0	OK	
1	AQTH & NEW	63	63	80	80			286	206	54.1	19%		0.0	10.0	OK	
2	QUWEIRA	16	45					61	16	18.7	31%	32%	2.7	6.0	OK	
2	DESI	63	63					126	63	40.4	32%		0.0	6.0	OK	
3	EL_HASA	25	25					50	25	30.3	61%		5.3	5.0	No	
3	Tafila	80	80					160	80	0.0	0%	22%	0.0	24.0	OK	
3	RASHADIA	16	40	40				96	56	36.2	38%		0.0	5.0	OK	
4	KARAK	16	16	25				57	32	41.4	73%	43%	9.4	10.0	OK	
4	KARAK SOUTH	80	80					160	80	56.5	35%		0.0	20.0	OK	
5	SUBEIHI	63	63	63				189	126	112.8	60%		0.0	6.0	OK	
5	SWEIMEH	80	80	80				240	160	91.9	38%	50%	0.0	3.0	OK	
5	ISHTAFINA	40	45	63				148	85	79.3	54%		0.0	3.0	OK	
5	WAQAS	63	63	63				189	126	99.4	53%		0.0	3.0	OK	
4	QATRANA	10	10	16				36	20	12.0	33%	-	0.0	10.0	OK	
99	GHORSAFI	40	40	40	40	40		200	160	70.6	35%	35%	0.0	0.0	OK	
99	MAAN	16	16	16	63	63		174	111	59.1	34%	34%	0.0	0.0	OK	
99	AZRAQ	25	25					50	25	19.0	38%	38%	0.0	0.0	OK	
99	SAFAWI	10	10					20	10	7.2	36%	36%	0.0	0.0	OK	
99	RWESHID	10	10					20	10	5.0	25%	25%	0.0	0.0	OK	
99	RESHA	12.5	12.5					25	12.5	4.4	18%	18%	0.0	0.0	OK	
										Average		33%				

ii) After countermeasures

BSP Grouping	BSP (Substation)	No. of TR's						Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
										Peak Demand 2019		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
										[MVA]	%					
1	AQ A2	40	40	63	63			206	143	81.5	40%		0.0	25.0	OK	
1	AQ IND	80	80					160	80	37.1	23%	26%	0.0	15.0	OK	
1	AQTH & NEW	63	63	80	80			286	206	54.1	19%		0.0	10.0	OK	
2	QUWEIRA	16	45					61	16	18.7	31%	32%	2.7	6.0	OK	
2	DESI	63	63					126	63	40.4	32%		0.0	6.0	OK	
3	EL_HASA	25	25					50	25	15.3	31%		0.0	5.0	OK	To Tafila 30%(15.0MVA)
3	Tafila	80	80					160	80	15.0	9%	22%	0.0	24.0	OK	From El Hasa
3	RASHADIA	16	40	40				96	56	36.2	38%		0.0	5.0	OK	
4	KARAK	16	16	25				57	32	41.4	73%	43%	9.4	10.0	OK	
4	KARAK SOUTH	80	80					160	80	56.5	35%		0.0	20.0	OK	
5	SUBEIHI	63	63	63				189	126	112.8	60%		0.0	6.0	OK	
5	SWEIMEH	80	80	80				240	160	91.9	38%	50%	0.0	3.0	OK	
5	ISHTAFINA	40	45	63				148	85	79.3	54%		0.0	3.0	OK	
5	WAQAS	63	63	63				189	126	99.4	53%		0.0	3.0	OK	
4	QATRANA	10	10	16				36	20	12.0	33%	-	0.0	10.0	OK	
99	GHORSAFI	40	40	40	40	40		200	160	70.6	35%	35%	0.0	0.0	OK	
99	MAAN	16	16	16	63	63		174	111	59.1	34%	34%	0.0	0.0	OK	
99	AZRAQ	25	25					50	25	19.0	38%	38%	0.0	0.0	OK	
99	SAFAWI	10	10					20	10	7.2	36%	36%	0.0	0.0	OK	
99	RWESHID	10	10					20	10	5.0	25%	25%	0.0	0.0	OK	
99	RESHA	12.5	12.5					25	12.5	4.4	18%	18%	0.0	0.0	OK	
										Average		33%				

Source: JICA Study Team

Table 15 BSP Analysis by the BSP Grouping Method for EDCO in 2020

i) No countermeasure

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2020		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	AQ A2	40	40	63	63		206	143	85.9	42%		0.0	25.0	OK	
1	AQ IND	80	80				160	80	39.0	24%	28%	0.0	15.0	OK	
1	AQTH & NEW	63	63	80	80		286	206	57.0	20%		0.0	10.0	OK	
2	QUWEIRA	16	45				61	16	19.7	32%	33%	3.7	6.0	OK	
2	DESI	63	63				126	63	42.5	34%		0.0	6.0	OK	
3	EL_HASA	25	25				50	25	16.1	32%		0.0	5.0	OK	
3	Tafila	80	80				160	80	15.8	10%	23%	0.0	24.0	OK	
3	RASHADIA	16	40	40			96	56	38.1	40%		0.0	5.0	OK	
4	KARAK	16	16	25			57	32	43.6	77%	46%	11.6	10.0	No	
4	KARAK SOUTH	80	80				160	80	59.5	37%		0.0	20.0	OK	
5	SUBEIHI	63	63	63			189	126	118.8	63%		0.0	6.0	OK	
5	SWEIMEH	80	80	80			240	160	96.9	40%	53%	0.0	3.0	OK	
5	ISHTAFINA	40	45	63			148	85	83.5	56%		0.0	3.0	OK	
5	WAQAS	63	63	63			189	126	104.8	55%		0.0	3.0	OK	
4	QATRANA	10	10	16			36	20	12.6	35%	-	0.0	10.0	OK	
99	GHORSAFI	40	40	40	40	40	200	160	74.4	37%	37%	0.0	0.0	OK	
99	MAAN	16	16	16	63	63	174	111	62.2	36%	36%	0.0	0.0	OK	
99	AZRAQ	25	25				50	25	20.0	40%	40%	0.0	0.0	OK	
99	SAFAWI	10	10				20	10	7.6	38%	38%	0.0	0.0	OK	
99	RWESHID	10	10				20	10	5.3	27%	27%	0.0	0.0	OK	
99	RESHA	12.5	12.5				25	12.5	4.7	19%	19%	0.0	0.0	OK	
									Average		34%				

ii) After countermeasures

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2020		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	AQ A2	40	40	63	63		206	143	85.9	42%		0.0	25.0	OK	
1	AQ IND	80	80				160	80	39.0	24%	28%	0.0	15.0	OK	
1	AQTH & NEW	63	63	80	80		286	206	57.0	20%		0.0	10.0	OK	
2	QUWEIRA	16	45				61	16	19.7	32%	33%	3.7	6.0	OK	
2	DESI	63	63				126	63	42.5	34%		0.0	6.0	OK	
3	EL_HASA	25	25				50	25	16.1	32%		0.0	5.0	OK	
3	Tafila	80	80				160	80	15.8	10%	37%	0.0	24.0	OK	
3	RASHADIA	16	40	40			96	56	38.1	40%		0.0	5.0	OK	
4	KARAK	63	63	25			151	88	43.6	29%	33%	0.0	10.0	OK	
4	KARAK SOUTH	80	80				160	80	59.5	37%		0.0	20.0	OK	
5	SUBEIHI	63	63	63			189	126	118.8	63%		0.0	6.0	OK	
5	SWEIMEH	80	80	80			240	160	96.9	40%	53%	0.0	3.0	OK	
5	ISHTAFINA	40	45	63			148	85	83.5	56%		0.0	3.0	OK	
5	WAQAS	63	63	63			189	126	104.8	55%		0.0	3.0	OK	
4	QATRANA	10	10	16			36	20	12.6	35%	-	0.0	10.0	OK	
99	GHORSAFI	40	40	40	40	40	200	160	74.4	37%	37%	0.0	0.0	OK	
99	MAAN	16	16	16	63	63	174	111	62.2	36%	36%	0.0	0.0	OK	
99	AZRAQ	25	25				50	25	20.0	40%	40%	0.0	0.0	OK	
99	SAFAWI	10	10				20	10	7.6	38%	38%	0.0	0.0	OK	
99	RWESHID	10	10				20	10	5.3	27%	27%	0.0	0.0	OK	
99	RESHA	12.5	12.5				25	12.5	4.7	19%	19%	0.0	0.0	OK	
									Average		35%				

Source: JICA Study Team

Table 16 BSP Analysis by the BSP Grouping Method for EDCO in 2021

i) No countermeasure

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2021		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	AQ A2	40	40	63	63	0	206	143	90.5	44%		0.0	25.0	OK	
1	AQ IND	80	80	0	0	0	160	80	41.1	26%	29%	0.0	15.0	OK	
1	AQTH & NEW	63	63	80	80	0	286	206	60.0	21%		0.0	10.0	OK	
2	QUWEIRA	16	45	0	0	0	61	16	20.8	34%	35%	4.8	6.0	OK	
2	DESI	63	63	0	0	0	126	63	44.8	36%		0.0	6.0	OK	
3	EL_HASA	25	25	0	0	0	50	25	16.9	34%		0.0	5.0	OK	
3	Tafila	80	80	0	0	0	160	80	16.6	10%	24%	0.0	24.0	OK	
3	RASHADIA	16	40	40	0	0	96	56	40.2	42%		0.0	5.0	OK	
4	KARAK	63	63	25	0	0	151	88	46.0	30%	35%	0.0	10.0	OK	
4	KARAK SOUTH	80	80	0	0	0	160	80	62.7	39%		0.0	20.0	OK	
5	SUBEIHI	63	63	63	0	0	189	126	125.2	66%		0.0	6.0	OK	
5	SWEIMEH	80	80	80	0	0	240	160	102.0	43%	56%	0.0	3.0	OK	
5	ISHTAFINA	40	45	63	0	0	148	85	88.0	59%		3.0	3.0	OK	
5	WAQAS	63	63	63	0	0	189	126	110.4	58%		0.0	3.0	OK	
4	QATRANA	10	10	16	0	0	36	20	13.3	37%	-	0.0	10.0	OK	
99	GHORSAFI	40	40	40	40	40	200	160	78.4	39%	39%	0.0	0.0	OK	
99	MAAN	16	16	16	63	63	174	111	65.6	38%	38%	0.0	0.0	OK	
99	AZRAQ	25	25	0	0	0	50	25	21.1	42%	42%	0.0	0.0	OK	
99	SAFAWI	10	10	0	0	0	20	10	8.0	40%	40%	0.0	0.0	OK	
99	RWESHID	10	10	0	0	0	20	10	5.6	28%	28%	0.0	0.0	OK	
99	RESHA	12.5	12.5	0	0	0	25	12.5	4.9	20%	20%	0.0	0.0	OK	
									Average		35%				

ii) After countermeasures

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2021		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	AQ A2	40	40	63	63	0	206	143	90.5	44%		0.0	25.0	OK	
1	AQ IND	80	80	0	0	0	160	80	41.1	26%	29%	0.0	15.0	OK	
1	AQTH & NEW	63	63	80	80	0	286	206	60.0	21%		0.0	10.0	OK	
2	QUWEIRA	16	45	0	0	0	61	16	20.8	34%	35%	4.8	6.0	OK	
2	DESI	63	63	0	0	0	126	63	44.8	36%		0.0	6.0	OK	
3	EL_HASA	25	25	0	0	0	50	25	16.9	34%		0.0	5.0	OK	
3	Tafila	80	80	0	0	0	160	80	16.6	10%	24%	0.0	24.0	OK	
3	RASHADIA	16	40	40	0	0	96	56	40.2	42%		0.0	5.0	OK	
4	KARAK	63	63	25	0	0	151	88	46.0	30%	35%	0.0	10.0	OK	
4	KARAK SOUTH	80	80	0	0	0	160	80	62.7	39%		0.0	20.0	OK	
5	SUBEIHI	63	63	63	0	0	189	126	125.2	66%		0.0	6.0	OK	
5	SWEIMEH	80	80	80	0	0	240	160	102.0	43%	56%	0.0	3.0	OK	
5	ISHTAFINA	40	45	63	0	0	148	85	88.0	59%		3.0	3.0	OK	
5	WAQAS	63	63	63	0	0	189	126	110.4	58%		0.0	3.0	OK	
4	QATRANA	10	10	16	0	0	36	20	13.3	37%	-	0.0	10.0	OK	
99	GHORSAFI	40	40	40	40	40	200	160	78.4	39%	39%	0.0	0.0	OK	
99	MAAN	16	16	16	63	63	174	111	65.6	38%	38%	0.0	0.0	OK	
99	AZRAQ	25	25	0	0	0	50	25	21.1	42%	42%	0.0	0.0	OK	
99	SAFAWI	10	10	0	0	0	20	10	8.0	40%	40%	0.0	0.0	OK	
99	RWESHID	10	10	0	0	0	20	10	5.6	28%	28%	0.0	0.0	OK	
99	RESHA	12.5	12.5	0	0	0	25	12.5	4.9	20%	20%	0.0	0.0	OK	
									Average		35%				

Source: JICA Study Team

Table 17 BSP Analysis by the BSP Grouping Method for EDCO in 2022

i) No countermeasure

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2022		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	AQ A2	40	40	63	63	0	206	143	95.3	46%		0.0	25.0	OK	
1	AQ IND	80	80	0	0	0	160	80	43.3	27%	31%	0.0	15.0	OK	
1	AQTH & NEW	63	63	80	80	0	286	206	63.2	22%		0.0	10.0	OK	
2	QUWEIRA	16	45	0	0	0	61	16	21.9	36%	37%	5.9	6.0	OK	
2	DESI	63	63	0	0	0	126	63	47.2	37%		0.0	6.0	OK	
3	EL_HASA	25	25	0	0	0	50	25	17.8	36%		0.0	5.0	OK	
3	Tafila	80	80	0	0	0	160	80	17.5	11%	25%	0.0	24.0	OK	
3	RASHADIA	16	40	40	0	0	96	56	42.3	44%		0.0	5.0	OK	
4	KARAK	63	63	25	0	0	151	88	48.4	32%	37%	0.0	10.0	OK	
4	KARAK SOUTH	80	80	0	0	0	160	80	66.0	41%		0.0	20.0	OK	
5	SUBEIHI	63	63	63	0	0	189	126	131.9	70%		5.9	6.0	OK	
5	SWEIMEH	80	80	80	0	0	240	160	107.5	45%	59%	0.0	3.0	OK	
5	ISHTAFINA	40	45	63	0	0	148	85	92.7	63%		7.7	3.0	No	
5	WAQAS	63	63	63	0	0	189	126	116.2	62%		0.0	3.0	OK	
4	QATRANA	10	10	16	0	0	36	20	14.0	39%	-	0.0	10.0	OK	
99	GHORSAFI	40	40	40	40	40	200	160	82.6	41%	41%	0.0	0.0	OK	
99	MAAN	16	16	16	63	63	174	111	69.1	40%	40%	0.0	0.0	OK	
99	AZRAQ	25	25	0	0	0	50	25	22.2	44%	44%	0.0	0.0	OK	
99	SAFAWI	10	10	0	0	0	20	10	8.4	42%	42%	0.0	0.0	OK	
99	RWESHID	10	10	0	0	0	20	10	5.9	30%	30%	0.0	0.0	OK	
99	RESHA	12.5	12.5	0	0	0	25	12.5	5.2	21%	21%	0.0	0.0	OK	
									Average		37%				

ii) After countermeasures

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2022		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	AQ A2	40	40	63	63	0	206	143	95.3	46%		0.0	25.0	OK	
1	AQ IND	80	80	0	0	0	160	80	43.3	27%	31%	0.0	15.0	OK	
1	AQTH & NEW	63	63	80	80	0	286	206	63.2	22%		0.0	10.0	OK	
2	QUWEIRA	16	45	0	0	0	61	16	21.9	36%	37%	5.9	6.0	OK	
2	DESI	63	63	0	0	0	126	63	47.2	37%		0.0	6.0	OK	
3	EL_HASA	25	25	0	0	0	50	25	17.8	36%		0.0	5.0	OK	
3	Tafila	80	80	0	0	0	160	80	17.5	11%	25%	0.0	24.0	OK	
3	RASHADIA	16	40	40	0	0	96	56	42.3	44%		0.0	5.0	OK	
4	KARAK	63	63	25	0	0	151	88	48.4	32%	37%	0.0	10.0	OK	
4	KARAK SOUTH	80	80	0	0	0	160	80	66.0	41%		0.0	20.0	OK	
5	SUBEIHI	63	63	63	0	0	189	126	111.9	59%		0.0	6.0	OK	
5	SWEIMEH	80	80	80	0	0	240	160	107.5	45%		0.0	3.0	OK	
5	New BSP	63	63				126	63	50.0	40%	50%	0.0	9.5	OK	BSP study at Group 5
5	ISHTAFINA	40	45	63	0	0	148	85	72.7	49%		0.0	3.0	OK	
5	WAQAS	63	63	63	0	0	189	126	106.2	56%		0.0	3.0	OK	
4	QATRANA	10	10	16	0	0	36	20	14.0	39%	-	0.0	10.0	OK	
99	GHORSAFI	40	40	40	40	40	200	160	82.6	41%	41%	0.0	0.0	OK	
99	MAAN	16	16	16	63	63	174	111	69.1	40%	40%	0.0	0.0	OK	
99	AZRAQ	25	25	0	0	0	50	25	22.2	44%	44%	0.0	0.0	OK	
99	SAFAWI	10	10	0	0	0	20	10	8.4	42%	42%	0.0	0.0	OK	
99	RWESHID	10	10	0	0	0	20	10	5.9	30%	30%	0.0	0.0	OK	
99	RESHA	12.5	12.5	0	0	0	25	12.5	5.2	21%	21%	0.0	0.0	OK	
									Average		36%				

Source: JICA Study Team

Table 18 BSP Analysis by the BSP Grouping Method for EDCO in 2023

i) No countermeasure

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2023		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	AQ A2	40	40	63	63	0	206	143	100.4	49%		0.0	25.0	OK	
1	AQ IND	80	80	0	0	0	160	80	45.6	29%	33%	0.0	15.0	OK	
1	AQTH & NEW	63	63	80	80	0	286	206	66.6	23%		0.0	10.0	OK	
2	QUWEIRA	16	45	0	0	0	61	16	23.1	38%	39%	7.1	6.0	No	
2	DESI	63	63	0	0	0	126	63	49.7	39%		0.0	6.0	OK	
3	EL_HASA	25	25	0	0	0	50	25	18.8	38%		0.0	5.0	OK	
3	Tafila	80	80	0	0	0	160	80	18.5	12%	27%	0.0	24.0	OK	
3	RASHADIA	16	40	40	0	0	96	56	44.6	46%		0.0	5.0	OK	
4	KARAK	63	63	25	0	0	151	88	51.0	34%	39%	0.0	10.0	OK	
4	KARAK SOUTH	80	80	0	0	0	160	80	69.6	43%		0.0	20.0	OK	
5	SUBEIHI	63	63	63	0	0	189	126	117.9	62%		0.0	6.0	OK	
5	SWEIMEH	80	80	80	0	0	240	160	113.2	47%		0.0	3.0	OK	
5	New BSP	63	63	0	0	0	126	63	52.7	42%	53%	0.0	9.5	OK	
5	ISHTAFINA	40	45	63	0	0	148	85	76.5	52%		0.0	3.0	OK	
5	WAQAS	63	63	63	0	0	189	126	111.9	59%		0.0	3.0	OK	
4	QATRANA	10	10	16	0	0	36	20	14.7	41%	-	0.0	10.0	OK	
99	GHORSAFI	40	40	40	40	40	200	160	87.0	43%	43%	0.0	0.0	OK	
99	MAAN	16	16	16	63	63	174	111	72.8	42%	42%	0.0	0.0	OK	
99	AZRAQ	25	25	0	0	0	50	25	23.4	47%	47%	0.0	0.0	OK	
99	SAFAWI	10	10	0	0	0	20	10	8.9	44%	44%	0.0	0.0	OK	
99	RWESHID	10	10	0	0	0	20	10	6.2	31%	31%	0.0	0.0	OK	
99	RESHA	12.5	12.5	0	0	0	25	12.5	5.5	22%	22%	0.0	0.0	OK	
									Average		38%				

ii) After countermeasures

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2023		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	AQ A2	40	40	63	63	0	206	143	100.4	49%		0.0	25.0	OK	
1	AQ IND	80	80	0	0	0	160	80	45.6	29%	33%	0.0	15.0	OK	
1	AQTH & NEW	63	63	80	80	0	286	206	66.6	23%		0.0	10.0	OK	
2	QUWEIRA	16	45	0	0	0	61	16	13.9	23%	39%	0.0	6.0	OK	To Desi 15%(9.2MVA)
2	DESI	63	63	0	0	0	126	63	58.8	47%		0.0	6.0	OK	From Quweira
3	EL_HASA	25	25	0	0	0	50	25	18.8	38%		0.0	5.0	OK	
3	Tafila	80	80	0	0	0	160	80	18.5	12%	27%	0.0	24.0	OK	
3	RASHADIA	16	40	40	0	0	96	56	44.6	46%		0.0	5.0	OK	
4	KARAK	63	63	25	0	0	151	88	51.0	34%	39%	0.0	10.0	OK	
4	KARAK SOUTH	80	80	0	0	0	160	80	69.6	43%		0.0	20.0	OK	
5	SUBEIHI	63	63	63	0	0	189	126	117.9	62%		0.0	6.0	OK	
5	SWEIMEH	80	80	80	0	0	240	160	113.2	47%		0.0	3.0	OK	
5	New BSP	63	63	0	0	0	126	63	52.7	42%	53%	0.0	9.5	OK	
5	ISHTAFINA	40	45	63	0	0	148	85	76.5	52%		0.0	3.0	OK	
5	WAQAS	63	63	63	0	0	189	126	111.9	59%		0.0	3.0	OK	
4	QATRANA	10	10	16	0	0	36	20	14.7	41%	-	0.0	10.0	OK	
99	GHORSAFI	40	40	40	40	40	200	160	87.0	43%	43%	0.0	0.0	OK	
99	MAAN	16	16	16	63	63	174	111	72.8	42%	42%	0.0	0.0	OK	
99	AZRAQ	25	25	0	0	0	50	25	23.4	47%	47%	0.0	0.0	OK	
99	SAFAWI	10	10	0	0	0	20	10	8.9	44%	44%	0.0	0.0	OK	
99	RWESHID	10	10	0	0	0	20	10	6.2	31%	31%	0.0	0.0	OK	
99	RESHA	12.5	12.5	0	0	0	25	12.5	5.5	22%	22%	0.0	0.0	OK	
									Average		38%				

Source: JICA Study Team

Table 19 BSP Analysis by the BSP Grouping Method for EDCO in 2024

i) No countermeasure

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2023		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	AQ A2	40	40	63	63	0	206	143	100.4	49%		0.0	25.0	OK	
1	AQ IND	80	80	0	0	0	160	80	45.6	29%	33%	0.0	15.0	OK	
1	AQTH & NEW	63	63	80	80	0	286	206	66.6	23%		0.0	10.0	OK	
2	QUWEIRA	16	45	0	0	0	61	16	23.1	38%	39%	7.1	6.0	No	
2	DESI	63	63	0	0	0	126	63	49.7	39%		0.0	6.0	OK	
3	EL_HASA	25	25	0	0	0	50	25	18.8	38%		0.0	5.0	OK	
3	Tafila	80	80	0	0	0	160	80	18.5	12%	27%	0.0	24.0	OK	
3	RASHADIA	16	40	40	0	0	96	56	44.6	46%		0.0	5.0	OK	
4	KARAK	63	63	25	0	0	151	88	51.0	34%	39%	0.0	10.0	OK	
4	KARAK SOUTH	80	80	0	0	0	160	80	69.6	43%		0.0	20.0	OK	
5	SUBEIHI	63	63	63	0	0	189	126	117.9	62%		0.0	6.0	OK	
5	SWEIMEH	80	80	80	0	0	240	160	113.2	47%		0.0	3.0	OK	
5	New BSP	63	63	0	0	0	126	63	52.7	42%	53%	0.0	9.5	OK	
5	ISHTAFINA	40	45	63	0	0	148	85	76.5	52%		0.0	3.0	OK	
5	WAQAS	63	63	63	0	0	189	126	111.9	59%		0.0	3.0	OK	
4	QATRANA	10	10	16	0	0	36	20	14.7	41%	-	0.0	10.0	OK	
99	GHORSAFI	40	40	40	40	40	200	160	87.0	43%	43%	0.0	0.0	OK	
99	MAAN	16	16	16	63	63	174	111	72.8	42%	42%	0.0	0.0	OK	
99	AZRAQ	25	25	0	0	0	50	25	23.4	47%	47%	0.0	0.0	OK	
99	SAFAWI	10	10	0	0	0	20	10	8.9	44%	44%	0.0	0.0	OK	
99	RWESHID	10	10	0	0	0	20	10	6.2	31%	31%	0.0	0.0	OK	
99	RESHA	12.5	12.5	0	0	0	25	12.5	5.5	22%	22%	0.0	0.0	OK	
									Average		38%				

ii) After countermeasures

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2023		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	AQ A2	40	40	63	63	0	206	143	100.4	49%		0.0	25.0	OK	
1	AQ IND	80	80	0	0	0	160	80	45.6	29%	33%	0.0	15.0	OK	
1	AQTH & NEW	63	63	80	80	0	286	206	66.6	23%		0.0	10.0	OK	
2	QUWEIRA	16	45	0	0	0	61	16	13.9	23%	39%	0.0	6.0	OK	To Desi 15%(9.2MVA)
2	DESI	63	63	0	0	0	126	63	58.8	47%		0.0	6.0	OK	From Quweira
3	EL_HASA	25	25	0	0	0	50	25	18.8	38%		0.0	5.0	OK	
3	Tafila	80	80	0	0	0	160	80	18.5	12%	27%	0.0	24.0	OK	
3	RASHADIA	16	40	40	0	0	96	56	44.6	46%		0.0	5.0	OK	
4	KARAK	63	63	25	0	0	151	88	51.0	34%	39%	0.0	10.0	OK	
4	KARAK SOUTH	80	80	0	0	0	160	80	69.6	43%		0.0	20.0	OK	
5	SUBEIHI	63	63	63	0	0	189	126	117.9	62%		0.0	6.0	OK	
5	SWEIMEH	80	80	80	0	0	240	160	113.2	47%		0.0	3.0	OK	
5	New BSP	63	63	0	0	0	126	63	52.7	42%	53%	0.0	9.5	OK	
5	ISHTAFINA	40	45	63	0	0	148	85	76.5	52%		0.0	3.0	OK	
5	WAQAS	63	63	63	0	0	189	126	111.9	59%		0.0	3.0	OK	
4	QATRANA	10	10	16	0	0	36	20	14.7	41%	-	0.0	10.0	OK	
99	GHORSAFI	40	40	40	40	40	200	160	87.0	43%	43%	0.0	0.0	OK	
99	MAAN	16	16	16	63	63	174	111	72.8	42%	42%	0.0	0.0	OK	
99	AZRAQ	25	25	0	0	0	50	25	23.4	47%	47%	0.0	0.0	OK	
99	SAFAWI	10	10	0	0	0	20	10	8.9	44%	44%	0.0	0.0	OK	
99	RWESHID	10	10	0	0	0	20	10	6.2	31%	31%	0.0	0.0	OK	
99	RESHA	12.5	12.5	0	0	0	25	12.5	5.5	22%	22%	0.0	0.0	OK	
									Average		38%				

Source: JICA Study Team

Table 20 BSP Analysis by the BSP Grouping Method for EDCO in 2025

i) No countermeasure

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2025		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	AQ A2	40	40	63	63	0	206	143	111.4	54%		0.0	25.0	OK	
1	AQ IND	80	80	0	0	0	160	80	50.6	32%	36%	0.0	15.0	OK	
1	AQTH & NEW	63	63	80	80	0	286	206	73.9	26%		0.0	10.0	OK	
2	QUWEIRA	16	45	0	0	0	61	16	15.4	25%	43%	0.0	6.0	OK	
2	DESI	63	63	0	0	0	126	63	65.3	52%		2.3	6.0	OK	
3	EL_HASA	25	25	0	0	0	50	25	20.9	42%		0.0	5.0	OK	
3	Tafila	80	80	0	0	0	160	80	20.5	13%	30%	0.0	24.0	OK	
3	RASHADIA	16	40	40	0	0	96	56	49.5	52%		0.0	5.0	OK	
4	KARAK	63	63	25	0	0	151	88	56.6	37%	43%	0.0	10.0	OK	
4	KARAK SOUTH	80	80	0	0	0	160	80	77.2	48%		0.0	20.0	OK	
5	SUBEIHI	63	63	63	0	0	189	126	130.8	69%		4.8	6.0	OK	
5	SWEIMEH	80	80	80	0	0	240	160	125.6	52%		0.0	3.0	OK	
5	New BSP	63	63	0	0	0	126	63	58.4	46%	59%	0.0	9.5	OK	
5	ISHTAFINA	40	45	63	0	0	148	85	84.9	57%		0.0	3.0	OK	
5	WAQAS	63	63	63	0	0	189	126	124.2	66%		0.0	3.0	OK	
4	QATRANA	10	10	16	0	0	36	20	16.3	45%	-	0.0	10.0	OK	
99	GHORSAFI	40	40	40	40	40	200	160	96.5	48%	48%	0.0	0.0	OK	
99	MAAN	16	16	16	63	63	174	111	80.7	46%	46%	0.0	0.0	OK	
99	AZRAQ	25	25	0	0	0	50	25	25.9	52%	52%	0.9	0.0	OK	
99	SAFAWI	10	10	0	0	0	20	10	9.8	49%	49%	0.0	0.0	OK	
99	RWESHID	10	10	0	0	0	20	10	6.9	34%	34%	0.0	0.0	OK	
99	RESHA	12.5	12.5	0	0	0	25	12.5	6.1	24%	24%	0.0	0.0	OK	
									Average		42%				

ii) After countermeasures

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2025		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	AQ A2	40	40	63	63	0	206	143	111.4	54%		0.0	25.0	OK	
1	AQ IND	80	80	0	0	0	160	80	50.6	32%	36%	0.0	15.0	OK	
1	AQTH & NEW	63	63	80	80	0	286	206	73.9	26%		0.0	10.0	OK	
2	QUWEIRA	16	45	0	0	0	61	16	15.4	25%	43%	0.0	6.0	OK	
2	DESI	63	63	0	0	0	126	63	65.3	52%		2.3	6.0	OK	
3	EL_HASA	25	25	0	0	0	50	25	20.9	42%		0.0	5.0	OK	
3	Tafila	80	80	0	0	0	160	80	20.5	13%	30%	0.0	24.0	OK	
3	RASHADIA	16	40	40	0	0	96	56	49.5	52%		0.0	5.0	OK	
4	KARAK	63	63	25	0	0	151	88	56.6	37%	43%	0.0	10.0	OK	
4	KARAK SOUTH	80	80	0	0	0	160	80	77.2	48%		0.0	20.0	OK	
5	SUBEIHI	63	63	63	0	0	189	126	130.8	69%		4.8	6.0	OK	
5	SWEIMEH	80	80	80	0	0	240	160	125.6	52%		0.0	3.0	OK	
5	New BSP	63	63	0	0	0	126	63	58.4	46%	59%	0.0	9.5	OK	
5	ISHTAFINA	40	45	63	0	0	148	85	84.9	57%		0.0	3.0	OK	
5	WAQAS	63	63	63	0	0	189	126	124.2	66%		0.0	3.0	OK	
4	QATRANA	10	10	16	0	0	36	20	16.3	45%	-	0.0	10.0	OK	
99	GHORSAFI	40	40	40	40	40	200	160	96.5	48%	48%	0.0	0.0	OK	
99	MAAN	16	16	16	63	63	174	111	80.7	46%	46%	0.0	0.0	OK	
99	AZRAQ	25	25	63	0	0	113	50	25.9	23%	23%	0.0	0.0	OK	Addition of 63MVA transformer
99	SAFAWI	10	10	0	0	0	20	10	9.8	49%	49%	0.0	0.0	OK	
99	RWESHID	10	10	0	0	0	20	10	6.9	34%	34%	0.0	0.0	OK	
99	RESHA	12.5	12.5	0	0	0	25	12.5	6.1	24%	24%	0.0	0.0	OK	
									Average		40%				

Source: JICA Study Team

(3) BSP Analysis for IDECO

Table 21 BSP Analysis by the BSP Grouping Method for IDECO in 2016

(1) Year 2016

i) No countermeasure

BSP Grouping	BSP (Substation)	No. of TR's						Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
										Peak Demand 2016		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
										[MVA]	%					
1	IRBID	80	60	63				203	123	161.5	80%		38.5	57.6	OK	
1	IRBID EAST	80	80					160	80	70.3	44%	56%	0.0	22.3	OK	
1	HASAN IND	80	80					160	80	59.2	37%		0.0	24.6	OK	
2	REHAB	40	40					80	40	72.7	91%		32.7	34.3	OK	
2	MAFRAQ	80	80	80				240	160	57.9	24%	39%	0.0	48.2	OK	
2	SABHA	40	40					80	40	29.6	37%		0.0	25.9	OK	
2	DHULEIL	80	80					160	80	56.7	35%		0.0	15.5	OK	
99	WAQAS	63	63					126	63	85.1	68%	-	22.1	25.1	OK	
99	ISHTAFINA	40	45					85	40	67.8	80%	-	27.8	14.0	No	
99	SAFAWI	10						10	0	6.2	62%	-	6.2	2.6	No	
										Average		47%				

ii) After countermeasures

BSP Grouping	BSP (Substation)	No. of TR's						Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
										Peak Demand 2016		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
										[MVA]	%					
1	IRBID	80	60	63				203	123	161.5	80%		38.5	57.6	OK	
1	IRBID EAST	80	80					160	80	70.3	44%	56%	0.0	22.3	OK	
1	HASAN IND	80	80					160	80	59.2	37%		0.0	24.6	OK	
2	REHAB	40	40					80	40	44.7	56%		4.7	34.3	OK	To Mafraq 35%(28MVA)
2	MAFRAQ	80	80	80				240	160	85.9	36%	39%	0.0	48.2	OK	From Rehab
2	SABHA	40	40					80	40	29.6	37%		0.0	25.9	OK	
2	DHULEIL	80	80					160	80	56.7	35%		0.0	15.5	OK	
99	WAQAS	63	63					126	63	85.1	68%	-	22.1	25.1	OK	
99	ISHTAFINA	40	45	63				148	85	67.8	46%	-	0.0	14.0	OK	NEPCO committed project
99	SAFAWI	10						10	0	6.2	62%	-	6.2	2.6	No	NEPCO Committed Project in 2017
										Average		47%				

Source: JICA Study Team

Table 22 BSP Analysis by the BSP Grouping Method for IDECO in 2017

i) No countermeasure

BSP Grouping	BSP (Substation)	No. of TR's						Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
										Peak Demand 2017		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
										[MVA]	%					
1	IRBID	80	60	63				203	123	170.1	84%		47.1	57.6	OK	
1	IRBID EAST	80	80					160	80	74.0	46%	59%	0.0	22.3	OK	
1	HASAN IND	80	80					160	80	62.3	39%		0.0	24.6	OK	
2	REHAB	40	40					80	40	47.1	59%		7.1	34.3	OK	
2	MAFRAQ	80	80	80				240	160	90.5	38%		0.0	48.2	OK	
2	SABHA	40	40					80	40	31.2	39%	41%	0.0	25.9	OK	
2	DHULEIL	80	80					160	80	59.7	37%		0.0	15.5	OK	
99	WAQAS	63	63					126	63	89.6	71%	-	26.6	25.1	No	
99	ISHTAFINA	40	45	63				148	85	71.4	48%	-	0.0	14.0	OK	
99	SAFAWI	10						10	0	6.5	65%	-	6.5	2.6	No	
										Average		50%				

ii) After countermeasures

BSP Grouping	BSP (Substation)	No. of TR's						Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
										Peak Demand 2017		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
										[MVA]	%					
1	IRBID	80	60	63				203	123	170.1	84%		47.1	57.6	OK	
1	IRBID EAST	80	80					160	80	74.0	46%	59%	0.0	22.3	OK	
1	HASAN IND	80	80					160	80	62.3	39%		0.0	24.6	OK	
2	REHAB	40	40					80	40	47.1	59%		7.1	34.3	OK	
2	MAFRAQ	80	80	80				240	160	90.5	38%		0.0	48.2	OK	
2	SABHA	40	40					80	40	31.2	39%	41%	0.0	25.9	OK	
2	DHULEIL	80	80					160	80	59.7	37%		0.0	15.5	OK	
99	WAQAS	63	63	63				189	126	89.6	47%	-	0.0	25.1	OK	NEPCO Committed Project
99	ISHTAFINA	40	45	63				148	85	71.4	48%	-	0.0	14.0	OK	
99	SAFAWI	10	10					20	10	6.5	32%	-	0.0	2.6	OK	NEPCO Committed Project
										Average		50%				

Source: JICA Study Team

Table 23　BSP Analysis by the BSP Grouping Method for IDECO in 2018

i) No countermeasure

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2018		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	IRBID	80	60	63			203	123	179.2	88%		56.2	57.6	OK	
1	IRBID EAST	80	80				160	80	78.0	49%	62%	0.0	22.3	OK	
1	HASAN IND	80	80				160	80	65.7	41%		0.0	24.6	OK	
2	REHAB	40	40				80	40	49.7	62%		9.7	34.3	OK	
2	MAFRAQ	80	80	80			240	160	95.4	40%		0.0	48.2	OK	
2	SABHA	40	40				80	40	32.8	41%	43%	0.0	25.9	OK	
2	DHULEIL	80	80				160	80	62.9	39%		0.0	15.5	OK	
99	WAQAS	63	63	63			189	126	94.4	50%	-	0.0	25.1	OK	
99	ISHTAFINA	40	45	63			148	85	75.3	51%	-	0.0	14.0	OK	
99	SAFAWI	10	10				20	10	6.8	34%	-	0.0	2.6	OK	
									Average		52%				

ii) After countermeasures

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2018		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	IRBID	80	60	63			203	123	179.2	88%		56.2	57.6	OK	
1	IRBID EAST	80	80				160	80	78.0	49%	62%	0.0	22.3	OK	
1	HASAN IND	80	80				160	80	65.7	41%		0.0	24.6	OK	
2	REHAB	40	40				80	40	49.7	62%		9.7	34.3	OK	
2	MAFRAQ	80	80	80			240	160	95.4	40%		0.0	48.2	OK	
2	SABHA	40	40				80	40	32.8	41%	43%	0.0	25.9	OK	
2	DHULEIL	80	80				160	80	62.9	39%		0.0	15.5	OK	
99	WAQAS	63	63	63			189	126	94.4	50%	-	0.0	25.1	OK	
99	ISHTAFINA	40	45	63			148	85	75.3	51%	-	0.0	14.0	OK	
99	SAFAWI	10	10				20	10	6.8	34%	-	0.0	2.6	OK	
									Average		52%				

Source: JICA Study Team

Table 24　BSP Analysis by the BSP Grouping Method for IDECO in 2019

i) No countermeasure

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2019		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	IRBID	80	60	63			203	123	188.8	93%		65.8	57.6	No	
1	IRBID EAST	80	80				160	80	82.2	51%	65%	2.2	22.3	OK	
1	HASAN IND	80	80				160	80	69.2	43%		0.0	24.6	OK	
2	REHAB	40	40				80	40	52.3	65%		12.3	34.3	OK	
2	MAFRAQ	80	80	80			240	160	100.5	42%		0.0	48.2	OK	
2	SABHA	40	40				80	40	34.6	43%	45%	0.0	25.9	OK	
2	DHULEIL	80	80				160	80	66.3	41%		0.0	15.5	OK	
99	WAQAS	63	63	63			189	126	99.4	53%	–	0.0	25.1	OK	
99	ISHTAFINA	40	45	63			148	85	79.3	54%	–	0.0	14.0	OK	
99	SAFAWI	10	10				20	10	7.2	36%	–	0.0	2.6	OK	
									Average		55%				

ii) After countermeasures

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2019		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	IRBID	80	60	63			203	123	158.4	78%		35.4	57.6	OK	To Hassan 12%(24.4MVA), Irbid E 3%(6.1MVA)
1	IRBID EAST	80	80				160	80	88.2	55%	65%	8.2	22.3	OK	From Irbid
1	HASAN IND	80	80				160	80	93.5	58%		13.5	24.6	OK	From Irbid
2	REHAB	40	40				80	40	52.3	65%		12.3	34.3	OK	
2	MAFRAQ	80	80	80			240	160	100.5	42%		0.0	48.2	OK	
2	SABHA	40	40				80	40	34.6	43%	45%	0.0	25.9	OK	
2	DHULEIL	80	80				160	80	66.3	41%		0.0	15.5	OK	
99	WAQAS	63	63	63			189	126	99.4	53%	–	0.0	25.1	OK	
99	ISHTAFINA	40	45	63			148	85	79.3	54%	–	0.0	14.0	OK	
99	SAFAWI	10	10				20	10	7.2	36%	–	0.0	2.6	OK	
									Average		55%				

Source: JICA Study Team

Table 25　BSP Analysis by the BSP Grouping Method for IDECO in 2020

i) No countermeasure

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2020		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	IRBID	80	60	63			203	123	166.8	82%		43.8	57.6	OK	
1	IRBID EAST	80	80				160	80	93.0	58%	69%	13.0	22.3	OK	
1	HASAN IND	80	80				160	80	98.5	62%		18.5	24.6	OK	
2	REHAB	40	40				80	40	55.1	69%		15.1	34.3	OK	
2	MAFRAQ	80	80	80			240	160	105.8	44%		0.0	48.2	OK	
3	SABHA	40	40				80	40	36.4	46%	48%	0.0	25.9	OK	
3	DHULEIL	80	80				160	80	69.8	44%		0.0	15.5	OK	
99	WAQAS	63	63	63			189	126	104.8	55%	－	0.0	25.1	OK	
99	ISHTAFINA	40	45	63			148	85	83.5	56%	－	0.0	14.0	OK	
99	SAFAWI	10	10				20	10	7.6	38%	－	0.0	2.6	OK	
									Average		58%				

ii) After countermeasures

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2020		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	IRBID	80	60	63			203	123	166.8	82%		43.8	57.6	OK	
1	IRBID EAST	80	80				160	80	93.0	58%	69%	13.0	22.3	OK	
1	HASAN IND	80	80				160	80	98.5	62%		18.5	24.6	OK	
2	REHAB	40	40				80	40	55.1	69%		15.1	34.3	OK	
2	MAFRAQ	80	80	80			240	160	105.8	44%		0.0	48.2	OK	
3	SABHA	40	40				80	40	36.4	46%	48%	0.0	25.9	OK	
3	DHULEIL	80	80				160	80	69.8	44%		0.0	15.5	OK	
99	WAQAS	63	63	63			189	126	104.8	55%	－	0.0	25.1	OK	
99	ISHTAFINA	40	45	63			148	85	83.5	56%	－	0.0	14.0	OK	
99	SAFAWI	10	10				20	10	7.6	38%	－	0.0	2.6	OK	
									Average		58%				

Source: JICA Study Team

Table 26　BSP Analysis by the BSP Grouping Method for IDECO in 2021

i) No countermeasure

BSP Grouping	BSP (Substation)	No. of TR's						Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
										Peak Demand 2021		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
										[MVA]	%					
1	IRBID	80	60	63				203	123	175.7	87%		52.7	57.6	OK	
1	IRBID EAST	80	80					160	80	97.9	61%	72%	17.9	22.3	OK	
1	HASAN IND	80	80					160	80	103.8	65%		23.8	24.6	OK	
2	REHAB	40	40					80	40	58.0	73%		18.0	34.3	OK	
2	MAFRAQ	80	80	80				240	160	111.5	46%		0.0	48.2	OK	
3	SABHA	40	40					80	40	38.4	48%	50%	0.0	25.9	OK	
3	DHULEIL	80	80					160	80	73.6	46%		0.0	15.5	OK	
99	WAQAS	63	63	63				189	126	110.4	58%	–	0.0	25.1	OK	
99	ISHTAFINA	40	45	63				148	85	88.0	59%	–	3.0	14.0	OK	
99	SAFAWI	10	10					20	10	8.0	40%	–	0.0	2.6	OK	
										Average		61%				

ii) After countermeasures

BSP Grouping	BSP (Substation)	No. of TR's						Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
										Peak Demand 2021		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
										[MVA]	%					
1	IRBID	80	60	63				203	123	175.7	87%		52.7	57.6	OK	
1	IRBID EAST	80	80					160	80	97.9	61%	72%	17.9	22.3	OK	
1	HASAN IND	80	80					160	80	103.8	65%		23.8	24.6	OK	
2	REHAB	40	40					80	40	58.0	73%		18.0	34.3	OK	
2	MAFRAQ	80	80	80				240	160	111.5	46%		0.0	48.2	OK	
3	SABHA	40	40					80	40	38.4	48%	50%	0.0	25.9	OK	
3	DHULEIL	80	80					160	80	73.6	46%		0.0	15.5	OK	
99	WAQAS	63	63	63				189	126	110.4	58%	–	0.0	25.1	OK	
99	ISHTAFINA	40	45	63				148	85	88.0	59%	–	3.0	14.0	OK	
99	SAFAWI	10	10					20	10	8.0	40%	–	0.0	2.6	OK	
										Average		61%				

Source: JICA Study Team

Table 27　BSP Analysis by the BSP Grouping Method for IDECO in 2022

i) No countermeasure

BSP Grouping	BSP (Substation)	No. of TR's						Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
										Peak Demand 2022		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
										[MVA]	%					
1	IRBID	80	60	63				203	123	185.1	91%		62.1	57.6	No	
1	IRBID EAST	80	80					160	80	103.1	64%	76%	23.1	22.3	No	
1	HASAN IND	80	80					160	80	109.3	68%		29.3	24.6	No	
2	REHAB	40	40					80	40	61.1	76%		21.1	34.3	OK	
2	MAFRAQ	80	80	80				240	160	117.4	49%		0.0	48.2	OK	
3	SABHA	40	40					80	40	40.4	51%	53%	0.4	25.9	OK	
3	DHULEIL	80	80					160	80	77.5	48%		0.0	15.5	OK	
99	WAQAS	63	63	63				189	126	116.2	62%	-	0.0	25.1	OK	
99	ISHTAFINA	40	45	63				148	85	92.7	63%	-	7.7	14.0	OK	
99	SAFAWI	10	10					20	10	8.4	42%	-	0.0	2.6	OK	
										Average		64%				

ii) After countermeasures

BSP Grouping	BSP (Substation)	No. of TR's						Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
										Peak Demand 2022		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
										[MVA]	%					
1	IRBID	80	60	63				203	123	154.7	76%		31.7	57.6	OK	
1	IRBID EAST	80	80	80				240	160	149.6	62%	66%	0.0	22.3	OK	Addition of 80MVA Transformer
1	HASAN IND	80	80					160	80	93.3	58%		13.3	24.6	OK	
2	REHAB	40	40					80	40	61.1	76%		21.1	34.3	OK	
2	MAFRAQ	80	80	80				240	160	117.4	49%		0.0	48.2	OK	
2	SABHA	40	40					80	40	40.4	51%	53%	0.4	25.9	OK	
2	DHULEIL	80	80					160	80	77.5	48%		0.0	15.5	OK	
99	WAQAS	63	63	63				189	126	116.2	62%	-	0.0	25.1	OK	
99	ISHTAFINA	40	45	63				148	85	92.7	63%	-	7.7	14.0	OK	
99	SAFAWI	10	10					20	10	8.4	42%	-	0.0	2.6	OK	
										Average		59%				

Source: JICA Study Team

Table 28　BSP Analysis by the BSP Grouping Method for IDECO in 2023

i) No countermeasure

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2023		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	IRBID	80	60	63	0	0	203	123	162.9	80%		39.9	57.6	OK	
1	IRBID EAST	80	80	80	0	0	240	160	157.6	66%	69%	0.0	22.3	OK	
1	HASAN IND	80	80	0	0	0	160	80	98.3	61%		18.3	24.6	OK	
2	REHAB	40	40	0	0	0	80	40	64.4	81%		24.4	34.3	OK	
2	MAFRAQ	80	80	80	0	0	240	160	123.7	52%		0.0	48.2	OK	
2	SABHA	40	40	0	0	0	80	40	42.6	53%	56%	2.6	25.9	OK	
2	DHULEIL	80	80	0	0	0	160	80	81.6	51%		1.6	15.5	OK	
99	WAQAS	63	63	63	0	0	189	126	122.5	65%	-	0.0	25.1	OK	
99	ISHTAFINA	40	45	63	0	0	148	85	97.6	66%	-	12.6	14.0	OK	
99	SAFAWI	10	10	0	0	0	20	10	8.9	44%	-	0.0	2.6	OK	
									Average		63%				

ii) After countermeasures

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2023		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	IRBID	80	60	63	0	0	203	123	162.9	80%		39.9	57.6	OK	
1	IRBID EAST	80	80	80	0	0	240	160	157.6	66%	69%	0.0	22.3	OK	
1	HASAN IND	80	80	0	0	0	160	80	98.3	61%		18.3	24.6	OK	
2	REHAB	40	40	0	0	0	80	40	64.4	81%		24.4	34.3	OK	
2	MAFRAQ	80	80	80	0	0	240	160	123.7	52%		0.0	48.2	OK	
2	SABHA	40	40	0	0	0	80	40	42.6	53%	56%	2.6	25.9	OK	
2	DHULEIL	80	80	0	0	0	160	80	81.6	51%		1.6	15.5	OK	
99	WAQAS	63	63	63	0	0	189	126	122.5	65%	-	0.0	25.1	OK	
99	ISHTAFINA	40	45	63	0	0	148	85	97.6	66%	-	12.6	14.0	OK	
99	SAFAWI	10	10	0	0	0	20	10	8.9	44%	-	0.0	2.6	OK	
									Average		63%				

Source: JICA Study Team

Table 29　BSP Analysis by the BSP Grouping Method for IDECO in 2024

i) No countermeasure

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2024		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	IRBID	80	60	63	0	0	203	123	171.6	85%		48.6	57.6	OK	
1	IRBID EAST	80	80	80	0	0	240	160	166.0	69%	73%	6.0	22.3	OK	
1	HASAN IND	80	80	0	0	0	160	80	103.6	65%		23.6	24.6	OK	
2	REHAB	40	40	0	0	0	80	40	67.8	85%		27.8	34.3	OK	
2	MAFRAQ	80	80	80	0	0	240	160	130.3	54%		0.0	48.2	OK	
2	SABHA	40	40	0	0	0	80	40	44.9	56%	59%	4.9	25.9	OK	
2	DHULEIL	80	80	0	0	0	160	80	86.0	54%		6.0	15.5	OK	
99	WAQAS	63	63	63	0	0	189	126	129.0	68%	-	3.0	25.1	OK	
99	ISHTAFINA	40	45	63	0	0	148	85	102.8	69%	-	17.8	14.0	No	
99	SAFAWI	10	10	0	0	0	20	10	9.3	47%	-	0.0	2.6	OK	
									Average		66%				

ii) After countermeasures

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2024		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	IRBID	80	60	63	0	0	203	123	171.6	85%		48.6	57.6	OK	
1	IRBID EAST	80	80	80	0	0	240	160	166.0	69%	73%	6.0	22.3	OK	
1	HASAN IND	80	80	0	0	0	160	80	103.6	65%		23.6	24.6	OK	
2	REHAB	40	40	0	0	0	80	40	67.8	85%		27.8	34.3	OK	
2	MAFRAQ	80	80	80	0	0	240	160	130.3	54%		0.0	48.2	OK	
2	SABHA	40	40	0	0	0	80	40	44.9	56%	59%	4.9	25.9	OK	
2	DHULEIL	80	80	0	0	0	160	80	86.0	54%		6.0	15.5	OK	
99	WAQAS	63	63	63	0	0	189	126	129.0	68%	-	3.0	25.1	OK	
99	ISHTAFINA	63	45	63	0	0	171	108	102.8	60%	-	0.0	14.0	OK	BSP reinfocement (40→63)
99	SAFAWI	10	10	0	0	0	20	10	9.3	47%	-	0.0	2.6	OK	
									Average		66%				

Source: JICA Study Team

Table 30　BSP Analysis by the BSP Grouping Method for IDECO in 2025

i) No countermeasure

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2025		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	IRBID	80	60	63	0	0	203	123	180.8	89%		57.8	57.6	No	
1	IRBID EAST	80	80	80	0	0	240	160	174.9	73%	77%	14.9	22.3	OK	
1	HASAN IND	80	80	0	0	0	160	80	109.1	68%		29.1	24.6	No	
2	REHAB	40	40	0	0	0	80	40	71.5	89%		31.5	34.3	OK	
2	MAFRAQ	80	80	80	0	0	240	160	137.3	57%		0.0	48.2	OK	
2	SABHA	40	40	0	0	0	80	40	47.3	59%	62%	7.3	25.9	OK	
2	DHULEIL	80	80	0	0	0	160	80	90.6	57%		10.6	15.5	OK	
99	WAQAS	63	63	63	0	0	189	126	135.9	72%	-	9.9	25.1	OK	
99	ISHTAFINA	63	45	63	0	0	171	108	108.3	63%	-	0.3	14.0	OK	
99	SAFAWI	10	10	0	0	0	20	10	9.8	49%	-	0.0	2.6	OK	
									Average		69%				

ii) After countermeasures

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2025		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	IRBID	80	60	63	0	0	203	123	150.3	74%		27.3	57.6	OK	
1	IRBID EAST	80	80	80	0	0	240	160	174.9	73%	68%	14.9	22.3	OK	
1	HASAN IND	80	80	80	0	0	240	160	139.6	58%		0.0	24.6	OK	Addition of 80MVA transformer
2	REHAB	40	40	0	0	0	80	40	71.5	89%		31.5	34.3	OK	
2	MAFRAQ	80	80	80	0	0	240	160	137.3	57%		0.0	48.2	OK	
2	SABHA	40	40	0	0	0	80	40	47.3	59%	62%	7.3	25.9	OK	
2	DHULEIL	80	80	0	0	0	160	80	90.6	57%		10.6	15.5	OK	
99	WAQAS	63	63	63	0	0	189	126	135.9	72%	-	9.9	25.1	OK	
99	ISHTAFINA	63	45	63	0	0	171	108	108.3	63%	-	0.3	14.0	OK	
99	SAFAWI	10	10	0	0	0	20	10	9.8	49%	-	0.0	2.6	OK	
									Average		65%				

Source: JICA Study Team

5.2 Result of BSP Analysis for the NEPCO Practice

(1) BSP Analysis for JEPCO

Table 1 BSP Analysis by the NEPCO Practice for JEPCO in 2016

i) No countermeasure

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2016		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	ABDOON	80	80	80			240	160	120.9	50%		0.0	48.0	OK	
1	AMMAN S	45	45	45			135	90	109.2	81%	76%	19.2	41.6	OK	
1	AMMAN S NEW	80	80				160	80	168.7	105%		88.7	63.2	No	
1	ASHRFIA	63	63				126	63	104.1	83%		41.1	51.3	OK	
2	MANARAH	80	80	80			240	160	54.4	23%		0.0	49.0	OK	
2	SAHAB	63	63	63			189	126	138.1	73%	41%	12.1	25.0	OK	
2	MWQAR	80	80				160	80	51.5	32%		0.0	24.0	OK	
3	ABDALI	40	40	40			120	80	67.9	57%		0.0	18.0	OK	
3	ABDALI NEW	80	80				160	80	143.2	89%		63.2	25.0	No	
3	HIZAM	80	80	80			240	160		0%	45%	0.0	36.0	OK	NEPCO ongoing project
3	ZERQA	30	30	30	40		130	90	93.0	72%		3.0	18.8	OK	
3	ZERQA TR5	63					63	0	24.0	38%		24.0	27.0	OK	
3	DHULEIL	80	80				160	80	61.3	38%		0.0	23.1	OK	
4	CITY CENTER	80	80	80			240	160	127.0	53%		0.0	111.6	OK	
4	MARQA	45	63	80			188	108	181.4	97%	64%	73.4	49.5	No	
4	TAREQ	80	80	80			240	160	121.3	51%		0.0	80.2	OK	
5	BAYADER	80	80	80			240	160	198.2	83%		38.2	79.2	OK	
5	New BAYDER	80	80				160	80		0%		0.0	24.0	OK	NEPCO ongoing project
5	SALT	80	80				160	80	173.4	108%	68%	93.4	29.5	No	
5	UNIVERSITY	80	80	80			240	160	178.6	74%		18.6	85.2	OK	
5	SUBEIHI	63	63	63			189	126	123.8	65%		0.0	5.2	OK	
6	QAIA	45	45				90	45	14.5	16%		0.0	24.5	OK	
6	QAIA New	80	80				160	80	102.3	64%	45%	22.3	24.0	OK	
6	MADABA SOUTH	80	80	80			240	160	103.9	43%		0	35.0	OK	
									Average		57%				

*FUHEIS, HASHIMIYA and MWQAR IND are excluded due to an exclusive use for large industries.

ii) After countermeasures

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2016		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	ABDOON	80	80	80			240	160	120.9	50%		0.0	48.0	OK	
1	AMMAN S	45	45	45			135	90	109.2	81%	68%	19.2	41.6	OK	
1	AMMAN S NEW	80	80	80			240	160	168.7	70%		8.7	63.2	OK	80MVA
1	ASHRFIA	63	63				126	63	104.1	83%		41.1	51.3	OK	
2	MANARAH	80	80	80			240	160	54.4	23%		0.0	49.0	OK	
2	SAHAB	63	63	63			189	126	138.1	73%	41%	12.1	25.0	OK	
2	MWQAR	80	80				160	80	51.5	32%		0.0	24.0	OK	
3	ABDALI	40	40	40			120	80	67.9	57%		0.0	18.0	OK	
3	ABDALI NEW	80	80				160	80	79.2	49%		0.0	25.0	OK	To HIZAM 40%(64MVA)
3	HIZAM	80	80	80			240	160	120.4	50%	51%	0.0	36.0	OK	From ABDLAI NEW, Marqa
3	ZERQA	30	30	30	40		130	90	93.0	72%		3.0	18.8	OK	
3	ZERQA TR5	63					63	0	24.0	38%		24.0	27.0	OK	
3	DHULEIL	80	80				160	80	61.3	38%		0.0	23.1	OK	
4	CITY CENTER	80	80	80			240	160	127.0	53%		0.0	111.6	OK	
4	MARQA	45	63	80			188	108	125.0	67%	56%	17.0	49.5	OK	To HIZAM 30%(56.4MVA)
4	TAREQ	80	80	80			240	160	121.3	51%		0.0	80.2	OK	
5	BAYADER	80	80	80			240	160	198.2	83%		38.2	79.2	OK	
5	New BAYDER	80	80				160	80	96.0	60%		16.0	24.0	OK	From AMMAN SNEW, Salt
5	SALT	80	80				160	160	125.4	78%	73%	0.0	29.5	OK	To New Bayder 30%(48MVA)
5	UNIVERSITY	80	80	80			240	160	178.6	74%		18.6	85.2	OK	
5	SUBEIHI	63	63	63			189	126	123.8	65%		0.0	5.2	OK	
6	QAIA	45	45				90	45	14.5	16%		0.0	24.5	OK	
6	QAIA New	80	80				160	80	102.3	64%	45%	22.3	24.0	OK	
6	MADABA SOUTH	80	80	80			240	160	103.9	43%		0.0	35.0	OK	
									Average		56%				

*FUHEIS, HASHIMIYA and MWQAR IND are excluded due to an exclusive use for large industries.

Source: JICA Study Team

Table 2　BSP Analysis by the NEPCO Practice for JEPCO in 2017

i) No countermeasure

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2017		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	ABDOON	80	80	80			240	160	131.6	55%		0.0	48.0	OK	
1	AMMAN S	45	45	45			135	90	118.7	88%	82%	28.7	41.6	OK	
1	AMMAN S NEW	80	80				160	80	183.2	115%		103.2	63.2	No	
1	ASHRFIA	63	63				126	63	108.4	86%		45.4	51.3	OK	
2	MANARAH	80	80	80			240	160	58.8	24%		0.0	49.0	OK	
2	SAHAB	63	63	63			189	126	145.0	77%	44%	19.0	25.0	OK	
2	MWQAR	80	80				160	80	55.5	35%		0.0	24.0	OK	
3	ABDALI	40	40	40			120	80	73.8	61%		0.0	18.0	OK	
3	ABDALI NEW	80	80				160	80	86.0	54%		6.0	25.0	OK	
3	HIZAM	80	80	80			240	160	126.8	53%	55%	0.0	36.0	OK	
3	ZERQA	30	30	30	40		130	90	100.8	78%		10.8	18.8	OK	
3	ZERQA TR5	63					63	0	26.0	41%		26.0	27.0	OK	
3	DHULEIL	80	80				160	80	67.2	42%		0.0	23.1	OK	
4	CITY CENTER	80	80	80			240	160	138.2	58%		0.0	111.6	OK	
4	MARQA	45	63	80			188	108	128.6	68%	59%	20.6	49.5	OK	
4	TAREQ	80	80	80			240	160	130.5	54%		0.0	80.2	OK	
5	BAYADER	80	80	80			240	160	214.8	89%		54.8	79.2	OK	
5	New BAYDER	80	80				160	80	104.0	65%		24.0	24.0	No	
5	SALT	80	80				160	80	139.5	87%	79%	59.5	29.5	No	NEPCO Commiitted project
5	UNIVERSITY	80	80	80			240	160	194.9	81%		34.9	85.2	OK	
5	SUBEIHI	63	63	63			189	126	132.9	70%		6.9	5.2	No	
6	QAIA	45	45				90	45	16.0	18%		0.0	24.5	OK	
6	QAIA New	80	80				160	80	113.1	71%	49%	33.1	24.0	No	
6	MADABA SOUTH	80	80	80			240	160	111.9	47%		0	35.0	OK	
									Average		62%				

*FUHEIS, HASHIMIYA and MWQAR IND are excluded due to an exclusive use for large industries.

ii) After countermeasures

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2017		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	ABDOON	80	80	80			240	160	131.6	55%		0.0	48.0	OK	
1	AMMAN S	45	45	45			135	90	118.7	88%	73%	28.7	41.6	OK	
1	AMMAN S NEW	80	80	80			240	160	183.2	76%		23.2	63.2	OK	
1	ASHRFIA	63	63				126	63	108.4	86%		45.4	51.3	OK	
2	MANARAH	80	80	80			240	160	58.8	24%		0.0	49.0	OK	
2	SAHAB	63	63	63			189	126	145.0	77%	44%	19.0	25.0	OK	
2	MWQAR	80	80				160	80	55.5	35%		0.0	24.0	OK	
3	ABDALI	40	40	40			120	80	73.8	61%		0.0	18.0	OK	
3	ABDALI NEW	80	80				160	80	86.0	54%		6.0	25.0	OK	
3	HIZAM	80	80	80			240	160	126.8	53%	55%	0.0	36.0	OK	
3	ZERQA	30	30	30	40		130	90	100.8	78%		10.8	18.8	OK	
3	ZERQA TR5	63					63	0	26.0	41%		26.0	27.0	OK	
3	DHULEIL	80	80				160	80	67.2	42%		0.0	23.1	OK	
4	CITY CENTER	80	80	80			240	160	138.2	58%		0.0	111.6	OK	
4	MARQA	45	63	80			188	108	128.6	68%	59%	20.6	49.5	OK	
4	TAREQ	80	80	80			240	160	130.5	54%		0.0	80.2	OK	
5	BAYADER	80	80	80			240	160	214.8	89%		54.8	79.2	OK	
5	New BAYDER	80	80				160	80	104.0	65%		24.0	24.0	No	
5	SALT	80	80	80			240	160	167.8	70%	74%	7.8	29.5	OK	From Subeihi
5	UNIVERSITY	80	80	80			240	160	194.9	81%		34.9	85.2	OK	
5	SUBEIHI	63	63	63			189	126	104.6	55%		0.0	5.2	OK	To Salt 15%(28.4MVA)
6	QAIA	45	45				90	45	16.0	18%		0.0	24.5	OK	
6	QAIA New	80	80	80			240	160	113.1	47%	42%	0.0	36.0	OK	80MVA
6	MADABA SOUTH	80	80	80			240	160	111.9	47%		0.0	35.0	OK	
									Average		58%				

*FUHEIS, HASHIMIYA and MWQAR IND are excluded due to an exclusive use for large industries.

Source: JICA Study Team

Table 3 BSP Analysis by the NEPCO Practice for JEPCO in 2018

i) No countermeasure

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2018		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	ABDOON	80	80	80			240	160	138.4	58%		0.0	48.0	OK	
1	AMMAN S	45	45	45			135	90	125.2	93%	76%	35.2	41.6	OK	
1	AMMAN S NEW	80	80	80			240	160	193.4	81%		33.4	63.2	OK	
1	ASHRFIA	63	63				126	63	109.4	87%		46.4	51.3	OK	
2	MANARAH	80	80	80			240	160	63.2	26%		0.0	49.0	OK	
2	SAHAB	63	63	63			189	126	148.4	79%	46%	22.4	25.0	OK	
2	MWQAR	80	80				160	80	59.5	37%		0.0	24.0	OK	
3	ABDALI	40	40	40			120	80	77.9	65%		0.0	18.0	OK	
3	ABDALI NEW	80	80				160	80	90.8	57%		10.8	25.0	OK	
3	HIZAM	80	80	80			240	160	133.6	56%		0.0	36.0	OK	
3	ZERQA	30	30	30	40		130	90	106.5	82%	46%	16.5	18.8	OK	
3	ZERQA TR5	63					63	0	27.4	44%		27.4	27.0	No	
3	New ZERQA	80	80	80			240	160		0%		0.0	36.0	OK	NEPCO committed projet
3	DHULEIL	80	80				160	80	73.0	46%		0.0	23.1	OK	
4	CITY CENTER	80	80	80			240	160	147.3	61%		0.0	111.6	OK	
4	MARQA	45	63	80			188	108	128.6	68%	62%	20.6	49.5	OK	
4	TAREQ	80	80	80			240	160	136.3	57%		0.0	80.2	OK	
5	BAYADER	80	80	80			240	160	226.5	94%		66.5	79.2	OK	
5	New BAYDER	80	80				160	80	109.7	69%		29.7	24.0	No	
5	SALT	80	80	80			240	160	182.3	76%	78%	22.3	29.5	OK	
5	UNIVERSITY	80	80	80			240	160	208.2	87%		48.2	85.2	OK	
5	SUBEIHI	63	63	63			189	126	104.6	55%		0.0	5.2	OK	
6	QAIA	45	45				90	45	17.4	19%		0.0	24.5	OK	
6	QAIA New	80	80	80			240	160	122.9	51%	45%	0.0	36.0	OK	
6	MADABA SOUTH	80	80	80			240	160	118.9	50%		0	35.0	OK	
									Average		59%				

*FUHEIS, HASHIMIYA and MWQAR IND are excluded due to an exclusive use for large industries.

ii) After countermeasures

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2018		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	ABDOON	80	80	80			240	160	138.4	58%		0.0	48.0	OK	
1	AMMAN S	80	80	80			240	160	125.2	52%	67%	0.0	41.6	OK	105MVA
1	AMMAN S NEW	80	80	80			240	160	193.4	81%		33.4	63.2	OK	
1	ASHRFIA	63	63				126	63	109.4	87%		46.4	51.3	OK	
2	MANARAH	80	80	80			240	160	63.2	26%		0.0	49.0	OK	
2	SAHAB	63	63	63			189	126	148.4	79%	46%	22.4	25.0	OK	
2	MWQAR	80	80				160	80	59.5	37%		0.0	24.0	OK	
3	ABDALI	40	40	40			120	80	77.9	65%		0.0	18.0	OK	
3	ABDALI NEW	80	80				160	80	90.8	57%		10.8	25.0	OK	
3	HIZAM	80	80	80			240	160	133.6	56%		0.0	36.0	OK	
3	ZERQA	30	30	30	40		130	90	80.5	62%	46%	0.0	18.8	OK	To New ZERQA(20%)
3	ZERQA TR5	63					63	0	14.8	24%		14.8	27.0	OK	To New ZERQA(20%)
3	New ZERQA	80	80	80			240	160	38.6	16%		0.0	36.0	OK	From ZERQA and New ZARQA
3	DHULEIL	80	80				160	80	73.0	46%		0.0	23.1	OK	
4	CITY CENTER	80	80	80			240	160	147.3	61%		0.0	111.6	OK	
4	MARQA	45	63	80			188	108	128.6	68%	62%	20.6	49.5	OK	
4	TAREQ	80	80	80			240	160	136.3	57%		0.0	80.2	OK	
5	BAYADER	80	80	80			240	160	190.5	79%		30.5	79.2	OK	
5	New BAYDER	80	80	80			240	159	145.7	61%		0.0	36.0	OK	80MVA
5	SALT	80	80	80			240	160	182.3	76%	72%	22.3	29.5	OK	
5	UNIVERSITY	80	80	80			240	160	208.2	87%		48.2	85.2	OK	
5	SUBEIHI	63	63	63			189	126	104.6	55%		0.0	5.2	OK	
6	QAIA	45	45				90	45	17.4	19%		0.0	24.5	OK	
6	QAIA New	80	80	80			240	160	122.9	51%	45%	0.0	36.0	OK	
6	MADABA SOUTH	80	80	80			240	160	118.9	50%		0.0	35.0	OK	
									Average		56%				

*FUHEIS, HASHIMIYA and MWQAR IND are excluded due to an exclusive use for large industries.

Source: JICA Study Team

Table 4　BSP Analysis by the NEPCO Practice for JEPCO in 2019

i) No countermeasure

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2019		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	ABDOON	80	80	80	0	0	240	160	150.1	63%		0.0	48.0	OK	
1	AMMAN S	80	80	80	0	0	240	160	135.4	56%	72%	0.0	41.6	OK	
1	AMMAN S NEW	80	80	80	0	0	240	160	209.2	87%		49.2	63.2	OK	
1	ASHRFIA	63	63	0	0	0	126	63	113.7	90%		50.7	51.3	OK	
2	MANARAH	80	80	80	0	0	240	160	69.1	29%		0.0	49.0	OK	
2	SAHAB	63	63	63	0	0	189	126	156.4	83%	49%	30.4	25.0	No	
2	MWQAR	80	80	0	0	0	160	80	63.4	40%		0.0	24.0	OK	
3	ABDALI	40	40	40	0	0	120	80	84.1	70%		4.1	18.0	OK	
3	ABDALI NEW	80	80	0	0	0	160	80	98.1	61%		18.1	25.0	OK	
3	HIZAM	80	80	80	0	0	240	160	140.7	59%		0.0	36.0	OK	
3	ZERQA	30	30	30	40	0	130	90	86.9	67%	49%	0.0	18.8	OK	
3	ZERQA TR5	63	0	0	0	0	63	0	16.0	25%		16.0	27.0	OK	
3	New ZERQA	80	80	80	0	0	240	160	41.7	17%		0.0	36.0	OK	
3	DHULEIL	80	80	0	0	0	160	80	80.3	50%		0.3	23.1	OK	
4	CITY CENTER	80	80	80	0	0	240	160	161.5	67%		1.5	111.6	OK	
4	MARQA	45	63	80	0	0	188	108	132.1	70%	66%	24.1	49.5	OK	
4	TAREQ	80	80	80	0	0	240	160	146.3	61%		0.0	80.2	OK	
5	BAYADER	80	80	80	0	0	240	160	206.1	86%		46.1	79.2	OK	
5	New BAYDER	80	80	80	0	0	240	160	157.6	66%		0.0	36.0	OK	
5	SALT	80	80	80	0	0	240	160	202.5	84%	79%	42.5	29.5	No	
5	UNIVERSITY	80	80	80	0	0	240	160	227.6	95%		67.6	85.2	OK	
5	SUBEIHI	63	63	63	0	0	189	126	111.8	59%		0.0	5.2	OK	
6	QAIA	45	45	0	0	0	90	45	19.4	22%		0.0	24.5	OK	
6	QAIA New	80	80	80	0	0	240	160	136.7	57%	50%	0.0	36.0	OK	
6	MADABA SOUTH	80	80	80	0	0	240	160	127.8	53%		0.0	35.0	OK	
									Average		61%				

*FUHEIS, HASHIMIYA and MWQAR IND are excluded due to an exclusive use for large industries.

ii) After countermeasures

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2019		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	ABDOON	80	80	80	0	0	240	160	150.1	63%		0.0	48.0	OK	
1	AMMAN S	80	80	80	0	0	240	160	135.4	56%	66%	0.0	41.6	OK	
1	AMMAN S NEW	80	80	80	0	0	240	160	209.2	87%		49.2	63.2	OK	
1	ASHRFIA	63	63	80	0	0	206	63	113.7	55%		50.7	51.3	OK	80MVA
2	MANARAH	80	80	80	0	0	240	160	69.1	29%		0.0	49.0	OK	
2	SAHAB	63	63	63	0	0	189	126	118.6	63%	43%	0.0	25.0	OK	
2	MWQAR	80	80	80	0	0	240	80	101.2	42%		21.2	36.0	OK	80MVA
3	ABDALI	40	40	40	0	0	120	80	84.1	70%		4.1	18.0	OK	
3	ABDALI NEW	80	80	0	0	0	160	80	98.1	61%		18.1	25.0	OK	
3	HIZAM	80	80	80	0	0	240	160	140.7	59%		0.0	36.0	OK	
3	ZERQA	30	30	30	40	0	130	90	86.9	67%	49%	0.0	18.8	OK	
3	ZERQA TR5	63	0	0	0	0	63	0	16.0	25%		16.0	27.0	OK	
3	New ZERQA	80	80	80	0	0	240	160	41.7	17%		0.0	36.0	OK	
3	DHULEIL	80	80	0	0	0	160	80	80.3	50%		0.3	23.1	OK	
4	CITY CENTER	80	80	80	0	0	240	160	161.5	67%		1.5	111.6	OK	
4	MARQA	45	63	80	0	0	188	108	132.1	70%	66%	24.1	49.5	OK	
4	TAREQ	80	80	80	0	0	240	160	146.3	61%		0.0	80.2	OK	
5	BAYADER	80	80	80	0	0	240	160	206.1	86%		46.1	79.2	OK	
5	New BAYDER	80	80	80	0	0	240	160	157.6	66%		0.0	36.0	OK	
5	SALT	80	80	80	0	0	240	160	154.5	64%	65%	0.0	29.5	OK	
5	UNIVERSITY	80	80	80	0	0	240	160	179.6	75%		19.6	85.2	OK	
5	New BSP	80	80	80			240	160	96.0	40%		0.0	36.0	OK	New BSP
5	SUBEIHI	63	63	63	0	0	189	126	111.8	59%		0.0	5.2	OK	
6	QAIA	45	45	0	0	0	90	45	19.4	22%		0.0	24.5	OK	
6	QAIA New	80	80	80	0	0	240	160	136.7	57%	50%	0.0	36.0	OK	
6	MADABA SOUTH	80	80	80	0	0	240	160	127.8	53%		0.0	35.0	OK	
									Average		56%				

*FUHEIS, HASHIMIYA and MWQAR IND are excluded due to an exclusive use for large industries.

Source: JICA Study Team

Table 5　BSP Analysis by the NEPCO Practice for JEPCO in 2020

i) No countermeasure

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2020		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	ABDOON	80	80	80	0	0	240	160	157.9	66%		0.0	48.0	OK	
1	AMMAN S	80	80	80	0	0	240	160	142.4	59%	68%	0.0	41.6	OK	
1	AMMAN S NEW	80	80	80	0	0	240	160	219.9	92%		59.9	63.2	OK	
1	ASHRFIA	63	63	80	0	0	206	63	113.7	55%		50.7	51.3	OK	
2	MANARAH	80	80	80	0	0	240	160	72.7	30%		0.0	49.0	OK	
2	SAHAB	63	63	63	0	0	189	126	121.2	64%	45%	0.0	25.0	OK	
2	MWQAR	80	80	80	0	0	240	80	107.5	45%		27.5	36.0	OK	
3	ABDALI	40	40	40	0	0	120	80	88.6	74%		8.6	18.0	OK	
3	ABDALI NEW	80	80	0	0	0	160	80	103.3	65%		23.3	25.0	OK	
3	HIZAM	80	80	80	0	0	240	160	148.3	62%		0.0	36.0	OK	
3	ZERQA	30	30	30	40	0	130	90	91.8	71%	52%	1.8	18.8	OK	
3	ZERQA TR5	63	0	0	0	0	63	0	16.9	27%		16.9	27.0	OK	
3	New ZERQA	80	80	80	0	0	240	160	44.0	18%		0.0	36.0	OK	
3	DHULEIL	80	80	0	0	0	160	80	86.2	54%		6.2	23.1	OK	
4	CITY CENTER	80	80	80	0	0	240	160	170.7	71%		10.7	111.6	OK	
4	MARQA	45	63	80	0	0	188	108	131.4	70%	68%	23.4	49.5	OK	
4	TAREQ	80	80	80	0	0	240	160	152.1	63%		0.0	80.2	OK	
5	BAYADER	80	80	80	0	0	240	160	216.8	90%		56.8	79.2	OK	
5	New BAYDER	80	80	80	0	0	240	160	165.8	69%		5.8	36.0	OK	
5	SALT	80	80	80	0	0	240	160	167.4	70%		7.4	29.5	OK	
5	UNIVERSITY	80	80	80	0	0	240	160	190.8	80%	70%	30.8	85.2	OK	
5	New BSP	80	80	80			240	160	118.8	49%		0.0	36.0	OK	
5	SUBIHI	63	63	63	0	0	189	126	115.4	61%		0.0	5.2	OK	
6	QAIA	45	45	0	0	0	90	45	21.0	23%		0.0	24.5	OK	
6	QAIA New	80	80	80	0	0	240	160	148.5	62%	53%	0.0	36.0	OK	
6	MADABA SOUTH	80	80	80	0	0	240	160	134.8	56%		0.0	35.0	OK	
									Average		60%				

*FUHBS, HASHIMIYA and MWQAR IND are excluded due to an exclusive use for large industries.

ii) After countermeasures

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2020		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	ABDOON	80	80	80	0	0	240	160	157.9	66%		0.0	48.0	OK	
1	AMMAN S	80	80	80	0	0	240	160	142.4	59%	66%	0.0	41.6	OK	
1	AMMAN S NEW	80	80	80	0	0	240	160	183.9	77%		23.9	63.2	OK	
1	ASHRFIA	80	80	80	0	0	240	160	149.7	62%		0.0	51.3	OK	34MVA
2	MANARAH	80	80	80	0	0	240	160	72.7	30%		0.0	49.0	OK	
2	SAHAB	63	63	63	0	0	189	126	121.2	64%	45%	0.0	25.0	OK	
2	MWQAR	80	80	80	0	0	240	80	107.5	45%		27.5	36.0	OK	
3	ABDALI	40	40	40	0	0	120	80	88.6	74%		8.6	18.0	OK	
3	ABDALI NEW	80	80	0	0	0	160	80	103.3	65%		23.3	25.0	OK	
3	HIZAM	80	80	80	0	0	240	160	148.3	62%		0.0	36.0	OK	
3	ZERQA	30	30	30	40	0	130	90	91.8	71%	52%	1.8	18.8	OK	
3	ZERQA TR5	63	0	0	0	0	63	0	16.9	27%		16.9	27.0	OK	
3	New ZERQA	80	80	80	0	0	240	160	44.0	18%		0.0	36.0	OK	
3	DHULEIL	80	80	0	0	0	160	80	86.2	54%		6.2	23.1	OK	
4	CITY CENTER	80	80	80	0	0	240	160	170.7	71%		10.7	111.6	OK	
4	MARQA	45	63	80	0	0	188	108	131.4	70%	68%	23.4	49.5	OK	
4	TAREQ	80	80	80	0	0	240	160	152.1	63%		0.0	80.2	OK	
5	BAYADER	80	80	80	0	0	240	160	144.8	60%		0.0	79.2	OK	
5	New BAYDER	80	80	80	0	0	240	160	165.8	69%		5.8	36.0	OK	
5	SALT	80	80	80	0	0	240	160	119.4	50%		0.0	29.5	OK	
5	UNIVERSITY	80	80	80	0	0	240	160	154.8	65%	60%	0.0	85.2	OK	
5	New BSP	80	80	80	0	0	240	160	118.8	49%		0.0	36.0	OK	
5	New BSP No2	80	80	80			240	160	156.0	65%		0.0	36.0	OK	New BSP
5	SUBIHI	63	63	63	0	0	189	126	115.4	61%		0.0	5.2	OK	
6	QAIA	45	45	0	0	0	90	45	21.0	23%		0.0	24.5	OK	
6	QAIA New	80	80	80	0	0	240	160	148.5	62%	53%	0.0	36.0	OK	
6	MADABA SOUTH	80	80	80	0	0	240	160	134.8	56%		0.0	35.0	OK	
									Average		57%				

*FUHBS, HASHIMIYA and MWQAR IND are excluded due to an exclusive use for large industries.

Source: JICA Study Team

Table 6 BSP Analysis by the NEPCO Practice for JEPCO in 2021

i) No countermeasure

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2021		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	ABDOON	80	80	80	0	0	240	160	169.6	71%		9.6	48.0	OK	
1	AMMAN S	80	80	80	0	0	240	160	152.6	64%	70%	0.0	41.6	OK	
1	AMMAN S NEW	80	80	80	0	0	240	160	197.1	82%		37.1	63.2	OK	
1	ASHRFIA	80	80	80	0	0	240	160	153.9	64%		0.0	51.3	OK	
2	MANARAH	80	80	80	0	0	240	160	79.4	33%		0.0	49.0	OK	
2	SAHAB	63	63	63	0	0	189	126	126.4	67%	48%	0.4	25.0	OK	
2	MWQAR	80	80	80	0	0	240	80	113.9	47%		33.9	36.0	OK	
3	ABDALI	40	40	40	0	0	120	80	95.2	79%		15.2	18.0	OK	
3	ABDALI NEW	80	80	0	0	0	160	80	110.9	69%		30.9	25.0	No	
3	HIZAM	80	80	80	0	0	240	160	156.2	65%		0.0	36.0	OK	
3	ZERQA	30	30	30	40	0	130	90	98.2	76%	56%	8.2	18.8	OK	
3	ZERQA TR5	63	0	0	0	0	63	0	18.1	29%		18.1	27.0	OK	
3	New ZERQA	80	80	80	0	0	240	160	47.1	20%		0.0	36.0	OK	
3	DHULEIL	80	80	0	0	0	160	80	93.5	58%		13.5	23.1	OK	
4	CITY CENTER	80	80	80	0	0	240	160	184.9	77%		24.9	111.6	OK	
4	MARQA	45	63	80	0	0	188	108	133.5	71%	72%	25.5	49.5	OK	
4	TAREQ	80	80	80	0	0	240	160	162.1	68%		2.1	80.2	OK	
5	BAYADER	80	80	80	0	0	240	160	155.2	65%		0.0	79.2	OK	
5	New BAYDER	80	80	80	0	0	240	160	177.7	74%		17.7	36.0	OK	
5	SALT	80	80	80	0	0	240	160	131.7	55%		0.0	29.5	OK	
5	UNIVERSITY	80	80	80	0	0	240	160	167.2	70%	64%	7.2	85.2	OK	
5	New BSP	80	80	80	0	0	240	160	128.3	53%		0.0	36.0	OK	
5	New BSP No2	80	80	80	0	0	240	160	168.5	70%		8.5	36.0	OK	
5	SUBIHI	63	63	63	0	0	189	126	119.0	63%		0.0	5.2	OK	
6	QAIA	45	45	0	0	0	90	45	23.1	26%		0.0	24.5	OK	
6	QAIA New	80	80	80	0	0	240	160	163.2	68%	58%	3.2	36.0	OK	
6	MADABA SOUTH	80	80	80	0	0	240	160	144.8	60%		0.0	35.0	OK	
									Average		61%				

*FUHEIS, HASHIMIYA and MWQAR IND are excluded due to an exclusive use for large industries.

ii) After countermeasures

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2021		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	ABDOON	80	80	80	0	0	240	160	169.6	71%		9.6	48.0	OK	
1	AMMAN S	80	80	80	0	0	240	160	152.6	64%	70%	0.0	41.6	OK	
1	AMMAN S NEW	80	80	80	0	0	240	160	197.1	82%		37.1	63.2	OK	
1	ASHRFIA	80	80	80	0	0	240	160	153.9	64%		0.0	51.3	OK	
2	MANARAH	80	80	80	0	0	240	160	79.4	33%		0.0	49.0	OK	
2	SAHAB	63	63	63	0	0	189	126	126.4	67%	48%	0.4	25.0	OK	
2	MWQAR	80	80	80	0	0	240	160	113.9	47%		0.0	36.0	OK	
3	ABDALI	40	40	40	0	0	120	80	95.2	79%		6.1	43.0	OK	Linkling of 33kV buses of Abdali and Abdali New
3	ABDALI NEW	80	80	0	0	0	160	80	110.9	69%					
3	HIZAM	80	80	80	0	0	240	160	156.2	65%		0.0	36.0	OK	
3	ZERQA	30	30	30	40	0	130	90	98.2	76%	56%	8.2	18.8	OK	
3	ZERQA TR5	63	0	0	0	0	63	0	18.1	29%		18.1	27.0	OK	
3	New ZERQA	80	80	80	0	0	240	160	47.1	20%		0.0	36.0	OK	
3	DHULEIL	80	80	0	0	0	160	80	93.5	58%		13.5	23.1	OK	
4	CITY CENTER	80	80	80	0	0	240	160	184.9	77%		24.9	111.6	OK	
4	MARQA	45	63	80	0	0	188	108	133.5	71%	72%	25.5	49.5	OK	
4	TAREQ	80	80	80	0	0	240	160	162.1	68%		2.1	80.2	OK	
5	BAYADER	80	80	80	0	0	240	160	155.2	65%		0.0	79.2	OK	
5	New BAYDER	80	80	80	0	0	240	160	177.7	74%		17.7	36.0	OK	
5	SALT	80	80	80	0	0	240	160	131.7	55%		0.0	29.5	OK	
5	UNIVERSITY	80	80	80	0	0	240	160	167.2	70%	64%	7.2	85.2	OK	
5	New BSP	80	80	80	0	0	240	160	128.3	53%		0.0	36.0	OK	
5	New BSP No2	80	80	80	0	0	240	160	168.5	70%		8.5	36.0	OK	
5	SUBIHI	63	63	63	0	0	189	126	119.0	63%		0.0	5.2	OK	
6	QAIA	45	45	0	0	0	90	45	23.1	26%		0.0	24.5	OK	
6	QAIA New	80	80	80	0	0	240	160	163.2	68%	58%	3.2	36.0	OK	
6	MADABA SOUTH	80	80	80	0	0	240	160	144.8	60%		0.0	35.0	OK	
									Average		61%				

*FUHEIS, HASHIMIYA and MWQAR IND are excluded due to an exclusive use for large industries.

Source: JICA Study Team

Table 7　BSP Analysis by the NEPCO Practice for JEPCO in 2022

i) No countermeasure

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2022		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	ABDOON	80	80	80	0	0	240	160	177.4	74%		17.4	48.0	OK	
1	AMMAN S	80	80	80	0	0	240	160	159.6	66%	73%	0.0	41.6	OK	
1	AMMAN S NEW	80	80	80	0	0	240	160	206.1	86%		46.1	63.2	OK	
1	ASHRFIA	80	80	80	0	0	240	160	153.9	64%		0.0	51.3	OK	
2	MANARAH	80	80	80	0	0	240	160	83.8	35%		0.0	49.0	OK	
2	SAHAB	63	63	63	0	0	189	126	128.1	68%	50%	2.1	25.0	OK	
2	MWQAR	80	80	80	0	0	240	160	120.2	50%		0.0	36.0	OK	
3	ABDALI	40	40	40	0	0	120	80	99.3	83%		15.1	43.0	OK	
3	ABDALI NEW	80	80	0	0	0	160	80	115.8	72%					
3	HIZAM	80	80	80	0	0	240	160	164.5	69%		4.5	36.0	OK	
3	ZERQA	30	30	30	40	0	130	90	102.5	79%	58%	12.5	18.8	OK	
3	ZERQA TR5	63	0	0	0	0	63	0	18.9	30%		18.9	27.0	OK	
3	New ZERQA	80	80	80	0	0	240	160	49.2	20%		0.0	36.0	OK	
3	DHULEIL	80	80	0	0	0	160	80	100.8	63%		20.8	23.1	OK	
4	CITY CENTER	80	80	80	0	0	240	160	195.0	81%		35.0	111.6	OK	
4	MARQA	45	63	80	0	0	188	108	132.8	71%	74%	24.8	49.5	OK	
4	TAREQ	80	80	80	0	0	240	160	167.9	70%		7.9	80.2	OK	
5	BAYADER	80	80	80	0	0	240	160	162.3	68%		2.3	79.2	OK	
5	New BAYDER	80	80	80	0	0	240	160	185.9	77%		25.9	36.0	OK	
5	SALT	80	80	80	0	0	240	160	141.4	59%		0.0	29.5	OK	
5	UNIVERSITY	80	80	80	0	0	240	160	176.4	73%	66%	16.4	85.2	OK	
5	New BSP	80	80	80	0	0	240	160	168.5	70%		8.5	36.0	OK	
5	New BSP No2	80	80	80	0	0	240	160	119.0	50%		0.0	36.0	OK	
5	SUBEIHI	63	63	63	0	0	189	126	122.6	65%		0.0	5.2	OK	
6	QAIA	45	45	0	0	0	90	45	24.9	28%		0.0	24.5	OK	
6	QAIA New	80	80	80	0	0	240	160	176.0	73%	62%	16.0	36.0	OK	
6	MADABA SOUTH	80	80	80	0	0	240	160	150.8	63%		0.0	35.0	OK	
									Average		64%				

*FUHEIS, HASHIMIYA and MWQAR IND are excluded due to an exclusive use for large industries.

ii) After countermeasures

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2022		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	ABDOON	80	80	80	0	0	240	160	177.4	74%		17.4	48.0	OK	
1	AMMAN S	80	80	80	0	0	240	160	159.6	66%		0.0	41.6	OK	
1	AMMAN S NEW	80	80	80	0	0	240	160	206.1	86%	73%	46.1	63.2	OK	
							0	0		#DIV/0!		0.0	0.0	OK	
1	ASHRFIA	80	80	80	0	0	240	160	153.9	64%		0.0	51.3	OK	
2	MANARAH	80	80	80	0	0	240	160	83.8	35%		0.0	49.0	OK	
2	SAHAB	63	63	63	0	0	189	126	128.1	68%	50%	2.1	25.0	OK	
2	MWQAR	80	80	80	0	0	240	160	120.2	50%		0.0	36.0	OK	
3	ABDALI	40	40	40	0	0	120	80	99.3	83%		15.1	43.0	OK	
3	ABDALI NEW	80	80	0	0	0	160	80	115.8	72%					
3	HIZAM	80	80	80	0	0	240	160	164.5	69%		4.5	36.0	OK	
3	ZERQA	30	30	30	40	0	130	90	102.5	79%	58%	12.5	18.8	OK	
3	ZERQA TR5	63	0	0	0	0	63	0	18.9	30%		18.9	27.0	OK	
3	New ZERQA	80	80	80	0	0	240	160	49.2	20%		0.0	36.0	OK	
3	DHULEIL	80	80	0	0	0	160	80	100.8	63%		20.8	23.1	OK	
4	CITY CENTER	80	80	80	0	0	240	160	195.0	81%		35.0	111.6	OK	
4	MARQA	45	63	80	0	0	188	108	132.8	71%	74%	24.8	49.5	OK	
4	TAREQ	80	80	80	0	0	240	160	167.9	70%		7.9	80.2	OK	
5	BAYADER	80	80	80	0	0	240	160	162.3	68%		2.3	79.2	OK	
5	New BAYDER	80	80	80	0	0	240	160	185.9	77%		25.9	36.0	OK	
5	SALT	80	80	80	0	0	240	160	141.4	59%		0.0	29.5	OK	
5	UNIVERSITY	80	80	80	0	0	240	160	176.4	73%	66%	16.4	85.2	OK	
5	New BSP	80	80	80	0	0	240	160	168.5	70%		8.5	36.0	OK	
5	New BSP No2	80	80	80	0	0	240	160	119.0	50%		0.0	36.0	OK	
5	SUBEIHI	63	63	63	0	0	189	126	122.6	65%		0.0	29.5	OK	
6	QAIA	45	45	0	0	0	90	45	24.9	28%		0.0	24.5	OK	
6	QAIA New	80	80	80	0	0	240	160	176.0	73%	62%	16.0	36.0	OK	
6	MADABA SOUTH	80	80	80	0	0	240	160	150.8	63%		0.0	35.0	OK	
									Average		64%				

*FUHEIS, HASHIMIYA and MWQAR IND are excluded due to an exclusive use for large industries.

Source: JICA Study Team

Table 8　BSP Analysis by the NEPCO Practice for JEPCO in 2023

i) No countermeasure

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis: Peak Demand 2023 [MVA]	Normal State Analysis: Peak Demand 2023 %	Normal State Analysis: Group Operating rate (%)	Contingency State Analysis: Load Transfer MVA Necessary for N-1 Observation	Contingency State Analysis: Possible Load Transfer MVA	Contingency State Analysis: N-1 Observation Check	Contingency State Analysis: Load Transfer between BSPs
1	ABDOON	80	80	80	0	0	240	160	189.1	79%		29.1	48.0	OK	
1	AMMAN S	80	80	80	0	0	240	160	171.0	71%		11.0	41.6	OK	
1	AMMAN S NEW	80	80	80	0	0	240	160	220.9	92%	77%	60.9	63.2	OK	
1	New BSP	0	0	0	0	0	0	0	0.0	#DIV/0!		0.0	0.0	OK	
1	ASHRFIA	80	80	80	0	0	240	160	158.1	66%		0.0	51.3	OK	
2	MANARAH	80	80	80	0	0	240	160	90.4	38%		0.0	49.0	OK	
2	SAHAB	63	63	63	0	0	189	126	133.3	71%	52%	7.3	25.0	OK	
2	MWQAR	80	80	80	0	0	240	160	126.5	53%		0.0	36.0	OK	
3	ABDALI	40	40	40	0	0	120	80	106.5	89%		30.8	43.0	OK	
3	ABDALI NEW	80	80	0	0	0	160	80	124.2	78%					
3	HIZAM	80	80	80	0	0	240	160	173.3	72%		13.3	36.0	OK	
3	ZERQA	30	30	30	40	0	130	90	110.0	85%	63%	20.0	18.8	No	
3	ZERQA TR5	63	0	0	0	0	63	0	20.3	32%		20.3	27.0	OK	
3	New ZERQA	80	80	80	0	0	240	160	52.8	22%		0.0	36.0	OK	
3	DHULEIL	80	80	0	0	0	160	80	109.5	68%		29.5	23.1	No	
4	CITY CENTER	80	80	80	0	0	240	160	211.3	88%		51.3	111.6	OK	
4	MARQA	45	63	80	0	0	188	108	134.9	72%	78%	26.9	49.5	OK	
4	TAREQ	80	80	80	0	0	240	160	177.9	74%		17.9	80.2	OK	
5	BAYADER	80	80	80	0	0	240	160	173.8	72%		13.8	79.2	OK	
5	New BAYDER	80	80	80	0	0	240	160	199.1	83%		39.1	36.0	No	
5	SALT	80	80	80	0	0	240	160	155.9	65%		0.0	29.5	OK	
5	UNIVERSITY	80	80	80	0	0	240	160	190.8	79%	71%	30.8	85.2	OK	
5	New BSP	80	80	80	0	0	240	160	182.2	76%		22.2	36.0	OK	
5	New BSP No2	80	80	80	0	0	240	160	128.7	54%		0.0	36.0	OK	
5	SUBBIHI	63	63	63	0	0	189	126	129.8	69%		3.8	29.5	OK	
6	QAIA	45	45	0	0	0	90	45	27.4	30%		0.0	24.5	OK	
6	QAIA New	80	80	80	0	0	240	160	193.7	81%	67%	33.7	36.0	OK	
6	MADABA SOUTH	80	80	80	0	0	240	160	161.8	67%		1.8	35.0	OK	
									Average		68%				

*FUHEIS, HASHIMIYA and MWQAR IND are excluded due to an exclusive use for large industries.

ii) After countermeasures

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis: Peak Demand 2023 [MVA]	Normal State Analysis: Peak Demand 2023 %	Normal State Analysis: Group Operating rate (%)	Contingency State Analysis: Load Transfer MVA Necessary for N-1 Observation	Contingency State Analysis: Possible Load Transfer MVA	Contingency State Analysis: N-1 Observation Check	Contingency State Analysis: Load Transfer between BSPs
1	ABDOON	80	80	80	0	0	240	160	165.1	69%		5.1	48.0	OK	
1	AMMAN S	80	80	80	0	0	240	160	171.0	71%		11.0	41.6	OK	
1	AMMAN S NEW	80	80	80	0	0	240	160	172.9	72%	63%	12.9	63.2	OK	
1	New BSP	60	80	80	0	0	240	160	72.0	30%		0.0	36.0	OK	New BSP
1	ASHRFIA	63	63	80	0	0	206	126	158.1	77%		32.1	51.3	OK	
2	MANARAH	80	80	80	0	0	240	160	90.4	38%		0.0	49.0	OK	
2	SAHAB	63	63	63	0	0	189	126	133.3	71%	52%	7.3	25.0	OK	
2	MWQAR	80	80	80	0	0	240	160	126.5	53%		0.0	36.0	OK	
3	ABDALI	40	40	40	0	0	120	80	106.5	89%		30.8	43.0	OK	
3	ABDALI NEW	80	80	0	0	0	160	80	124.2	78%					
3	HIZAM	80	80	80	0	0	240	160	173.3	72%		13.3	36.0	OK	
3	ZERQA	30	30	30	40	0	130	90	110.0	85%	58%	0.3	45.8	OK	Linkling of 33kV buses of Zarqa and Zarqa TR5
3	ZERQA TR5	63	0	0	0	0	63	0	20.3	32%					
3	New ZERQA	80	80	80	0	0	240	160	52.8	22%		0.0	36.0	OK	
3	DHULEIL	80	80	80	0	0	240	160	109.5	46%		0.0	23.1	OK	80MVA
4	CITY CENTER	80	80	80	0	0	240	160	211.3	88%		51.3	111.6	OK	
4	MARQA	45	63	80	0	0	188	108	134.9	72%	78%	26.9	49.5	OK	
4							0	0		#DIV/0!		0.0	0.0	OK	
4	TAREQ	80	80	80	0	0	240	160	177.9	74%		17.9	80.2	OK	
5	BAYADER	80	80	80	0	0	240	160	173.8	72%		0.0	115.2	OK	Linkling of 33kV buses of Bayader New and old
5	New BAYDER	80	80	80	0	0	240	160	199.1	83%					
5	SALT	80	80	80	0	0	240	160	155.9	65%		0.0	29.5	OK	
5	UNIVERSITY	80	80	80	0	0	240	160	190.8	79%	71%	30.8	85.2	OK	
5	New BSP	80	80	80	0	0	240	160	182.2	76%		22.2	36.0	OK	
5	New BSP No2	80	80	80	0	0	240	160	128.7	54%		0.0	36.0	OK	
5	SUBBIHI	63	63	63	0	0	189	126	129.8	69%		3.8	29.5	OK	
6	QAIA	45	45	0	0	0	90	45	27.4	30%		0.0	24.5	OK	
6	QAIA New	80	80	80	0	0	240	160	193.7	81%	67%	33.7	36.0	OK	
6	MADABA SOUTH	80	80	80	0	0	240	160	161.8	67%		1.8	35.0	OK	
									Average		65%				

*FUHEIS, HASHIMIYA and MWQAR IND are excluded due to an exclusive use for large industries.

Source: JICA Study Team

Table 9 BSP Analysis by the NEPCO Practice for JEPCO in 2024

i) No countermeasure

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2024		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	ABDOON	80	80	80	0	0	240	160	177.0	74%		17.0	48.0	OK	
1	AMMAN S	80	80	80	0	0	240	160	183.3	76%		23.3	41.6	OK	
1	AMMAN S NEW	80	80	80	0	0	240	160	185.3	77%	67%	25.3	63.2	OK	
1	New BSP	80	80	80	0	0	240	160	77.2	32%		0.0	36.0	OK	
1	ASHRFIA	63	63	80	0	0	206	126	162.3	79%		36.3	51.3	OK	
2	MANARAH	80	80	80	0	0	240	160	97.7	41%		0.0	49.0	OK	
2	SAHAB	63	63	63	0	0	189	126	138.5	73%	56%	12.5	25.0	OK	
2	MWQAR	80	80	80	0	0	240	160	136.0	57%		0.0	36.0	OK	
3	ABDALI	40	40	40	0	0	120	80	113.8	95%		46.4	43.0	No	
3	ABDALI NEW	80	80	0	0	0	160	80	132.7	83%					
3	HIZAM	80	80	80	0	0	240	160	182.6	76%		22.6	36.0	OK	
3	ZERQA	30	30	30	40	0	130	90	117.5	90%	62%	9.2	45.8	OK	
3	ZERQA TR5	63	0	0	0	0	63	0	21.6	34%					
3	New ZERQA	80	80	80	0	0	240	160	56.4	23%		0.0	36.0	OK	
3	DHULEIL	80	80	80	0	0	240	160	119.7	50%		0.0	23.1	OK	
4	CITY CENTER	80	80	80	0	0	240	160	228.6	95%		68.6	111.6	OK	
4	MARQA	45	63	80	0	0	188	108	137.1	73%	83%	29.1	49.5	OK	
4	New BSP	0	0	0	0	0	0	0	0.0	#DIV/0!		0.0	0.0	OK	
4	TAREQ	80	80	80	0	0	240	160	188.7	79%		28.7	80.2	OK	
5	BAYADER	80	80	80	0	0	240	160	185.9	77%		0.0	115.2	OK	
5	New BAYDER	80	80	80	0	0	240	160	212.9	89%					
5	SALT	80	80	80	0	0	240	160	171.7	72%		11.7	29.5	OK	
5	UNIVERSITY	80	80	80	0	0	240	160	206.4	86%	76%	46.4	85.2	OK	
5	NEW BSP	80	80	80	0	0	240	160	187.3	78%		27.3	36.0	OK	
5	New BSP N02	80	80	80	0	0	240	160	139.3	58%		0.0	36.0	OK	
5	SUBEIHI	63	63	63	0	0	189	126	133.4	71%		7.4	29.5	OK	
6	QAIA	45	45	0	0	0	90	45	30.2	34%		0.0	24.5	OK	
6	QAIA New	80	80	80	0	0	240	160	213.4	89%	73%	53.4	36.0	No	
6	MADABA SOUTH	80	80	80	0	0	240	160	173.8	72%		13.8	35.0	OK	
									Average		70%				

*FUHEIS, HASHIMIYA and MWQAR IND are excluded due to an exclusive use for large industries.

ii) After countermeasures

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2024		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	ABDOON	80	80	80	0	0	240	160	177.0	74%		17.0	48.0	OK	
1	AMMAN S	80	80	80	0	0	240	160	183.3	76%		23.3	41.6	OK	
1	AMMAN S NEW	80	80	80	0	0	240	160	185.3	77%	67%	25.3	63.2	OK	
1	New BSP	80	80	80	0	0	240	160	77.2	32%		0.0	36.0	OK	
1	ASHRFIA	63	63	80	0	0	206	126	162.3	79%		36.3	51.3	OK	
2	MANARAH	80	80	80	0	0	240	160	97.7	41%		0.0	49.0	OK	
2	SAHAB	63	63	63	0	0	189	126	138.5	73%	56%	12.5	25.0	OK	
2	MWQAR	80	80	80	0	0	240	160	136.0	57%		0.0	36.0	OK	
3	ABDALI	80	80	80	0	0	240	160	113.8	47%		0.0	43.0	OK	120MVA
3	ABDALI NEW	80	80	0	0	0	160	80	132.7	83%					
3	HIZAM	80	80	80	0	0	240	160	182.6	76%		22.6	36.0	OK	
3	ZERQA	80	80	30	40	0	230	150	117.5	51%	53%	0.0	45.8	OK	100MVA
3	ZERQA TR5	63	0	0	0	0	63	0	21.6	34%					
3	New ZERQA	80	80	80	0	0	240	160	56.4	23%		0.0	36.0	OK	
3	DHULEIL	80	80	80	0	0	240	160	119.7	50%		0.0	23.1	OK	
4	CITY CENTER	80	80	80	0	0	240	160	180.6	75%		20.6	111.6	OK	
4	MARQA	45	63	80	0	0	188	108	137.1	73%	61%	29.1	49.5	OK	
4	New BSP	80	80	80	0	0	240	160	72.0	30%		0.0	36.0	OK	New BSP
4	TAREQ	80	80	80	0	0	240	160	164.7	69%		4.7	80.2	OK	
5	BAYADER	80	80	80	0	0	240	160	185.9	77%		0.0	115.2	OK	
5	New BAYDER	80	80	80	0	0	240	160	212.9	89%					
5	SALT	80	80	80	0	0	240	160	171.7	72%		11.7	29.5	OK	
5	UNIVERSITY	80	80	80	0	0	240	160	206.4	86%	76%	46.4	85.2	OK	
5	NEW BSP	80	80	80	0	0	240	160	187.3	78%		27.3	36.0	OK	
5	New BSP No2	80	80	80			240	160	139.3	58%		0.0	36.0	OK	
5	SUBEIHI	63	63	63	0	0	189	126	133.4	71%		7.4	29.5	OK	
6	QAIA	45	45	80	0	0	170	90	66.2	39%		0.0	24.5	OK	80MVA
6	QAIA New	80	80	80	0	0	240	160	177.4	74%	64%	17.4	36.0	OK	
6	MADABA SOUTH	80	80	80	0	0	240	160	173.8	72%		13.8	35.0	OK	
									Average		63%				

*FUHEIS, HASHIMIYA and MWQAR IND are excluded due to an exclusive use for large industries.

Source: JICA Study Team

Table 10 BSP Analysis by the NEPCO Practice for JEPCO in 2025

i) No countermeasure

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2024		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	ABDOON	80	80	80	0	0	240	160	177.0	74%		17.0	48.0	OK	
1	AMMAN S	80	80	80	0	0	240	160	183.3	76%		23.3	41.6	OK	
1	AMMAN S NEW	80	80	80	0	0	240	160	185.3	77%	67%	25.3	63.2	OK	
1	New BSP	80	80	80	0	0	240	160	77.2	32%		0.0	36.0	OK	
1	ASHRFIA	63	63	80	0	0	206	126	162.3	79%		36.3	51.3	OK	
2	MANARAH	80	80	80	0	0	240	160	97.7	41%		0.0	49.0	OK	
2	SAHAB	63	63	63	0	0	189	126	138.5	73%	56%	12.5	25.0	OK	
2	MWQAR	80	80	80	0	0	240	160	136.0	57%		0.0	36.0	OK	
3	ABDALI	40	40	40	0	0	120	80	113.8	95%		46.4	43.0	No	
3	ABDALI NEW	80	80	0	0	0	160	80	132.7	83%					
3	HIZAM	80	80	80	0	0	240	160	182.6	76%		22.6	36.0	OK	
3	ZERQA	30	30	30	40	0	130	90	117.5	90%	62%	9.2	45.8	OK	
3	ZERQA TR5	63	0	0	0	0	63	0	21.6	34%					
3	New ZERQA	80	80	80	0	0	240	160	56.4	23%		0.0	36.0	OK	
3	DHULEIL	80	80	80	0	0	240	160	119.7	50%		0.0	23.1	OK	
4	CITY CENTER	80	80	80	0	0	240	160	228.6	95%		68.6	111.6	OK	
4	MARQA	45	63	80	0	0	188	108	137.1	73%	83%	29.1	49.5	OK	
4	New BSP	0	0	0	0	0	0	0	0.0	#DIV/0!		0.0	0.0	OK	
4	TAREQ	80	80	80	0	0	240	160	188.7	79%		28.7	80.2	OK	
5	BAYADER	80	80	80	0	0	240	160	185.9	77%		0.0	115.2	OK	
5	New BAYDER	80	80	80	0	0	240	160	212.9	89%					
5	SALT	80	80	80	0	0	240	160	171.7	72%		11.7	29.5	OK	
5	UNIVERSITY	80	80	80	0	0	240	160	206.4	86%	76%	46.4	85.2	OK	
5	NEW BSP	80	80	80	0	0	240	160	187.3	78%		27.3	36.0	OK	
5	New BSP N02	80	80	80	0	0	240	160	139.3	58%		0.0	36.0	OK	
5	SUBEIHI	63	63	63	0	0	189	126	133.4	71%		7.4	29.5	OK	
6	QAIA	45	45	0	0	0	90	45	30.2	34%		0.0	24.5	OK	
6	QAIA New	80	80	80	0	0	240	160	213.4	89%	73%	53.4	36.0	No	
6	MADABA SOUTH	80	80	80	0	0	240	160	173.8	72%		13.8	35.0	OK	
									Average		70%				

*FUHEIS, HASHIMIYA and MWQAR IND are excluded due to an exclusive use for large industries.

ii) After countermeasures

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2024		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	ABDOON	80	80	80	0	0	240	160	177.0	74%		17.0	48.0	OK	
1	AMMAN S	80	80	80	0	0	240	160	183.3	76%		23.3	41.6	OK	
1	AMMAN S NEW	80	80	80	0	0	240	160	185.3	77%	67%	25.3	63.2	OK	
1	New BSP	80	80	80	0	0	240	160	77.2	32%		0.0	36.0	OK	
1	ASHRFIA	63	63	80	0	0	206	126	162.3	79%		36.3	51.3	OK	
2	MANARAH	80	80	80	0	0	240	160	97.7	41%		0.0	49.0	OK	
2	SAHAB	63	63	63	0	0	189	126	138.5	73%	56%	12.5	25.0	OK	
2	MWQAR	80	80	80	0	0	240	160	136.0	57%		0.0	36.0	OK	
3	ABDALI	80	80	80	0	0	240	160	113.8	47%		0.0	43.0	OK	120MVA
3	ABDALI NEW	80	80	0	0	0	160	80	132.7	83%					
3	HIZAM	80	80	80	0	0	240	160	182.6	76%		22.6	36.0	OK	
3	ZERQA	80	80	30	40	0	230	150	117.5	51%	53%	0.0	45.8	OK	100MVA
3	ZERQA TR5	63	0	0	0	0	63	0	21.6	34%					
3	New ZERQA	80	80	80	0	0	240	160	56.4	23%		0.0	36.0	OK	
3	DHULEIL	80	80	80	0	0	240	160	119.7	50%		0.0	23.1	OK	
4	CITY CENTER	80	80	80	0	0	240	160	180.6	75%		20.6	111.6	OK	
4	MARQA	45	63	80	0	0	188	108	137.1	73%	61%	29.1	49.5	OK	
4	New BSP	80	80	80	0	0	240	160	72.0	30%		0.0	36.0	OK	New BSP
4	TAREQ	80	80	80	0	0	240	160	164.7	69%		4.7	80.2	OK	
5	BAYADER	80	80	80	0	0	240	160	185.9	77%		0.0	115.2	OK	
5	New BAYDER	80	80	80	0	0	240	160	212.9	89%					
5	SALT	80	80	80	0	0	240	160	171.7	72%		11.7	29.5	OK	
5	UNIVERSITY	80	80	80	0	0	240	160	206.4	86%	76%	46.4	85.2	OK	
5	NEW BSP	80	80	80	0	0	240	160	187.3	78%		27.3	36.0	OK	
5	New BSP No2	80	80	80			240	160	139.3	58%		0.0	36.0	OK	
5	SUBEIHI	63	63	63	0	0	189	126	133.4	71%		7.4	29.5	OK	
6	QAIA	45	45	80	0	0	170	90	66.2	39%		0.0	24.5	OK	80MVA
6	QAIA New	80	80	80	0	0	240	160	177.4	74%	64%	17.4	36.0	OK	
6	MADABA SOUTH	80	80	80	0	0	240	160	173.8	72%		13.8	35.0	OK	
									Average		63%				

*FUHEIS, HASHIMIYA and MWQAR IND are excluded due to an exclusive use for large industries.

Source: JICA Study Team

(2) BSP Analysis for EDCO

Table 11 BSP Analysis by the NEPCO Practice for EDCO in 2016

i) No countermeasure

BSP Grouping	BSP (Substation)	No. of TR's						Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
										Peak Demand 2016		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
										[MVA]	%					
1	AQ A2	40	40	63	63			206	143	69.7	34%		0.0	25.0	OK	
1	AQ IND	80	80					160	80	31.7	20%	23%	0.0	15.0	OK	
1	AQTH & NEW	63	63	80	80			286	206	46.3	16%		0.0	10.0	OK	
2	QUWEIRA	16	45					61	16	16.0	26%		0.0	6.0	OK	
2	DESI	63	63					126	63	34.5	27%	27%	0.0	6.0	OK	
3	EL_HASA	25	25					50	25	25.9	52%		0.9	5.0	OK	
3	RASHADIA	16	40	40				96	56	31.0	32%	39%	0.0	5.0	OK	
4	KARAK	16	16	25				57	32	45.4	80%		13.4	10.0	No	
4	KARAK SOUTH	80	80					160	80	28.9	18%	34%	0.0	10.0	OK	
5	SUBEIHI	63	63	63				189	126	122.1	65%		0.0	6.0	OK	
5	SWEIMEH	80	80	80				240	160	78.7	33%		0.0	3.0	OK	
5	ISHTAFINA	40	45					85	40	67.8	80%	55%	27.8	3.0	No	
5	WAQAS	63	63					126	63	85.1	68%		22.1	3.0	No	
99	QATRANA	10	10	16				36	20	19.7	55%	55%	0.0	0.0	OK	
99	GHORSAFI	40	40	40	40	40		200	160	60.4	30%	30%	0.0	0.0	OK	
99	MAAN	16	16	16	63	63		174	111	50.6	29%	29%	0.0	0.0	OK	
99	AZRAQ	25	25					50	25	16.2	32%	32%	0.0	0.0	OK	
99	SAFAWI	10						10	0	6.2	62%	62%	6.2	0.0	No	
99	RWESHID	10						10	0	4.3	43%	43%	4.3	0.0	No	
99	RESHA	12.5	12.5					25	12.5	3.8	15%	15%	0.0	0.0	OK	
										Average		37%				

ii) After countermeasures

BSP Grouping	BSP (Substation)	No. of TR's						Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
										Peak Demand 2016		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
										[MVA]	%					
1	AQ A2	40	40	63	63			206	143	69.7	34%		0.0	25.0	OK	
1	AQ IND	80	80					160	80	31.7	20%	23%	0.0	15.0	OK	
1	AQTH & NEW	63	63	80	80			286	206	46.3	16%		0.0	10.0	OK	
2	QUWEIRA	16	45					61	16	16.0	26%		0.0	6.0	OK	
2	DESI	63	63					126	63	34.5	27%	27%	0.0	6.0	OK	
3	EL_HASA	25	25					50	25	25.9	52%		0.9	5.0	OK	
3	RASHADIA	16	40	40				96	56	31.0	32%	39%	0.0	5.0	OK	
4	KARAK	63	63	25				151	88	45.4	30%		0.0	10.0	OK	94MVA
4	KARAK SOUTH	80	80					160	80	28.9	18%	24%	0.0	10.0	OK	From Karak
5	SUBEIHI	63	63	63				189	126	122.1	65%		0.0	6.0	OK	
5	SWEIMEH	80	80	80				240	160	78.7	33%		0.0	3.0	OK	
5	ISHTAFINA	40	45	63				148	85	67.8	46%		0.0	3.0	OK	NEPCO Committed Project
5	WAQAS	63	63					126	63	85.1	68%	50%	22.1	3.0	No	NEPCO Committed Project
99	QATRANA	10	10	16				36	20	19.7	55%	55%	0.0	0.0	OK	
99	GHORSAFI	40	40	40	40	40		200	160	60.4	30%	30%	0.0	0.0	OK	
99	MAAN	16	16	16	63	63		174	111	50.6	29%	29%	0.0	0.0	OK	
99	AZRAQ	25	25					50	25	16.2	32%	32%	0.0	0.0	OK	
99	SAFAWI	10						10	0	6.2	62%	62%	6.2	0.0	No	NEPCO Committed Project
99	RWESHID	10						10	0	4.3	43%	43%	4.3	0.0	No	NEPCO Committed Project
99	RESHA	12.5	12.5					25	12.5	3.8	15%	15%	0.0	0.0	OK	
										Average		36%				

Source: JICA Study Team

Table 12 BSP Analysis by the NEPCO Practice for EDCO in 2017

i) No countermeasure

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2017		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	AQ A2	40	40	63	63	0	206	143	73.5	36%		0.0	25.0	OK	
1	AQ IND	80	80	0	0	0	160	80	33.4	21%	24%	0.0	15.0	OK	
1	AQTH & NEW	63	63	80	80	0	286	206	48.7	17%		0.0	10.0	OK	
2	QUWEIRA	16	45	0	0	0	61	16	16.9	28%		0.9	6.0	OK	
2	DESI	63	63	0	0	0	126	63	36.4	29%	28%	0.0	6.0	OK	
3	EL_HASA	25	25	0	0	0	50	25	27.3	55%		2.3	5.0	OK	
3	RASHADIA	16	40	40	0	0	96	56	32.6	34%	41%	0.0	5.0	OK	
4	KARAK	63	63	25	0	0	151	88	47.8	32%		0.0	10.0	OK	
4	KARAK SOUTH	80	80	0	0	0	160	80	30.4	19%	25%	0.0	10.0	OK	
5	SUBEIHI	63	63	63	0	0	189	126	128.6	68%		2.6	6.0	OK	
5	SWEIMEH	80	80	80	0	0	240	160	82.9	35%		0.0	3.0	OK	
5	ISHTAFINA	40	45	63	0	0	148	85	71.4	48%	53%	0.0	3.0	OK	
5	WAQAS	63	63	0	0	0	126	63	89.6	71%		26.6	3.0	No	
99	QATRANA	10	10	16	0	0	36	20	20.8	58%	55%	0.8	0.0	No	
99	GHORSAFI	40	40	40	40	40	200	160	63.6	32%	30%	0.0	0.0	OK	
99	MAAN	16	16	16	63	63	174	111	53.3	31%	31%	0.0	0.0	OK	
99	AZRAQ	25	25	0	0	0	50	25	17.1	34%	34%	0.0	0.0	OK	
99	SAFAWI	10	0	0	0	0	10	0	6.5	65%	65%	6.5	0.0	No	
99	RWESHID	10	0	0	0	0	10	0	4.5	45%	45%	4.5	0.0	No	
99	RESHA	12.5	12.5	0	0	0	25	12.5	4.0	16%	16%	0.0	0.0	OK	
									Average		37%				

ii) After countermeasures

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2017		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	AQ A2	40	40	63	63	0	206	143	73.5	36%		0.0	25.0	OK	
1	AQ IND	80	80	0	0	0	160	80	33.4	21%	24%	0.0	15.0	OK	
1	AQTH & NEW	63	63	80	80	0	286	206	48.7	17%		0.0	10.0	OK	
2	QUWEIRA	16	45	0	0	0	61	16	16.9	28%		0.9	6.0	OK	
2	DESI	63	63	0	0	0	126	63	36.4	29%	28%	0.0	6.0	OK	
3	EL_HASA	25	25	0	0	0	50	25	27.3	55%		2.3	5.0	OK	
3	RASHADIA	16	40	40	0	0	96	56	32.6	34%	0%	0.0	5.0	OK	
4	KARAK	63	63	25	0	0	151	88	47.8	32%		0.0	10.0	OK	
4	KARAK SOUTH	80	80	0	0	0	160	80	30.4	19%	25%	0.0	10.0	OK	From Qatrana
5	SUBEIHI	63	63	63	0	0	189	126	128.6	68%		2.6	6.0	OK	
5	SWEIMEH	80	80	80	0	0	240	160	82.9	35%		0.0	3.0	OK	
5	ISHTAFINA	40	45	63	0	0	148	85	71.4	48%	49%	0.0	3.0	OK	
5	WAQAS	63	63	63	0	0	189	126	89.6	47%		0.0	3.0	OK	NEPCO Committed Project
4	QATRANA	63	10	16	0	0	89	26	20.8	23%	-	0.0	0.0	OK	53MVA
99	GHORSAFI	40	40	40	40	40	200	160	63.6	32%	32%	0.0	0.0	OK	
99	MAAN	16	16	16	63	63	174	111	53.3	31%	31%	0.0	0.0	OK	
99	AZRAQ	25	25	0	0	0	50	25	17.1	34%	34%	0.0	0.0	OK	
99	SAFAWI	10	10	0	0	0	20	10	6.5	32%	32%	0.0	0.0	OK	NEPCO Committed Project
99	RWESHID	10	10	0	0	0	20	10	4.5	23%	23%	0.0	0.0	OK	NEPCO Committed Project
99	RESHA	12.5	12.5	0	0	0	25	12.5	4.0	16%	16%	0.0	0.0	OK	
									Average		27%				

Source: JICA Study Team

Table 13 BSP Analysis by the NEPCO Practice for EDCO in 2018

i) No countermeasure

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2018		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	AQ A2	40	40	63	63	0	206	143	77.4	38%		0.0	25.0	OK	
1	AQ IND	80	80	0	0	0	160	80	35.2	22%	25%	0.0	15.0	OK	
1	AQTH & NEW	63	63	80	80	0	286	206	51.3	18%		0.0	10.0	OK	
2	QUWEIRA	16	45	0	0	0	61	16	17.8	29%		1.8	6.0	OK	
2	DESI	63	63	0	0	0	126	63	38.3	30%	30%	0.0	6.0	OK	
3	EL_HASA	25	25	0	0	0	50	25	28.7	57%		3.7	5.0	OK	
3	RASHADIA	16	40	40	0	0	96	56	34.4	36%	43%	0.0	5.0	OK	
4	KARAK	63	63	25	0	0	151	88	50.4	33%		0.0	10.0	OK	
4	KARAK SOUTH	80	80	0	0	0	160	80	32.0	20%	26%	0.0	20.0	OK	
5	SUBEIHI	63	63	63	0	0	189	126	135.5	72%		9.5	6.0	No	
5	SWEIMEH	80	80	80	0	0	240	160	87.3	36%		0.0	3.0	OK	
5	ISHTAFINA	40	45	63	0	0	148	85	75.3	51%	51%	0.0	3.0	OK	
5	WAQAS	63	63	63	0	0	189	126	94.4	50%		0.0	3.0	OK	
4	QATRANA	63	10	16	0	0	89	26	21.9	25%	-	0.0	10.0	OK	
99	GHORSAFI	40	40	40	40	40	200	160	67.0	34%	34%	0.0	0.0	OK	
99	MAAN	16	16	16	63	63	174	111	56.1	32%	32%	0.0	0.0	OK	
99	AZRAQ	25	25	0	0	0	50	25	18.0	36%	36%	0.0	0.0	OK	
99	SAFAWI	10	10	0	0	0	20	10	6.8	34%	34%	0.0	0.0	OK	
99	RWESHID	10	10	0	0	0	20	10	4.8	24%	24%	0.0	0.0	OK	
99	RESHA	12.5	12.5	0	0	0	25	12.5	4.2	17%	17%	0.0	0.0	OK	
									Average		32%				

ii) After countermeasures

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2018		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	AQ A2	40	40	63	63	0	206	143	77.4	38%		0.0	25.0	OK	
1	AQ IND	80	80	0	0	0	160	80	35.2	22%	25%	0.0	15.0	OK	
1	AQTH & NEW	63	63	80	80	0	286	206	51.3	18%		0.0	10.0	OK	
2	QUWEIRA	16	45	0	0	0	61	16	17.8	29%		1.8	6.0	OK	
2	DESI	63	63	0	0	0	126	63	38.3	30%	30%	0.0	6.0	OK	
3	EL_HASA	25	25	0	0	0	50	25	28.7	57%		3.7	5.0	OK	
3	Tafila	80	80				160	80		0%	21%	0.0	24.0	OK	NEPCO Committed Project
3	RASHADIA	16	40	40	0	0	96	56	34.4	36%		0.0	5.0	OK	
4	KARAK	63	63	25	0	0	151	88	50.4	33%		0.0	10.0	OK	
4	KARAK SOUTH	80	80	0	0	0	160	80	32.0	20%	26%	0.0	20.0	OK	
5	SUBEIHI	80	80	63	0	0	223	143	135.5	61%		0.0	6.0	OK	34MVA
5	SWEIMEH	80	80	80	0	0	240	160	87.3	36%		0.0	3.0	OK	
5	ISHTAFINA	40	45	63	0	0	148	85	75.3	51%	49%	0.0	3.0	OK	
5	WAQAS	63	63	63	0	0	189	126	94.4	50%		0.0	3.0	OK	
4	QATRANA	63	10	16	0	0	89	26	21.9	25%	-	0.0	10.0	OK	
99	GHORSAFI	40	40	40	40	40	200	160	67.0	34%	34%	0.0	0.0	OK	
99	MAAN	16	16	16	63	63	174	111	56.1	32%	32%	0.0	0.0	OK	
99	AZRAQ	25	25	0	0	0	50	25	18.0	36%	36%	0.0	0.0	OK	
99	SAFAWI	10	10	0	0	0	20	10	6.8	34%	34%	0.0	0.0	OK	
99	RWESHID	10	10	0	0	0	20	10	4.8	24%	24%	0.0	0.0	OK	
99	RESHA	12.5	12.5	0	0	0	25	12.5	4.2	17%	17%	0.0	0.0	OK	
									Average		30%				

Source: JICA Study Team

Table 14 BSP Analysis by the NEPCO Practice for EDCO in 2019

i) No countermeasure

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2019		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	AQ A2	40	40	63	63	0	206	143	81.5	40%		0.0	25.0	OK	
1	AQ IND	80	80	0	0	0	160	80	37.1	23%	26%	0.0	15.0	OK	
1	AQTH & NEW	63	63	80	80	0	286	206	54.1	19%		0.0	10.0	OK	
2	QUWEIRA	16	45	0	0	0	61	16	18.7	31%	32%	2.7	6.0	OK	
2	DESI	63	63	0	0	0	126	63	40.4	32%		0.0	6.0	OK	
3	EL_HASA	25	25	0	0	0	50	25	30.3	61%		5.3	5.0	No	
3	Tafila	80	80	0	0	0	160	80	0.0	0%	22%	0.0	24.0	OK	
3	RASHADIA	16	40	40	0	0	96	56	36.2	38%		0.0	5.0	OK	
4	KARAK	63	63	25	0	0	151	88	53.1	35%	27%	0.0	10.0	OK	
4	KARAK SOUTH	80	80	0	0	0	160	80	33.7	21%		0.0	20.0	OK	
5	SUBEIHI	80	80	63	0	0	223	143	142.7	64%		0.0	6.0	OK	
5	SWEIMEH	80	80	80	0	0	240	160	91.9	38%	52%	0.0	3.0	OK	
5	ISHTAFINA	40	45	63	0	0	148	85	79.3	54%		0.0	3.0	OK	
5	WAQAS	63	63	63	0	0	189	126	99.4	53%		0.0	3.0	OK	
4	QATRANA	63	10	16	0	0	89	26	23.1	26%	-	0.0	10.0	OK	
99	GHORSAFI	40	40	40	40	40	200	160	70.6	35%	35%	0.0	0.0	OK	
99	MAAN	16	16	16	63	63	174	111	59.1	34%	34%	0.0	0.0	OK	
99	AZRAQ	25	25	0	0	0	50	25	19.0	38%	38%	0.0	0.0	OK	
99	SAFAWI	10	10	0	0	0	20	10	7.2	36%	36%	0.0	0.0	OK	
99	RWESHID	10	10	0	0	0	20	10	5.0	25%	25%	0.0	0.0	OK	
99	RESHA	12.5	12.5	0	0	0	25	12.5	4.4	18%	18%	0.0	0.0	OK	
									Average		31%				

ii) After countermeasures

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2019		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	AQ A2	40	40	63	63	0	206	143	81.5	40%		0.0	25.0	OK	
1	AQ IND	80	80	0	0	0	160	80	37.1	23%	26%	0.0	15.0	OK	
1	AQTH & NEW	63	63	80	80	0	286	206	54.1	19%		0.0	10.0	OK	
2	QUWEIRA	16	45	0	0	0	61	16	18.7	31%	32%	2.7	6.0	OK	
2	DESI	63	63	0	0	0	126	63	40.4	32%		0.0	6.0	OK	
3	EL_HASA	25	25	0	0	0	50	25	15.3	31%		0.0	5.0	OK	
3	Tafila	80	80	0	0	0	160	80	15.0	9%	22%	0.0	24.0	OK	
3	RASHADIA	16	40	40	0	0	96	56	36.2	38%		0.0	5.0	OK	
4	KARAK	63	63	25	0	0	151	88	53.1	35%	27%	0.0	10.0	OK	
4	KARAK SOUTH	80	80	0	0	0	160	80	33.7	21%		0.0	20.0	OK	
5	SUBEIHI	80	80	63	0	0	223	143	142.7	64%		0.0	6.0	OK	
5	SWEIMEH	80	80	80	0	0	240	160	91.9	38%	52%	0.0	3.0	OK	
5	ISHTAFINA	40	45	63	0	0	148	85	79.3	54%		0.0	3.0	OK	
5	WAQAS	63	63	63	0	0	189	126	99.4	53%		0.0	3.0	OK	
4	QATRANA	63	10	16	0	0	89	26	23.1	26%	-	0.0	10.0	OK	
99	GHORSAFI	40	40	40	40	40	200	160	70.6	35%	35%	0.0	0.0	OK	
99	MAAN	16	16	16	63	63	174	111	59.1	34%	34%	0.0	0.0	OK	
99	AZRAQ	25	25	0	0	0	50	25	19.0	38%	38%	0.0	0.0	OK	
99	SAFAWI	10	10	0	0	0	20	10	7.2	36%	36%	0.0	0.0	OK	
99	RWESHID	10	10	0	0	0	20	10	5.0	25%	25%	0.0	0.0	OK	
99	RESHA	12.5	12.5	0	0	0	25	12.5	4.4	18%	18%	0.0	0.0	OK	
									Average		31%				

Source: JICA Study Team

Table 15 BSP Analysis by the NEPCO Practice for EDCO in 2020

i) No countermeasure

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2020		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	AQ A2	40	40	63	63	0	206	143	85.9	42%		0.0	25.0	OK	
1	AQ IND	80	80	0	0	0	160	80	39.0	24%	28%	0.0	15.0	OK	
1	AQTH & NEW	63	63	80	80	0	286	206	57.0	20%		0.0	10.0	OK	
2	QUWEIRA	16	45	0	0	0	61	16	19.7	32%		3.7	6.0	OK	
2	DESI	63	63	0	0	0	126	63	42.5	34%	33%	0.0	6.0	OK	
3	EL_HASA	25	25	0	0	0	50	25	16.1	32%		0.0	5.0	OK	
3	Tafila	80	80	0	0	0	160	80	15.8	10%	23%	0.0	24.0	OK	
3	RASHADIA	16	40	40	0	0	96	56	38.1	40%		0.0	5.0	OK	
4	KARAK	63	63	25	0	0	151	88	55.9	37%		0.0	10.0	OK	
4	KARAK SOUTH	80	80	0	0	0	160	80	35.5	22%	29%	0.0	20.0	OK	
5	SUBEIHI	80	80	63	0	0	223	143	150.3	67%		7.3	6.0	No	
5	SWEIMEH	80	80	80	0	0	240	160	96.9	40%		0.0	3.0	OK	
5	ISHTAFINA	40	45	63	0	0	148	85	83.5	56%	54%	0.0	3.0	OK	
5	WAQAS	63	63	63	0	0	189	126	104.8	55%		0.0	3.0	OK	
4	QATRANA	63	10	16	0	0	89	26	24.3	27%	-	0.0	10.0	OK	
99	GHORSAFI	40	40	40	40	40	200	160	74.4	37%	37%	0.0	0.0	OK	
99	MAAN	16	16	16	63	63	174	111	62.2	36%	36%	0.0	0.0	OK	
99	AZRAQ	25	25	0	0	0	50	25	20.0	40%	40%	0.0	0.0	OK	
99	SAFAWI	10	10	0	0	0	20	10	7.6	38%	38%	0.0	0.0	OK	
99	RWESHID	10	10	0	0	0	20	10	5.3	27%	27%	0.0	0.0	OK	
99	RESHA	12.5	12.5	0	0	0	25	12.5	4.7	19%	19%	0.0	0.0	OK	
									Average		33%				

ii) After countermeasures

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2020		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	AQ A2	40	40	63	63	0	206	143	85.9	42%		0.0	25.0	OK	
1	AQ IND	80	80	0	0	0	160	80	39.0	24%	28%	0.0	15.0	OK	
1	AQTH & NEW	63	63	80	80	0	286	206	57.0	20%		0.0	10.0	OK	
2	QUWEIRA	16	45	0	0	0	61	16	19.7	32%		3.7	6.0	OK	
2	DESI	63	63	0	0	0	126	63	42.5	34%	33%	0.0	6.0	OK	
3	EL_HASA	25	25	0	0	0	50	25	16.1	32%		0.0	5.0	OK	
3	Tafila	80	80	0	0	0	160	80	15.8	10%	37%	0.0	24.0	OK	
3	RASHADIA	16	40	40	0	0	96	56	38.1	40%		0.0	5.0	OK	
4	KARAK	63	63	25	0	0	151	88	55.9	37%		0.0	10.0	OK	
4	KARAK SOUTH	80	80	0	0	0	160	80	35.5	22%	29%	0.0	20.0	OK	
5	SUBEIHI	80	80	80	0	0	240	160	150.3	63%		0.0	6.0	OK	17MVA
5	SWEIMEH	80	80	80	0	0	240	160	96.9	40%		0.0	3.0	OK	
5	ISHTAFINA	40	45	63	0	0	148	85	83.5	56%	53%	0.0	3.0	OK	
5	WAQAS	63	63	63	0	0	189	126	104.8	55%		0.0	3.0	OK	
4	QATRANA	63	10	16	0	0	89	26	24.3	27%	-	0.0	10.0	OK	
99	GHORSAFI	40	40	40	40	40	200	160	74.4	37%	37%	0.0	0.0	OK	
99	MAAN	16	16	16	63	63	174	111	62.2	36%	36%	0.0	0.0	OK	
99	AZRAQ	25	25	0	0	0	50	25	20.0	40%	40%	0.0	0.0	OK	
99	SAFAWI	10	10	0	0	0	20	10	7.6	38%	38%	0.0	0.0	OK	
99	RWESHID	10	10	0	0	0	20	10	5.3	27%	27%	0.0	0.0	OK	
99	RESHA	12.5	12.5	0	0	0	25	12.5	4.7	19%	19%	0.0	0.0	OK	
									Average		34%				

Source: JICA Study Team

Table 16 BSP Analysis by the NEPCO Practice for EDCO in 2021

i) No countermeasure

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2021		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	AQ A2	40	40	63	63	0	206	143	90.5	44%		0.0	25.0	OK	
1	AQ IND	80	80	0	0	0	160	80	41.1	26%	29%	0.0	15.0	OK	
1	AQTH & NEW	63	63	80	80	0	286	206	60.0	21%		0.0	10.0	OK	
2	QUWEIRA	16	45	0	0	0	61	16	20.8	34%	35%	4.8	6.0	OK	
2	DESI	63	63	0	0	0	126	63	44.8	36%		0.0	6.0	OK	
3	EL_HASA	25	25	0	0	0	50	25	16.9	34%		0.0	5.0	OK	
3	Tafila	80	80	0	0	0	160	80	16.6	10%	24%	0.0	24.0	OK	
3	RASHADIA	16	40	40	0	0	96	56	40.2	42%		0.0	5.0	OK	
4	KARAK	63	63	25	0	0	151	88	58.9	39%	30%	0.0	10.0	OK	
4	KARAK SOUTH	80	80	0	0	0	160	80	37.4	23%		0.0	20.0	OK	
5	SUBEIHI	80	80	80	0	0	240	160	158.3	66%		0.0	6.0	OK	
5	SWEIMEH	80	80	80	0	0	240	160	102.0	43%	56%	0.0	3.0	OK	
5	ISHTAFINA	40	45	63	0	0	148	85	88.0	59%		3.0	3.0	OK	
5	WAQAS	63	63	63	0	0	189	126	110.4	58%		0.0	3.0	OK	
4	QATRANA	63	10	16	0	0	89	26	25.6	29%	-	0.0	10.0	OK	
99	GHORSAFI	40	40	40	40	40	200	160	78.4	39%	39%	0.0	0.0	OK	
99	MAAN	16	16	16	63	63	174	111	65.6	38%	38%	0.0	0.0	OK	
99	AZRAQ	25	25	0	0	0	50	25	21.1	42%	42%	0.0	0.0	OK	
99	SAFAWI	10	10	0	0	0	20	10	8.0	40%	40%	0.0	0.0	OK	
99	RWESHID	10	10	0	0	0	20	10	5.6	28%	28%	0.0	0.0	OK	
99	RESHA	12.5	12.5	0	0	0	25	12.5	4.9	20%	20%	0.0	0.0	OK	
									Average		35%				

ii) After countermeasures

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2021		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	AQ A2	40	40	63	63	0	206	143	90.5	44%		0.0	25.0	OK	
1	AQ IND	80	80	0	0	0	160	80	41.1	26%	29%	0.0	15.0	OK	
1	AQTH & NEW	63	63	80	80	0	286	206	60.0	21%		0.0	10.0	OK	
2	QUWEIRA	16	45	0	0	0	61	16	20.8	34%	35%	4.8	6.0	OK	
2	DESI	63	63	0	0	0	126	63	44.8	36%		0.0	6.0	OK	
3	EL_HASA	25	25	0	0	0	50	25	16.9	34%		0.0	5.0	OK	
3	Tafila	80	80	0	0	0	160	80	16.6	10%	24%	0.0	24.0	OK	
3	RASHADIA	16	40	40	0	0	96	56	40.2	42%		0.0	5.0	OK	
4	KARAK	63	63	25	0	0	151	88	58.9	39%	30%	0.0	10.0	OK	
4	KARAK SOUTH	80	80	0	0	0	160	80	37.4	23%		0.0	20.0	OK	
5	SUBEIHI	80	80	80	0	0	240	160	158.3	66%		0.0	6.0	OK	
5	SWEIMEH	80	80	80	0	0	240	160	102.0	43%	56%	0.0	3.0	OK	
5	ISHTAFINA	40	45	63	0	0	148	85	88.0	59%		3.0	3.0	OK	
5	WAQAS	63	63	63	0	0	189	126	110.4	58%		0.0	3.0	OK	
4	QATRANA	63	10	16	0	0	89	26	25.6	29%	-	0.0	10.0	OK	
99	GHORSAFI	40	40	40	40	40	200	160	78.4	39%	39%	0.0	0.0	OK	
99	MAAN	16	16	16	63	63	174	111	65.6	38%	38%	0.0	0.0	OK	
99	AZRAQ	25	25	0	0	0	50	25	21.1	42%	42%	0.0	0.0	OK	
99	SAFAWI	10	10	0	0	0	20	10	8.0	40%	40%	0.0	0.0	OK	
99	RWESHID	10	10	0	0	0	20	10	5.6	28%	28%	0.0	0.0	OK	
99	RESHA	12.5	12.5	0	0	0	25	12.5	4.9	20%	20%	0.0	0.0	OK	
									Average		35%				

Source: JICA Study Team

Table 17 BSP Analysis by the NEPCO Practice for EDCO in 2022

i) No countermeasure

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2022		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	AQ A2	40	40	63	63	0	206	143	95.3	46%		0.0	25.0	OK	
1	AQ IND	80	80	0	0	0	160	80	43.3	27%	31%	0.0	15.0	OK	
1	AQTH & NEW	63	63	80	80	0	286	206	63.2	22%		0.0	10.0	OK	
2	QUWEIRA	16	45	0	0	0	61	16	21.9	36%	37%	5.9	6.0	OK	
2	DESI	63	63	0	0	0	126	63	47.2	37%		0.0	6.0	OK	
3	EL_HASA	25	25	0	0	0	50	25	17.8	36%		0.0	5.0	OK	
3	Tafila	80	80	0	0	0	160	80	17.5	11%	25%	0.0	24.0	OK	
3	RASHADIA	16	40	40	0	0	96	56	42.3	44%		0.0	5.0	OK	
4	KARAK	63	63	25	0	0	151	88	62.0	41%	32%	0.0	10.0	OK	
4	KARAK SOUTH	80	80	0	0	0	160	80	39.4	25%		0.0	20.0	OK	
5	SUBEIHI	80	80	80	0	0	240	160	166.8	69%		6.8	6.0	No	
5	SWEIMEH	80	80	80	0	0	240	160	107.5	45%	59%	0.0	3.0	OK	
5	ISHTAFINA	40	45	63	0	0	148	85	92.7	63%		7.7	3.0	No	
5	WAQAS	63	63	63	0	0	189	126	116.2	62%		0.0	3.0	OK	
4	QATRANA	63	10	16	0	0	89	26	27.0	30%	-	1.0	10.0	OK	
99	GHORSAFI	40	40	40	40	40	200	160	82.6	41%	41%	0.0	0.0	OK	
99	MAAN	16	16	16	63	63	174	111	69.1	40%	40%	0.0	0.0	OK	
99	AZRAQ	25	25	0	0	0	50	25	22.2	44%	44%	0.0	0.0	OK	
99	SAFAWI	10	10	0	0	0	20	10	8.4	42%	42%	0.0	0.0	OK	
99	RWESHID	10	10	0	0	0	20	10	5.9	30%	30%	0.0	0.0	OK	
99	RESHA	12.5	12.5	0	0	0	25	12.5	5.2	21%	21%	0.0	0.0	OK	
									Average		37%				

ii) After countermeasures

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2022		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	AQ A2	40	40	63	63	0	206	143	95.3	46%		0.0	25.0	OK	
1	AQ IND	80	80	0	0	0	160	80	43.3	27%	31%	0.0	15.0	OK	
1	AQTH & NEW	63	63	80	80	0	286	206	63.2	22%		0.0	10.0	OK	
2	QUWEIRA	16	45	0	0	0	61	16	21.9	36%	37%	5.9	6.0	OK	
2	DESI	63	63	0	0	0	126	63	47.2	37%		0.0	6.0	OK	
3	EL_HASA	25	25	0	0	0	50	25	17.8	36%		0.0	5.0	OK	
3	Tafila	80	80	0	0	0	160	80	17.5	11%	25%	0.0	24.0	OK	
3	RASHADIA	16	40	40	0	0	96	56	42.3	44%		0.0	5.0	OK	
4	KARAK	63	63	25	0	0	151	88	62.0	41%	32%	0.0	10.0	OK	
4	KARAK SOUTH	80	80	0	0	0	160	80	39.4	25%		0.0	20.0	OK	
5	SUBEIHI	80	80	80	0	0	240	160	136.8	57%		0.0	6.0	OK	
5	SWEIMEH	80	80	80	0	0	240	160	107.5	45%		0.0	3.0	OK	
5	New BSP	63	63				126	63	60.0	48%	51%	0.0	9.5	OK	BSP study at Group 5
5	ISHTAFINA	40	45	63	0	0	148	85	72.7	49%		0.0	3.0	OK	
5	WAQAS	63	63	63	0	0	189	126	106.2	56%		0.0	3.0	OK	
4	QATRANA	63	10	16	0	0	89	26	27.0	30%	-	1.0	10.0	OK	
99	GHORSAFI	40	40	40	40	40	200	160	82.6	41%	41%	0.0	0.0	OK	
99	MAAN	16	16	16	63	63	174	111	69.1	40%	40%	0.0	0.0	OK	
99	AZRAQ	25	25	0	0	0	50	25	22.2	44%	44%	0.0	0.0	OK	
99	SAFAWI	10	10	0	0	0	20	10	8.4	42%	42%	0.0	0.0	OK	
99	RWESHID	10	10	0	0	0	20	10	5.9	30%	30%	0.0	0.0	OK	
99	RESHA	12.5	12.5	0	0	0	25	12.5	5.2	21%	21%	0.0	0.0	OK	
									Average		36%				

Source: JICA Study Team

Table 18 BSP Analysis by the NEPCO Practice for EDCO in 2023

i) No countermeasure

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2023		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	AQ A2	40	40	63	63	0	206	143	100.4	49%		0.0	25.0	OK	
1	AQ IND	80	80	0	0	0	160	80	45.6	29%	33%	0.0	15.0	OK	
1	AQTH & NEW	63	63	80	80	0	286	206	66.6	23%		0.0	10.0	OK	
2	QUWEIRA	16	45	0	0	0	61	16	23.1	38%	39%	7.1	6.0	No	
2	DESI	63	63	0	0	0	126	63	49.7	39%		0.0	6.0	OK	
3	EL_HASA	25	25	0	0	0	50	25	18.8	38%		0.0	5.0	OK	
3	Tafila	80	80	0	0	0	160	80	18.5	12%	27%	0.0	24.0	OK	
3	RASHADIA	16	40	40	0	0	96	56	44.6	46%		0.0	5.0	OK	
4	KARAK	63	63	25	0	0	151	88	65.4	43%	34%	0.0	10.0	OK	
4	KARAK SOUTH	80	80	0	0	0	160	80	41.5	26%		0.0	20.0	OK	
5	SUBEIHI	80	80	80	0	0	240	160	144.1	60%		0.0	6.0	OK	
5	SWEIMEH	80	80	80	0	0	240	160	113.2	47%		0.0	3.0	OK	
5	New BSP	63	63	0	0	0	126	63	63.2	50%	54%	0.2	9.5	OK	
5	ISHTAFINA	40	45	63	0	0	148	85	76.5	52%		0.0	3.0	OK	
5	WAQAS	63	63	63	0	0	189	126	111.9	59%		0.0	3.0	OK	
4	QATRANA	63	10	16	0	0	89	26	28.4	32%	-	2.4	10.0	OK	
99	GHORSAFI	40	40	40	40	40	200	160	87.0	43%	43%	0.0	0.0	OK	
99	MAAN	16	16	16	63	63	174	111	72.8	42%	42%	0.0	0.0	OK	
99	AZRAQ	25	25	0	0	0	50	25	23.4	47%	47%	0.0	0.0	OK	
99	SAFAWI	10	10	0	0	0	20	10	8.9	44%	44%	0.0	0.0	OK	
99	RWESHID	10	10	0	0	0	20	10	6.2	31%	31%	0.0	0.0	OK	
99	RESHA	12.5	12.5	0	0	0	25	12.5	5.5	22%	22%	0.0	0.0	OK	
									Average		38%				

ii) After countermeasures

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2023		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	AQ A2	40	40	63	63	0	206	143	100.4	49%		0.0	25.0	OK	
1	AQ IND	80	80	0	0	0	160	80	45.6	29%	33%	0.0	15.0	OK	
1	AQTH & NEW	63	63	80	80	0	286	206	66.6	23%		0.0	10.0	OK	
2	QUWEIRA	63	45	0	0	0	108	45	23.1	21%	31%	0.0	6.0	OK	47MVA
2	DESI	63	63	0	0	0	126	63	49.7	39%		0.0	6.0	OK	
3	EL_HASA	25	25	0	0	0	50	25	18.8	38%		0.0	5.0	OK	
3	Tafila	80	80	0	0	0	160	80	18.5	12%	27%	0.0	24.0	OK	
3	RASHADIA	16	40	40	0	0	96	56	44.6	46%		0.0	5.0	OK	
4	KARAK	63	63	25	0	0	151	88	65.4	43%	34%	0.0	10.0	OK	
4	KARAK SOUTH	80	80	0	0	0	160	80	41.5	26%		0.0	20.0	OK	
5	SUBEIHI	80	80	80	0	0	240	160	144.1	60%		0.0	6.0	OK	
5	SWEIMEH	80	80	80	0	0	240	160	113.2	47%		0.0	3.0	OK	
5	New BSP	63	63	0	0	0	126	63	63.2	50%	54%	0.2	9.5	OK	
5	ISHTAFINA	40	45	63	0	0	148	85	76.5	52%		0.0	3.0	OK	
5	WAQAS	63	63	63	0	0	189	126	111.9	59%		0.0	3.0	OK	
4	QATRANA	63	10	16	0	0	89	26	28.4	32%	-	2.4	10.0	OK	
99	GHORSAFI	40	40	40	40	40	200	160	87.0	43%	43%	0.0	0.0	OK	
99	MAAN	16	16	16	63	63	174	111	72.8	42%	42%	0.0	0.0	OK	
99	AZRAQ	25	25	0	0	0	50	25	23.4	47%	47%	0.0	0.0	OK	
99	SAFAWI	10	10	0	0	0	20	10	8.9	44%	44%	0.0	0.0	OK	
99	RWESHID	10	10	0	0	0	20	10	6.2	31%	31%	0.0	0.0	OK	
99	RESHA	12.5	12.5	0	0	0	25	12.5	5.5	22%	22%	0.0	0.0	OK	
									Average		37%				

Source: JICA Study Team

Table 19 BSP Analysis by the NEPCO Practice for EDCO in 2024

i) No countermeasure

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2024		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	AQ A2	40	40	63	63	0	206	143	105.7	51%		0.0	25.0	OK	
1	AQ IND	80	80	0	0	0	160	80	48.1	30%	34%	0.0	15.0	OK	
1	AQTH & NEW	63	63	80	80	0	286	206	70.1	25%		0.0	10.0	OK	
2	QUWEIRA	63	45	0	0	0	108	45	24.3	23%	33%	0.0	6.0	OK	
2	DESI	63	63	0	0	0	126	63	52.3	42%		0.0	6.0	OK	
3	EL_HASA	25	25	0	0	0	50	25	19.8	40%		0.0	5.0	OK	
3	Tafila	80	80	0	0	0	160	80	19.5	12%	28%	0.0	24.0	OK	
3	RASHADIA	16	40	40	0	0	96	56	47.0	49%		0.0	5.0	OK	
4	KARAK	63	63	25	0	0	151	88	68.8	46%	36%	0.0	10.0	OK	
4	KARAK SOUTH	80	80	0	0	0	160	80	43.8	27%		0.0	20.0	OK	
5	SUBEIHI	80	80	80	0	0	240	160	151.8	63%		0.0	6.0	OK	
5	SWEIMEH	80	80	80	0	0	240	160	119.3	50%		0.0	3.0	OK	
5	New BSP	63	63	0	0	0	126	63	66.6	53%	57%	3.6	9.5	OK	
5	ISHTAFINA	40	45	63	0	0	148	85	80.6	54%		0.0	3.0	OK	
5	WAQAS	63	63	63	0	0	189	126	117.9	62%		0.0	3.0	OK	
4	QATRANA	63	10	16	0	0	89	26	29.9	34%	-	3.9	10.0	OK	
99	GHORSAFI	40	40	40	40	40	200	160	91.6	46%	46%	0.0	0.0	OK	
99	MAAN	16	16	16	63	63	174	111	76.6	44%	44%	0.0	0.0	OK	
99	AZRAQ	25	25	0	0	0	50	25	24.6	49%	49%	0.0	0.0	OK	
99	SAFAWI	10	10	0	0	0	20	10	9.3	47%	47%	0.0	0.0	OK	
99	RWESHID	10	10	0	0	0	20	10	6.5	33%	33%	0.0	0.0	OK	
99	RESHA	12.5	12.5	0	0	0	25	12.5	5.8	23%	23%	0.0	0.0	OK	
									Average		39%				

ii) After countermeasures

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2024		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	AQ A2	40	40	63	63	0	206	143	105.7	51%		0.0	25.0	OK	
1	AQ IND	80	80	0	0	0	160	80	48.1	30%	34%	0.0	15.0	OK	
1	AQTH & NEW	63	63	80	80	0	286	206	70.1	25%		0.0	10.0	OK	
2	QUWEIRA	63	45	0	0	0	108	45	24.3	23%	33%	0.0	6.0	OK	
2	DESI	63	63	0	0	0	126	63	52.3	42%		0.0	6.0	OK	
3	EL_HASA	25	25	0	0	0	50	25	19.8	40%		0.0	5.0	OK	
3	Tafila	80	80	0	0	0	160	80	19.5	12%	28%	0.0	24.0	OK	
3	RASHADIA	16	40	40	0	0	96	56	47.0	49%		0.0	5.0	OK	
4	KARAK	63	63	25	0	0	151	88	68.8	46%	36%	0.0	10.0	OK	
4	KARAK SOUTH	80	80	0	0	0	160	80	43.8	27%		0.0	20.0	OK	
5	SUBEIHI	80	80	80	0	0	240	160	151.8	63%		0.0	6.0	OK	
5	SWEIMEH	80	80	80	0	0	240	160	119.3	50%		0.0	3.0	OK	
5	New BSP	63	63	0	0	0	126	63	66.6	53%	57%	3.6	9.5	OK	
5	ISHTAFINA	40	45	63	0	0	148	85	80.6	54%		0.0	3.0	OK	
5	WAQAS	63	63	63	0	0	189	126	117.9	62%		0.0	3.0	OK	
4	QATRANA	63	10	16	0	0	89	26	29.9	34%	-	3.9	10.0	OK	
99	GHORSAFI	40	40	40	40	40	200	160	91.6	46%	46%	0.0	0.0	OK	
99	MAAN	16	16	16	63	63	174	111	76.6	44%	44%	0.0	0.0	OK	
99	AZRAQ	25	25	0	0	0	50	25	24.6	49%	49%	0.0	0.0	OK	
99	SAFAWI	10	10	0	0	0	20	10	9.3	47%	47%	0.0	0.0	OK	
99	RWESHID	10	10	0	0	0	20	10	6.5	33%	33%	0.0	0.0	OK	
99	RESHA	12.5	12.5	0	0	0	25	12.5	5.8	23%	23%	0.0	0.0	OK	
									Average		39%				

Source: JICA Study Team

Table 20 BSP Analysis by the NEPCO Practice for EDCO in 2025

i) No countermeasure

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2025		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	AQ A2	40	40	63	63	0	206	143	111.4	54%		0.0	25.0	OK	
1	AQ IND	80	80	0	0	0	160	80	50.6	32%	36%	0.0	15.0	OK	
1	AQTH & NEW	63	63	80	80	0	286	206	73.9	26%		0.0	10.0	OK	
2	QUWEIRA	63	45	0	0	0	108	45	25.6	24%	35%	0.0	6.0	OK	
2	DESI	63	63	0	0	0	126	63	55.1	44%		0.0	6.0	OK	
3	EL_HASA	25	25	0	0	0	50	25	20.9	42%		0.0	5.0	OK	
3	Tafila	80	80	0	0	0	160	80	20.5	13%	30%	0.0	24.0	OK	
3	RASHADIA	16	40	40	0	0	96	56	49.5	52%		0.0	5.0	OK	
4	KARAK	63	63	25	0	0	151	88	72.5	48%	38%	0.0	10.0	OK	
4	KARAK SOUTH	80	80	0	0	0	160	80	46.1	29%		0.0	20.0	OK	
5	SUBEIHI	80	80	80	0	0	240	160	159.9	67%		0.0	6.0	OK	
5	SWEIMEH	80	80	80	0	0	240	160	125.6	52%		0.0	3.0	OK	
5	New BSP	63	63	0	0	0	126	63	70.1	56%	60%	7.1	9.5	OK	
5	ISHTAFINA	40	45	63	0	0	148	85	84.9	57%		0.0	3.0	OK	
5	WAQAS	63	63	63	0	0	189	126	124.2	66%		0.0	3.0	OK	
4	QATRANA	63	10	16	0	0	89	26	31.5	35%	-	5.5	10.0	OK	
99	GHORSAFI	40	40	40	40	40	200	160	96.5	48%	48%	0.0	0.0	OK	
99	MAAN	16	16	16	63	63	174	111	80.7	46%	46%	0.0	0.0	OK	
99	AZRAQ	25	25	0	0	0	50	25	25.9	52%	52%	0.9	0.0	OK	
99	SAFAWI	10	10	0	0	0	20	10	9.8	49%	49%	0.0	0.0	OK	
99	RWESHID	10	10	0	0	0	20	10	6.9	34%	34%	0.0	0.0	OK	
99	RESHA	12.5	12.5	0	0	0	25	12.5	6.1	24%	24%	0.0	0.0	OK	
									Average		41%				

ii) After countermeasures

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2025		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	AQ A2	40	40	63	63	0	206	143	111.4	54%		0.0	25.0	OK	
1	AQ IND	80	80	0	0	0	160	80	50.6	32%	36%	0.0	15.0	OK	
1	AQTH & NEW	63	63	80	80	0	286	206	73.9	26%		0.0	10.0	OK	
2	QUWEIRA	63	45	0	0	0	108	45	25.6	24%	35%	0.0	6.0	OK	
2	DESI	63	63	0	0	0	126	63	55.1	44%		0.0	6.0	OK	
3	EL_HASA	25	25	0	0	0	50	25	20.9	42%		0.0	5.0	OK	
3	Tafila	80	80	0	0	0	160	80	20.5	13%	30%	0.0	24.0	OK	
3	RASHADIA	16	40	40	0	0	96	56	49.5	52%		0.0	5.0	OK	
4	KARAK	63	63	25	0	0	151	88	72.5	48%	38%	0.0	10.0	OK	
4	KARAK SOUTH	80	80	0	0	0	160	80	46.1	29%		0.0	20.0	OK	
5	SUBEIHI	80	80	80	0	0	240	160	159.9	67%		0.0	6.0	OK	
5	SWEIMEH	80	80	80	0	0	240	160	125.6	52%		0.0	3.0	OK	
5	New BSP	63	63	0	0	0	126	63	70.1	56%	60%	7.1	9.5	OK	
5	ISHTAFINA	40	45	63	0	0	148	85	84.9	57%		0.0	3.0	OK	
5	WAQAS	63	63	63	0	0	189	126	124.2	66%		0.0	3.0	OK	
4	QATRANA	63	10	16	0	0	89	26	31.5	35%	-	5.5	10.0	OK	
99	GHORSAFI	40	40	40	40	40	200	160	96.5	48%	48%	0.0	0.0	OK	
99	MAAN	16	16	16	63	63	174	111	80.7	46%	46%	0.0	0.0	OK	
99	AZRAQ	25	25	63	0	0	113	50	25.9	23%	23%	0.0	0.0	OK	Addition of 63MVA transformer
99	SAFAWI	10	10	0	0	0	20	10	9.8	49%	49%	0.0	0.0	OK	
99	RWESHID	10	10	0	0	0	20	10	6.9	34%	34%	0.0	0.0	OK	
99	RESHA	12.5	12.5	0	0	0	25	12.5	6.1	24%	24%	0.0	0.0	OK	
									Average		38%				

Source: JICA Study Team

(3) BSP Analysis for IDECO

Table 21 BSP Analysis by the NEPCO Practice for IDECO in 2016

i) No countermeasure

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2016		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	IRBID	80	60	63			203	123	161.5	80%		38.5	57.6	OK	
1	IRBID EAST	80	80				160	80	70.3	44%	56%	0.0	22.3	OK	
1	HASAN IND	80	80				160	80	59.2	37%		0.0	24.6	OK	
2	REHAB	40	40				80	40	72.7	91%		32.7	34.3	OK	
2	MAFRAQ	80	80	80			240	160	57.9	24%		0.0	48.2	OK	
2	SABHA	40	40				80	40	29.6	37%	39%	0.0	25.9	OK	
2	DHULEIL	80	80				160	80	56.7	35%		0.0	15.5	OK	
99	WAQAS	63	63				126	63	85.1	68%	-	22.1	25.1	OK	
99	ISHTAFINA	40	45				85	40	67.8	80%	-	27.8	14.0	No	
99	SAFAWI	10					10	0	6.2	62%	-	6.2	2.6	No	
									Average		47%				

ii) After countermeasures

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2016		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	IRBID	80	60	63			203	123	161.5	80%		38.5	57.6	OK	
1	IRBID EAST	80	80				160	80	70.3	44%	56%	0.0	22.3	OK	
1	HASAN IND	80	80				160	80	59.2	37%		0.0	24.6	OK	
2	REHAB	40	40	80			160	80	72.7	45%		0.0	34.3	OK	80MVA
2	MAFRAQ	80	80	80			240	160	57.9	24%		0.0	48.2	OK	
2	SABHA	40	40				80	40	29.6	37%	34%	0.0	25.9	OK	
2	DHULEIL	80	80				160	80	56.7	35%		0.0	15.5	OK	
99	WAQAS	63	63				126	63	85.1	68%	-	22.1	25.1	OK	
99	ISHTAFINA	40	45	63			148	85	67.8	46%	-	0.0	14.0	OK	NEPCO committed project
99	SAFAWI	10					10	0	6.2	62%	-	6.2	2.6	No	NEPCO Committed Project in 2017
									Average		45%				

Source: JICA Study Team

Table 22 BSP Analysis by the NEPCO Practice for IDECO in 2017

i) No countermeasure

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2017		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	IRBID	80	60	63	0	0	203	123	170.1	84%		47.1	57.6	OK	
1	IRBID EAST	80	80	0	0	0	160	80	74.0	46%	59%	0.0	22.3	OK	
1	HASAN IND	80	80	0	0	0	160	80	62.3	39%		0.0	24.6	OK	
2	REHAB	40	40	80	0	0	160	80	76.6	48%		0.0	34.3	OK	
2	MAFRAQ	80	80	80	0	0	240	160	61.0	25%		0.0	48.2	OK	
2	SABHA	40	40	0	0	0	80	40	31.2	39%	36%	0.0	25.9	OK	
2	DHULEIL	80	80	0	0	0	160	80	59.7	37%		0.0	15.5	OK	
99	WAQAS	63	63	0	0	0	126	63	89.6	71%	–	26.6	25.1	No	
99	ISHTAFINA	40	45	63	0	0	148	85	71.4	48%	–	0.0	14.0	OK	
99	SAFAWI	10	0	0	0	0	10	0	6.5	65%	–	6.5	2.6	No	
									Average		47%				

ii) After countermeasures

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2017		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	IRBID	80	60	63	0	0	203	123	170.1	84%		47.1	57.6	OK	
1	IRBID EAST	80	80	0	0	0	160	80	74.0	46%	59%	0.0	22.3	OK	
1	HASAN IND	80	80	0	0	0	160	80	62.3	39%		0.0	24.6	OK	
2	REHAB	40	40	80	0	0	160	80	76.6	48%		0.0	34.3	OK	
2	MAFRAQ	80	80	80	0	0	240	160	61.0	25%		0.0	48.2	OK	
2	SABHA	40	40	0	0	0	80	40	31.2	39%	36%	0.0	25.9	OK	
2	DHULEIL	80	80	0	0	0	160	80	59.7	37%		0.0	15.5	OK	
99	WAQAS	63	63	63			189	126	89.6	47%	–	0.0	25.1	OK	NEPCO Committed Project
99	ISHTAFINA	40	45	63			148	85	71.4	48%	–	0.0	14.0	OK	
99	SAFAWI	10	10				20	10	6.5	32%	–	0.0	2.6	OK	NEPCO Committed Project
									Average		47%				

Source: JICA Study Team

Table 23 BSP Analysis by the NEPCO Practice for IDECO in 2018

i) No countermeasure

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2018		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	IRBID	80	60	63	0	0	203	123	179.2	88%		56.2	57.6	OK	
1	IRBID EAST	80	80	0	0	0	160	80	78.0	49%	62%	0.0	22.3	OK	
1	HASAN IND	80	80	0	0	0	160	80	65.7	41%		0.0	24.6	OK	
2	REHAB	40	40	80	0	0	160	80	80.7	50%		0.7	34.3	OK	
2	MAFRAQ	80	80	80	0	0	240	160	64.3	27%		0.0	48.2	OK	
2	SABHA	40	40	0	0	0	80	40	32.8	41%	38%	0.0	25.9	OK	
2	DHULEIL	80	80	0	0	0	160	80	62.9	39%		0.0	15.5	OK	
99	WAQAS	63	63	63	0	0	189	126	94.4	50%	-	0.0	25.1	OK	
99	ISHTAFINA	40	45	63	0	0	148	85	75.3	51%	-	0.0	14.0	OK	
99	SAFAWI	10	10	0	0	0	20	10	6.8	34%	-	0.0	2.6	OK	
									Average		50%				

ii) After countermeasures

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2018		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	IRBID	80	60	63	0	0	203	123	179.2	88%		56.2	57.6	OK	
1	IRBID EAST	80	80	0	0	0	160	80	78.0	49%	62%	0.0	22.3	OK	
1	HASAN IND	80	80	0	0	0	160	80	65.7	41%		0.0	24.6	OK	
2	REHAB	40	40	80	0	0	160	80	80.7	50%		0.7	34.3	OK	
2	MAFRAQ	80	80	80	0	0	240	160	64.3	27%		0.0	48.2	OK	
2	SABHA	40	40	0	0	0	80	40	32.8	41%	38%	0.0	25.9	OK	
2	DHULEIL	80	80	0	0	0	160	80	62.9	39%		0.0	15.5	OK	
99	WAQAS	63	63	63	0	0	189	126	94.4	50%	-	0.0	25.1	OK	
99	ISHTAFINA	40	45	63	0	0	148	85	75.3	51%	-	0.0	14.0	OK	
99	SAFAWI	10	10	0	0	0	20	10	6.8	34%	-	0.0	2.6	OK	
									Average		50%				

Source: JICA Study Team

Table 24 BSP Analysis by the NEPCO Practice for IDECO in 2019

i) No countermeasure

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2019		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	IRBID	80	60	63	0	0	203	123	188.8	93%		65.8	57.6	No	
1	IRBID EAST	80	80	0	0	0	160	80	82.2	51%	65%	2.2	22.3	OK	
1	HASAN IND	80	80	0	0	0	160	80	69.2	43%		0.0	24.6	OK	
2	REHAB	40	40	80	0	0	160	80	85.0	53%		5.0	34.3	OK	
2	MAFRAQ	80	80	80	0	0	240	160	67.7	28%		0.0	48.2	OK	
2	SABHA	40	40	0	0	0	80	40	34.6	43%	40%	0.0	25.9	OK	
2	DHULEIL	80	80	0	0	0	160	80	66.3	41%		0.0	15.5	OK	
99	WAQAS	63	63	63	0	0	189	126	99.4	53%	–	0.0	25.1	OK	
99	ISHTAFINA	40	45	63	0	0	148	85	79.3	54%	–	0.0	14.0	OK	
99	SAFAWI	10	10	0	0	0	20	10	7.2	36%	–	0.0	2.6	OK	
									Average		52%				

ii) After countermeasures

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2019		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	IRBID	80	80	80	0	0	240	160	188.8	79%		28.8	57.6	OK	37MVA
1	IRBID EAST	80	80	0	0	0	160	80	82.2	51%	61%	2.2	22.3	OK	
1	HASAN IND	80	80	0	0	0	160	80	69.2	43%		0.0	24.6	OK	
2	REHAB	40	40	80	0	0	160	80	85.0	53%		5.0	34.3	OK	
2	MAFRAQ	80	80	80	0	0	240	160	67.7	28%		0.0	48.2	OK	
2	SABHA	40	40	0	0	0	80	40	34.6	43%	40%	0.0	25.9	OK	
2	DHULEIL	80	80	0	0	0	160	80	66.3	41%		0.0	15.5	OK	
99	WAQAS	63	63	63	0	0	189	126	99.4	53%	–	0.0	25.1	OK	
99	ISHTAFINA	40	45	63	0	0	148	85	79.3	54%	–	0.0	14.0	OK	
99	SAFAWI	10	10	0	0	0	20	10	7.2	36%	–	0.0	2.6	OK	
									Average		50%				

Source: JICA Study Team

Table 25 BSP Analysis by the NEPCO Practice for IDECO in 2020

i) No countermeasure

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2020		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	IRBID	80	80	80	0	0	240	160	198.9	83%		38.9	57.6	OK	
1	IRBID EAST	80	80	0	0	0	160	80	86.5	54%	64%	6.5	22.3	OK	
1	HASAN IND	80	80	0	0	0	160	80	72.9	46%		0.0	24.6	OK	
2	REHAB	40	40	80	0	0	160	80	89.6	56%		9.6	34.3	OK	
2	MAFRAQ	80	80	80	0	0	240	160	71.4	30%		0.0	48.2	OK	
3	SABHA	40	40	0	0	0	80	40	36.4	46%	42%	0.0	25.9	OK	
3	DHULEIL	80	80	0	0	0	160	80	69.8	44%		0.0	15.5	OK	
99	WAQAS	63	63	63	0	0	189	126	104.8	55%	–	0.0	25.1	OK	
99	ISHTAFINA	40	45	63	0	0	148	85	83.5	56%	–	0.0	14.0	OK	
99	SAFAWI	10	10	0	0	0	20	10	7.6	38%	–	0.0	2.6	OK	
									Average		53%				

ii) After countermeasures

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2020		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	IRBID	80	80	80	0	0	240	160	198.9	83%		38.9	57.6	OK	
1	IRBID EAST	80	80	0	0	0	160	80	86.5	54%	64%	6.5	22.3	OK	
1	HASAN IND	80	80	0	0	0	160	80	72.9	46%		0.0	24.6	OK	
2	REHAB	40	40	80	0	0	160	80	89.6	56%		9.6	34.3	OK	
2	MAFRAQ	80	80	80	0	0	240	160	71.4	30%		0.0	48.2	OK	
3	SABHA	40	40	0	0	0	80	40	36.4	46%	42%	0.0	25.9	OK	
3	DHULEIL	80	80	0	0	0	160	80	69.8	44%		0.0	15.5	OK	
99	WAQAS	63	63	63	0	0	189	126	104.8	55%	–	0.0	25.1	OK	
99	ISHTAFINA	40	45	63	0	0	148	85	83.5	56%	–	0.0	14.0	OK	
99	SAFAWI	10	10	0	0	0	20	10	7.6	38%	–	0.0	2.6	OK	
									Average		53%				

Source: JICA Study Team

Table 26 BSP Analysis by the NEPCO Practice for IDECO in 2021

i) No countermeasure

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2021		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	IRBID	80	80	80	0	0	240	160	209.5	87%		49.5	57.6	OK	
1	IRBID EAST	80	80	0	0	0	160	80	91.2	57%	67%	11.2	22.3	OK	
1	HASAN IND	80	80	0	0	0	160	80	76.8	48%		0.0	24.6	OK	
2	REHAB	40	40	80	0	0	160	80	94.4	59%		14.4	34.3	OK	
2	MAFRAQ	80	80	80	0	0	240	160	75.2	31%		0.0	48.2	OK	
3	SABHA	40	40	0	0	0	80	40	38.4	48%	44%	0.0	25.9	OK	
3	DHULEIL	80	80	0	0	0	160	80	73.6	46%		0.0	15.5	OK	
99	WAQAS	63	63	63	0	0	189	126	110.4	58%	–	0.0	25.1	OK	
99	ISHTAFINA	40	45	63	0	0	148	85	88.0	59%	–	3.0	14.0	OK	
99	SAFAWI	10	10	0	0	0	20	10	8.0	40%	–	0.0	2.6	OK	
									Average		56%				

ii) After countermeasures

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2021		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	IRBID	80	80	80	0	0	240	160	209.5	87%		49.5	57.6	OK	
1	IRBID EAST	80	80	0	0	0	160	80	91.2	57%	67%	11.2	22.3	OK	
1	HASAN IND	80	80	0	0	0	160	80	76.8	48%		0.0	24.6	OK	
2	REHAB	40	40	80	0	0	160	80	94.4	59%		14.4	34.3	OK	
2	MAFRAQ	80	80	80	0	0	240	160	75.2	31%		0.0	48.2	OK	
3	SABHA	40	40	0	0	0	80	40	38.4	48%	44%	0.0	25.9	OK	
3	DHULEIL	80	80	0	0	0	160	80	73.6	46%		0.0	15.5	OK	
99	WAQAS	63	63	63	0	0	189	126	110.4	58%	–	0.0	25.1	OK	
99	ISHTAFINA	40	45	63	0	0	148	85	88.0	59%	–	3.0	14.0	OK	
99	SAFAWI	10	10	0	0	0	20	10	8.0	40%	–	0.0	2.6	OK	
									Average		56%				

Source: JICA Study Team

Table 27 BSP Analysis by the NEPCO Practice for IDECO in 2022

i) No countermeasure

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2022		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	IRBID	80	80	80	0	0	240	160	220.7	92%		60.7	57.6	No	
1	IRBID EAST	80	80	0	0	0	160	80	96.0	60%	71%	16.0	22.3	OK	
1	HASAN IND	80	80	0	0	0	160	80	80.9	51%		0.9	24.6	OK	
2	REHAB	40	40	80	0	0	160	80	99.4	62%		19.4	34.3	OK	
2	MAFRAQ	80	80	80	0	0	240	160	79.2	33%		0.0	48.2	OK	
3	SABHA	40	40	0	0	0	80	40	40.4	51%	46%	0.4	25.9	OK	
3	DHULEIL	80	80	0	0	0	160	80	77.5	48%		0.0	15.5	OK	
99	WAQAS	63	63	63	0	0	189	126	116.2	62%	-	0.0	25.1	OK	
99	ISHTAFINA	40	45	63	0	0	148	85	92.7	63%	-	7.7	14.0	OK	
99	SAFAWI	10	10	0	0	0	20	10	8.4	42%	-	0.0	2.6	OK	
									Average		59%				

ii) After countermeasures

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2022		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	IRBID	80	80	80	0	0	240	160	184.7	77%		24.7	57.6	OK	
1	IRBID EAST	80	80	80	0	0	240	160	148.0	62%	62%	0.0	22.3	OK	Addition of 80MVA Transformer
1	HASAN IND	80	80	0	0	0	160	80	64.9	41%		0.0	24.6	OK	
2	REHAB	40	40	80	0	0	160	80	99.4	62%		19.4	34.3	OK	
2	MAFRAQ	80	80	80	0	0	240	160	79.2	33%		0.0	48.2	OK	
2	SABHA	40	40	0	0	0	80	40	40.4	51%	46%	0.4	25.9	OK	
2	DHULEIL	80	80	0	0	0	160	80	77.5	48%		0.0	15.5	OK	
99	WAQAS	63	63	63	0	0	189	126	116.2	62%	-	0.0	25.1	OK	
99	ISHTAFINA	40	45	63	0	0	148	85	92.7	63%	-	7.7	14.0	OK	
99	SAFAWI	10	10	0	0	0	20	10	8.4	42%	-	0.0	2.6	OK	
									Average		54%				

Source: JICA Study Team

Table 28 BSP Analysis by the NEPCO Practice for IDECO in 2023

i) No countermeasure

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2023		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	IRBID	80	80	80	0	0	240	160	194.6	81%		34.6	57.6	OK	
1	IRBID EAST	80	80	80	0	0	240	160	155.9	65%	65%	0.0	22.3	OK	
1	HASAN IND	80	80	0	0	0	160	80	68.3	43%		0.0	24.6	OK	
2	REHAB	40	40	80	0	0	160	80	104.7	65%		24.7	34.3	OK	
2	MAFRAQ	80	80	80	0	0	240	160	83.4	35%		0.0	48.2	OK	
2	SABHA	40	40	0	0	0	80	40	42.6	53%	49%	2.6	25.9	OK	
2	DHULEIL	80	80	0	0	0	160	80	81.6	51%		1.6	15.5	OK	
99	WAQAS	63	63	63	0	0	189	126	122.5	65%	-	0.0	25.1	OK	
99	ISHTAFINA	40	45	63	0	0	148	85	97.6	66%	-	12.6	14.0	OK	
99	SAFAWI	10	10	0	0	0	20	10	8.9	44%	-	0.0	2.6	OK	
									Average		57%				

ii) After countermeasures

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2023		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	IRBID	80	80	80	0	0	240	160	194.6	81%		34.6	57.6	OK	
1	IRBID EAST	80	80	80	0	0	240	160	155.9	65%	65%	0.0	22.3	OK	
1	HASAN IND	80	80	0	0	0	160	80	68.3	43%		0.0	24.6	OK	
2	REHAB	40	40	80	0	0	160	80	104.7	65%		24.7	34.3	OK	
2	MAFRAQ	80	80	80	0	0	240	160	83.4	35%		0.0	48.2	OK	
2	SABHA	40	40	0	0	0	80	40	42.6	53%	49%	2.6	25.9	OK	
2	DHULEIL	80	80	0	0	0	160	80	81.6	51%		1.6	15.5	OK	
99	WAQAS	63	63	63	0	0	189	126	122.5	65%	-	0.0	25.1	OK	
99	ISHTAFINA	40	45	63	0	0	148	85	97.6	66%	-	12.6	14.0	OK	
99	SAFAWI	10	10	0	0	0	20	10	8.9	44%	-	0.0	2.6	OK	
									Average		57%				

Source: JICA Study Team

Table 29　BSP Analysis by the NEPCO Practice for IDECO in 2024

i) No countermeasure

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2024		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	IRBID	80	80	80	0	0	240	160	205.0	85%		45.0	57.6	OK	
1	IRBID EAST	80	80	80	0	0	240	160	164.3	68%	69%	4.3	22.3	OK	
1	HASAN IND	80	80	0	0	0	160	80	72.0	45%		0.0	24.6	OK	
2	REHAB	40	40	80	0	0	160	80	110.3	69%		30.3	34.3	OK	
2	MAFRAQ	80	80	80	0	0	240	160	87.9	37%		0.0	48.2	OK	
2	SABHA	40	40	0	0	0	80	40	44.9	56%	51%	4.9	25.9	OK	
2	DHULEIL	80	80	0	0	0	160	80	86.0	54%		6.0	15.5	OK	
99	WAQAS	63	63	63	0	0	189	126	129.0	68%	-	3.0	25.1	OK	
99	ISHTAFINA	40	45	63	0	0	148	85	102.8	69%	-	17.8	14.0	No	
99	SAFAWI	10	10	0	0	0	20	10	9.3	47%	-	0.0	2.6	OK	
									Average		60%				

ii) After countermeasures

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2024		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	IRBID	80	80	80	0	0	240	160	205.0	85%		45.0	57.6	OK	
1	IRBID EAST	80	80	80	0	0	240	160	164.3	68%	69%	4.3	22.3	OK	
1	HASAN IND	80	80	0	0	0	160	80	72.0	45%		0.0	24.6	OK	
2	REHAB	40	40	80	0	0	160	80	110.3	69%		30.3	34.3	OK	
2	MAFRAQ	80	80	80	0	0	240	160	87.9	37%		0.0	48.2	OK	
2	SABHA	40	40	0	0	0	80	40	44.9	56%	51%	4.9	25.9	OK	
2	DHULEIL	80	80	0	0	0	160	80	86.0	54%		6.0	15.5	OK	
99	WAQAS	63	63	63	0	0	189	126	129.0	68%	-	3.0	25.1	OK	
99	ISHTAFINA	63	45	63	0	0	171	108	102.8	60%	-	0.0	14.0	OK	BSP reinfocement (40→63)
99	SAFAWI	10	10	0	0	0	20	10	9.3	47%	-	0.0	2.6	OK	
									Average		60%				

Source: JICA Study Team

Table 30 BSP Analysis by the NEPCO Practice for IDECO in 2025

i) No countermeasure

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2025		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	IRBID	80	80	80	0	0	240	160	215.9	90%		55.9	57.6	OK	
1	IRBID EAST	80	80	80	0	0	240	160	173.0	72%	73%	13.0	22.3	OK	
1	HASAN IND	80	80	0	0	0	160	80	75.8	47%		0.0	24.6	OK	
2	REHAB	40	40	80	0	0	160	80	116.2	73%		36.2	34.3	No	
2	MAFRAQ	80	80	80	0	0	240	160	92.6	39%		0.0	48.2	OK	
2	SABHA	40	40	0	0	0	80	40	47.3	59%	54%	7.3	25.9	OK	
2	DHULEIL	80	80	0	0	0	160	80	90.6	57%		10.6	15.5	OK	
99	WAQAS	63	63	63	0	0	189	126	135.9	72%	-	9.9	25.1	OK	
99	ISHTAFINA	63	45	63	0	0	171	108	108.3	63%	-	0.3	14.0	OK	
99	SAFAWI	10	10	0	0	0	20	10	9.8	49%	-	0.0	2.6	OK	
									Average		63%				

ii) After countermeasures

BSP Grouping	BSP (Substation)	No. of TR's					Installed Capacity [MVA]	N-1 Capacity [MVA]	Normal State Analysis			Contingency State Analysis			
									Peak Demand 2025		Group Operating rate (%)	Load Transfer MVA Necessary for N-1 Observation	Possible Load Transfer MVA	N-1 Observation Check	Load Transfer between BSPs
									[MVA]	%					
1	IRBID	80	80	80	0	0	240	160	179.9	75%		19.9	57.6	OK	
1	IRBID EAST	80	80	80	0	0	240	160	173.0	72%	65%	13.0	22.3	OK	
1	HASAN IND	80	80	80	0	0	240	160	111.8	47%		0.0	24.6	OK	Addition of 80MVA transformer
2	REHAB	40	80	80	0	0	200	120	116.2	58%		0.0	34.3	OK	40MVA
2	MAFRAQ	80	80	80	0	0	240	160	92.6	39%		0.0	48.2	OK	
2	SABHA	40	40	0	0	0	80	40	47.3	59%	51%	7.3	25.9	OK	
2	DHULEIL	80	80	0	0	0	160	80	90.6	57%		10.6	15.5	OK	
99	WAQAS	63	63	63	0	0	189	126	135.9	72%	-	9.9	25.1	OK	
99	ISHTAFINA	63	45	63	0	0	171	108	108.3	63%	-	0.3	14.0	OK	
99	SAFAWI	10	10	0	0	0	20	10	9.8	49%	-	0.0	2.6	OK	
									Average		58%				

Source: JICA Study Team

5.3 Draft BSP Plans

Table 1 Draft BSP Plans

Year	JEPCO					EDCO					IDECO					Total	
	BSP Group Method		NEPCO Practice		Difference	BSP Group Method		NEPCO Practice		Difference	BSP Group Method		NEPCO Practice		Difference	BSP Group Method	NEPCO Practice
2016			Amman South New	80MVA	-80MVA			Karak	94MVA	-94MVA			Rehab	80MVA	-80MVA	MVA	254MVA
2017			QAIA New	80MVA	-80MVA			Qatrana	53MVA	-53MVA					MVA	MVA	133MVA
					MVA					MVA					MVA	MVA	MVA
					MVA					MVA					MVA	MVA	MVA
2018			Amman South	105MVA	-105MVA			Subeihi	34MVA	-34MVA					MVA	MVA	139MVA
			New Bayader	80MVA	-80MVA					MVA					MVA	MVA	80MVA
					MVA					MVA					MVA	MVA	MVA
2019			Ashrafia	80MVA	-80MVA					MVA			Irbid	37MVA	-37MVA	MVA	117MVA
			Muwaqar	80MVA	-80MVA					MVA					MVA	MVA	80MVA
			New BSP	240MVA	-240MVA					MVA					MVA	MVA	240MVA
2020	New Bayader	80MVA	Ashrafia	34MVA	46MVA	Karak	94MVA	Subeihi	17MVA	77MVA					MVA	174MVA	51MVA
	QAIA New	80MVA	New BSP	240MVA	-160MVA					MVA					MVA	80MVA	240MVA
					MVA					MVA					MVA	MVA	MVA
2021					MVA					MVA					MVA	MVA	MVA
					MVA					MVA					MVA	MVA	MVA
					MVA					MVA					MVA	MVA	MVA
2022	New BSP G1	240MVA			240MVA	New BSP	126MVA	New BSP	126MVA	MVA	Irbid East	80MVA	Irbid East	80MVA	MVA	446MVA	206MVA
	New BSP G5	240MVA			240MVA					MVA					MVA	240MVA	MVA
					MVA					MVA					MVA	MVA	MVA
2023	Mwaqar	80MVA	New BSP	240MVA	-160MVA			Quweira	47MVA	-47MVA					MVA	80MVA	287MVA
	New BSP G4	240MVA	Dhuleil	80MVA	160MVA					MVA					MVA	240MVA	80MVA
					MVA					MVA					MVA	MVA	MVA
2024	Subeihi	51MVA	Abdoon	120MVA	-69MVA					MVA	Ishtafina	23MVA	Ishtafina	23MVA	MVA	74MVA	143MVA
			Zarqa, QAIA	180MVA	-180MVA					MVA					MVA	MVA	180MVA
			New BSP	240MVA	-240MVA					MVA					MVA	MVA	240MVA
2025	Abdali New	80MVA			80MVA	Azraq	63MVA	Azraq	63MVA	MVA	Hassan Ind.	80MVA	Hassan Ind.	80MVA	MVA	223MVA	143MVA
	QAIA	80MVA			80MVA					MVA			Rehab	40MVA	-40MVA	80MVA	40MVA
					MVA					MVA					MVA	MVA	MVA
2026				240MVA	-240MVA					MVA					MVA	MVA	240MVA
					MVA					MVA					MVA	MVA	MVA
					MVA					MVA					MVA	MVA	MVA
2027	Group 5	240MVA		80MVA	160MVA					MVA					MVA	240MVA	80MVA
					MVA					MVA					MVA	MVA	MVA
					MVA					MVA					MVA	MVA	MVA
2028	Group 1	240MVA		560MVA	-320MVA					MVA					MVA	240MVA	560MVA
					MVA					MVA					MVA	MVA	MVA
					MVA					MVA					MVA	MVA	MVA
2029	Group 4	240MVA		240MVA	MVA					MVA				80MVA	-80MVA	240MVA	320MVA
					MVA					MVA					MVA	MVA	MVA
					MVA					MVA					MVA	MVA	MVA
2030	Group 2	240MVA		320MVA	-80MVA					MVA				160MVA	-160MVA	240MVA	480MVA
	Group 5	240MVA			240MVA					MVA					MVA	240MVA	MVA
					MVA					MVA					MVA	MVA	MVA
2031	Group 6	160MVA		240MVA	-80MVA			Group 5	160MVA	-160MVA	Group 1	160MVA			160MVA	320MVA	400MVA
					MVA					MVA					MVA	MVA	MVA
					MVA					MVA					MVA	MVA	MVA
2032	Group 3	240MVA		80MVA	160MVA					MVA				80MVA	-80MVA	240MVA	160MVA
					MVA					MVA					MVA	MVA	MVA
					MVA					MVA					MVA	MVA	MVA
2033	Group 5	240MVA		480MVA	-240MVA					MVA	Group 2	160MVA		80MVA	80MVA	400MVA	560MVA
	Group 1	240MVA			240MVA					MVA					MVA	240MVA	MVA
					MVA					MVA					MVA	MVA	MVA
2034	Group 4	240MVA		320MVA	-80MVA	Group 5	160MVA	Group 5	80MVA	80MVA				160MVA	-160MVA	400MVA	560MVA
					MVA					MVA					MVA	MVA	MVA
					MVA					MVA					MVA	MVA	MVA
Subtotal		3,491MVA		4,439MVA	-948MVA		443MVA		674MVA	-231MVA		503MVA		900MVA	-397MVA	4,437MVA	6,013MVA

Source: JICA Study Team

5.4 Power Demand Forecast for each BSP

Table 1 Power Demand Forecast for each BSP

	BSP Grouping	BSP (Substation)	Installed Capacity [MVA]	Peak Demand(MVA)																				
				2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
JEPCO	1	ABDOON	320	103	114	137	149	184	199	190	205	166	177	190	198	202	208	212	217	222	225	229	232	235
	1	AMMAN S	215	94	103	109	119	98	106	112	120	98	105	113	118	120	123	126	129	131	134	136	138	139
	1	AMMAN S NEW	240	145	159	121	131	138	118	124	133	115	123	132	137	140	144	147	150	153	156	159	161	163
	1	New BSP	240	-	-	-	-	-	-	-	-	118	126	135	141	144	148	152	155	158	160	163	165	168
	1	ASHRFIA	286	97	103	104	108	109	88	108	111	92	94	97	97	98	100	102	103	105	107	108	108	109
	2	MANARAH	240	46	51	54	59	63	126	149	163	172	173	187	197	213	231	251	272	294	317	341	366	393
	2	SAHAB	349	124	134	138	145	148	119	121	126	128	133	139	141	143	146	149	152	153	156	158	158	160
	2	MWQAR	160	44	48	52	55	59	101	92	97	102	120	129	135	144	156	168	180	192	206	218	233	248
	3	ABDALI	200	58	64	68	74	78	84	89	95	99	107	102	94	96	99	101	103	106	107	109	111	112
	3	ABDALI NEW	240	123	135	79	86	91	98	103	111	116	124	139	181	185	189	194	198	202	206	209	212	215
	3	HIZAM	320	0	0	120	127	134	141	148	156	165	173	189	175	184	194	204	215	227	239	251	265	279
	3	ZERQA	210	80	88	93	101	81	87	92	98	103	110	111	116	119	122	125	127	130	132	134	136	138
	3	ZERQA TR5	63	20	23	24	26	15	16	17	18	19	44	54	56	57	59	60	62	63	64	65	66	67
	3	New ZERQA	240	-	-	-	-	39	42	44	47	49	53	56	59	62	65	69	73	76	81	85	89	94
	3	DHULEIL	160	51	57	61	67	73	80	86	93	101	86	94	99	108	119	130	141	154	168	182	198	214
	4	CITY CENTER	240	107	118	127	138	147	186	196	212	212	182	197	207	224	243	264	286	308	333	358	384	412
	4	MARQA	268	172	180	125	129	129	132	131	157	156	131	133	131	133	136	138	141	143	144	146	148	149
	4	New BSP	240	-	-	-	-	-	-	-	-	-	112	114	117	130	144	158	175	192	211	232	253	277
	4	TAREQ	240	106	116	121	130	184	198	206	195	214	191	203	209	214	220	225	230	234	238	242	246	248
	5	BAYADER	400	169	186	198	215	178	203	199	213	175	187	200	209	214	219	225	229	234	238	242	245	248
	5	New BAYDER	240	-	-	80	87	91	104	181	194	167	179	191	200	204	209	214	219	223	227	231	234	237
	5	SALT	240	140	159	125	168	182	188	168	185	167	185	167	179	198	219	242	267	294	323	354	387	423
	5	UNIVERSITY	320	150	167	179	195	208	204	195	210	174	188	203	214	232	252	273	296	319	344	371	399	427
	5	New BSP	240	-	-	-	-	-	-	-	-	163	176	181	191	205	221	238	255	272	290	311	330	351
	5	SUBEIHI	349	110	119	124	105	105	112	115	119	123	130	169	174	179	179	183	188	188	192	192	197	197
	6	QAIA	90	12	13	14	16	17	19	21	23	25	27	30	80	89	98	108	119	132	144	158	173	189
	6	QAIA New	240	83	93	102	81	88	98	106	117	126	168	185	174	192	213	235	259	285	313	343	376	410
	6	MADABA SOUTH	240	89	98	104	144	153	164	173	186	194	179	193	176	189	204	219	235	251	268	286	304	323
EDCO	1	AQ A2	206	63	66	70	73	77	82	86	90	95	100	106	111	117	124	130	137	144	152	160	169	178
	1	AQ IND	160	29	30	32	33	35	37	39	41	43	46	48	51	53	56	59	62	66	69	73	77	81
	1	AQTH & NEW	286	42	44	46	49	51	54	57	60	63	67	70	74	78	82	86	91	96	101	106	112	118
	2	QUWEIRA	61	14	15	16	17	18	19	20	21	22	14	15	15	16	17	18	19	20	21	22	23	25
	2	DESI	126	31	33	35	36	38	40	43	45	47	59	62	65	69	72	76	80	85	89	94	99	104
	3	EL_HASA	50	23	25	26	27	29	15	16	17	18	19	20	21	22	23	24	26	27	29	30	32	33
	3	Tafila	160	-	-	-	-	-	15	16	17	18	18	19	20	22	23	24	25	27	28	30	31	33
	3	RASHADIA	96	28	29	31	33	34	36	38	40	42	45	47	49	52	55	58	61	64	68	71	75	79
	4	KARAK	57	41	43	35	37	39	41	44	46	48	51	54	57	60	63	66	70	73	77	81	86	90
	4	KARAK SOUTH	160	27	29	39	51	54	56	60	63	66	70	73	77	81	86	90	95	100	105	111	117	123
	5	SUBEIHI	189																					
	5	SWEIMEH	240	71	75	79	83	87	92	97	102	107	113	119	126	132	139	147	155	163	172	181	190	201
	5	New BSP	126	-	-	-	-	-	-	-	-	50	53	55	58	62	65	68	72	76	80	84	89	93
	5	ISHTAFINA	165	61	64	68	71	75	79	84	88	73	77	81	85	89	94	99	105	110	116	122	129	136
	5	WAQAS	189	77	81	85	90	94	99	105	110	106	112	118	124	131	138	145	153	161	170	179	188	198
	4	QATRANA	36	18	19	20	11	11	12	13	13	14	15	16	16	17	18	19	20	21	22	24	25	26
	99	GHORSAFI	200	54	57	60	64	67	71	74	78	83	87	92	96	102	107	113	119	125	132	139	146	154
	99	MAAN	174	46	48	51	53	56	59	62	66	69	73	77	81	85	90	94	99	105	110	116	122	129
	99	AZRAQ	50	15	15	16	17	18	19	20	21	22	23	25	26	27	29	30	32	34	35	37	39	41
	99	SAFAWI	30	6	6	6	6	7	7	8	8	8	9	9	10	10	11	12	12	13	13	14	15	16
	99	RWESHID	20	4	4	4	5	5	5	5	6	6	6	7	7	7	8	8	8	9	9	10	10	11
	99	Shedia	80	8	51	54	57	60	63	66	70	73	77	81	86	90	95	100	106	111	117	123	130	137
	99	RESHA	25	3	4	4	4	4	4	5	5	5	5	6	6	6	7	7	7	8	8	9	9	10
IDECO	1	IRBID	203	146	153	162	170	179	189	199	210	185	195	205	180	190	200	210	222	233	246	259	273	287
	1	IRBID EAST	160	63	67	70	74	78	82	87	91	148	156	164	173	182	192	202	213	224	236	249	262	276
	1	HASAN IND	160	53	56	59	62	66	69	73	77	65	68	72	112	118	124	131	138	145	153	161	170	179
	2	REHAB	80	66	69	73	77	81	85	90	94	99	105	110	116	122	129	136	143	151	159	167	176	186
	2	MAFRAQ	240	52	55	58	61	64	68	71	75	79	83	88	93	98	103	108	114	120	126	133	140	148
	2	SABHA	80	27	28	30	31	33	35	36	38	40	43	45	47	50	52	55	58	61	65	68	72	75
	2	DHULEIL	160	51	54	57	60	63	66	70	74	77	82	86	91	95	101	106	112	118	124	130	137	145
Others		Fuheis		0	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36
		M Cement		11	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31
		Q Cement		4	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31
		Hashimiya		0	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39
		Raiji Cement		19	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39
		Muwaqar IND		0	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44
			Total	3,273	3,769	3,965	4,227	4,439	4,734	4,967	5,271	5,533	5,873	6,220	6,501	6,823	7,179	7,557	7,948	8,353	8,778	9,218	9,680	10,158

Source: JICA Study Team

Source: JICA Study Team

5.5 Countermeaser for each scenarios of power system plans

Table 1 Oil-shale connection plan 1 (connect to Amman South-Amman East T/L) in 2019

Item	Line/Substation	Current rate	Length/ place	Unit cost	Cost
132kV Transmission line loading in N-1 state	Amman South-Bayader	147%	26km	150kUSD/km	3,900kUSD
	Bayader-University (cable)	122%	6.9km	1,300kUSD/km	8,970kUSD
	Rehab-Samra	115%	25.67km	150kUSD/km	3,851kUSD
400kV Trasmission line loading in N-1 state	Aqaba-New Ma'an	111%	130km	395kUSD/km	51,350kUSD
400kV Substation loading in N-1 state	Amman South	183%	1Tr	4,230kUSD	4,230kUSD

Source: JICA Study Team

Table 2 Oil-shale connection plan 2 (connect to QAIA substation) in 2019

Item	Line/Substation	Current rate	Length/ place	Unit cost	Cost
132kV Transmission line loading in N-1 state	Amman South-Bayader	-	-	-	-
	Bayader-University (cable)	-	-	-	-
	Rehab-Samra	107%	25.67km	150kUSD/km	3,851kUSD
400kV Trasmission line loading in N-1 state	Aqaba-New Ma'an	110%	130km	395kUSD/km	51,350kUSD
400kV Substation loading in N-1 state	Amman South	-	-	-	-

Source: JICA Study Team

Table 3 Oil-shale connection plan 3 (connect to New Qatrana Substation) in 2019

Item	Line/Substation	Current rate	Length/ place	Unit cost	Cost
132kV Transmission line loading in N-1 state	Amman South-Bayader	119%	26km	150kUSD/km	3,900kUSD
	Bayader-University (cable)	127%	6.9km	1,300kUSD/km	8,970kUSD
	Rehab-Samra	102%	25.67km	150kUSD/km	3,851kUSD
400kV Trasmission line loading in N-1 state	Aqaba-New Ma'an	108%	130km	395kUSD/km	51,350kUSD
400kV Substation loading in N-1 state	Amman South	135%	1Tr	4,230kUSD	4,230kUSD

Source: JICA Study Team

Table 4 Oil-shale connection plan 4 (connect to New QAIA Substation) in 2019

Item	Line/Substation	Current rate	Length/ place	Unit cost	Cost
132kV Transmission line loading in N-1 state	Amman South-Bayader	149%	26km	150kUSD/km	3,900kUSD
	Bayader-University (cable)	117%	6.9km	1,300kUSD/km	8,970kUSD
	Rehab-Samra	106%	25.67km	150kUSD/km	3,851kUSD
400kV Trasmission line loading in N-1 state	Aqaba-New Ma'an	110%	130km	395kUSD/km	51,350kUSD
400kV Substation loading in N-1 state	Amman South	-	-	-	-

Source: JICA Study Team

Table 5 Nuclear connection plan 1 with oil-shale connection 1 in 2025

Item	Line/Substation	Current rate	Length/ place	Unit cost	Cost
132kV Transmission line loading in N-1 state	Hizam-Manar	103%	12.1km	150kUSD/km	1,815kUSD
	Hizam-Abdali (replace to HTLS)	189%	7.3km	113kUSD/km	825kUSD
	Hizam-Samra (replace to HTLS)	124%	27.3km	113kUSD/km	3,085kUSD
	Bayader-Amman South	151%	26km	150kUSD/km	3,900kUSD
	Marqa-Zarqa (replace to HTLS)	140%	11km	113kUSD/km	1,243kUSD
	HTPS-Zarqa (add HTLS)	119%	11km	450kUSD/km	4,950kUSD
	HIE-Hassan	-	-	-	-
	Manara-Amman South (replace to HTLS)	116%	9.57km	113kUSD/km	1,081kUSD
	Amman South-QAIA	-	-	-	-
	QAIA-Madaba	-	-	-	-
400kV Trasmission line loading in N-1 state	Samra-Amman North	-	-	-	-
400kV Substation loading in N-1 state	Amman South	146%	1Tr	4,230kUSD	4,230kUSD
	Amman East	102%	1Tr	4,230kUSD	4,230kUSD
	Amman North	106%	1Tr	4,230kUSD	4,230kUSD
	Amman West	-	-	-	-

Source: JICA Study Team

Table 6 Nuclear connection plan 1 with oil-shale connection 2 in 2025

Item	Line/Substation	Current rate	Length/ place	Unit cost	Cost
132kV Transmission line loading in N-1 state	Hizam-Manar	107%	12.1km	150kUSD/km	1,815kUSD
	Hizam-Abdali (replace to HTLS)	189%	7.3km	113kUSD/km	825kUSD
	Hizam-Samra (replace to HTLS)	127%	27.3km	113kUSD/km	3,085kUSD
	Bayader-Amman South	150%	26km	150kUSD/km	3,900kUSD
	Marqa-Zarqa (replace to HTLS)	140%	11km	113kUSD/km	1,243kUSD
	HTPS-Zarqa (add HTLS)	119%	11km	450kUSD/km	4,950kUSD
	HIE-Hassan	-	-	-	-
	Manara-Amman South (replace to HTLS)	116%	9.57km	113kUSD/km	1,081kUSD
	Amman South-QAIA	-	-	-	-
	QAIA-Madaba	108%	21.07km	150kUSD/km	3,160kUSD
400kV Trasmission line loading in N-1 state	Samra-Amman North	-	-	-	-
400kV Substation loading in N-1 state	Amman South	-	-	-	-
	Amman East	102%	1Tr	4,230kUSD	4,230kUSD
	Amman North	103%	1Tr	4,230kUSD	4,230kUSD
	Amman West	-	-	-	-

Source: JICA Study Team

Table 7 Nuclear connection plan 1 with oil-shale connection 3 in 2025

Item	Line/Substation	Current rate	Length/ place	Unit cost	Cost
132kV Transmission line loading in N-1 state	Hizam-Manar	102%	12.1km	150kUSD/km	1,815kUSD
	Hizam-Abdali (replace to HTLS)	189%	7.3km	113kUSD/km	825kUSD
	Hizam-Samra (replace to HTLS)	126%	27.3km	113kUSD/km	3,085kUSD
	Bayader-Amman South	152%	26km	150kUSD/km	3,900kUSD
	Marqa-Zarqa (replace to HTLS)	140%	11km	113kUSD/km	1,243kUSD
	HTPS-Zarqa (add HTLS)	119%	11km	450kUSD/km	4,950kUSD
	HIE-Hassan	-	-	-	-
	Manara-Amman South (replace to HTLS)	116%	9.57km	113kUSD/km	1,081kUSD
	Amman South-QAIA	-	-	-	-
	QAIA-Madaba	-	-	-	-
400kV Trasmission line loading in N-1 state	Samra-Amman North	-	-	-	-
400kV Substation loading in N-1 state	Amman South	143%	1Tr	4,230kUSD	4,230kUSD
	Amman East	102%	1Tr	4,230kUSD	4,230kUSD
	Amman North	103%	1Tr	4,230kUSD	4,230kUSD
	Amman West	-	-	-	-

Source: JICA Study Team

Table 8　Nuclear connection plan 2 with oil-shale connection 1 in 2025

Item	Line/Substation	Current rate	Length/ place	Unit cost	Cost
132kV Transmission line loading in N-1 state	Hizam-Manar	-	-	-	-
	Hizam-Abdali (replace to HTLS)	189%	7.3km	113kUSD/km	825kUSD
	Hizam-Samra (replace to HTLS)	131%	27.3km	113kUSD/km	3,085kUSD
	Bayader-Amman South	151%	26km	150kUSD/km	3,900kUSD
	Marqa-Zarqa (replace to HTLS)	140%	11km	113kUSD/km	1,243kUSD
	HTPS-Zarqa (add HTLS)	119%	11km	450kUSD/km	4,950kUSD
	HIE-Hassan	-	-	-	-
	Manara-Amman South (replace to HTLS)	116%	9.57km	113kUSD/km	1,081kUSD
	Amman South-QAIA	-	-	-	-
	QAIA-Madaba	-	-	-	-
400kV Trasmission line loading in N-1 state	Samra-Amman North	-	-	-	-
400kV Substation loading in N-1 state	Amman South	140%	1Tr	4,230kUSD	4,230kUSD
	Amman East	-	-	-	-
	Amman North	-	-	-	-
	Amman West	-	-	-	-

Source: JICA Study Team

Table 9　Nuclear connection plan 2 with oil-shale connection 2 in 2025

Item	Line/Substation	Current rate	Length/ place	Unit cost	Cost
132kV Transmission line loading in N-1 state	Hizam-Manar	-	-	-	-
	Hizam-Abdali (replace to HTLS)	189%	7.3km	113kUSD/km	949kUSD
	Hizam-Samra (replace to HTLS)	137%	27.3km	113kUSD/km	3,085kUSD
	Bayader-Amman South	151%	26km	150kUSD/km	3,900kUSD
	Marqa-Zarqa (replace to HTLS)	140%	11km	113kUSD/km	1,243kUSD
	HTPS-Zarqa (add HTLS)	119%	11km	450kUSD/km	4,950kUSD
	HIE-Hassan	-	-	-	-
	Manara-Amman South (replace to HTLS)	117%	9.57km	113kUSD/km	1,081kUSD
	Amman South-QAIA	103%	20.63km	150kUSD/km	3,095kUSD
	QAIA-Madaba	109%	21.07km	150kUSD/km	3,160kUSD
400kV Trasmission line loading in N-1 state	Samra-Amman North	-	-	-	-
400kV Substation loading in N-1 state	Amman South	-	-	-	-
	Amman East	-	-	-	-
	Amman North	-	-	-	-
	Amman West	-	-	-	-

Source: JICA Study Team

Table 10　Nuclear connection plan 2with oil-shale connection 3 in 2025

Item	Line/Substation	Current rate	Length/ place	Unit cost	Cost
132kV Transmission line loading in N-1 state	Hizam-Manar	-	-	-	-
	Hizam-Abdali (replace to HTLS)	189%	7.3km	113kUSD/km	825kUSD
	Hizam-Samra (replace to HTLS)	137%	27.3km	113kUSD/km	3,085kUSD
	Bayader-Amman South	153%	26km	150kUSD/km	3,900kUSD
	Marqa-Zarqa (replace to HTLS)	140%	11km	113kUSD/km	1,243kUSD
	HTPS-Zarqa (add HTLS)	119%	11km	450kUSD/km	4,950kUSD
	HIE-Hassan (add HTLS)	102%	15km	450kUSD/km	6,750kUSD
	Manara-Amman South (replace to HTLS)	117%	9.57km	113kUSD/km	1,081kUSD
	Amman South-QAIA	-	-	-	-
	QAIA-Madaba	-	-	-	-
400kV Trasmission line loading in N-1 state	Samra-Amman North	-	-	-	-
400kV Substation loading in N-1 state	Amman South	138%	1Tr	4,230kUSD	4,230kUSD
	Amman East	-	-	-	-
	Amman North	-	-	-	-
	Amman West	101%	1Tr	4,230kUSD	4,230kUSD

Source: JICA Study Team

Table 11　Nuclear connection plan 3 with oil-shale connection 1 in 2025

Item	Line/Substation	Current rate	Length/ place	Unit cost	Cost
132kV Transmission line loading in N-1 state	Hizam-Manar	-	-	-	-
	Hizam-Abdali (replace to HTLS)	189%	7.3km	113kUSD/km	825kUSD
	Hizam-Samra (replace to HTLS)	142%	27.3km	113kUSD/km	3,085kUSD
	Bayader-Amman South	152%	26km	150kUSD/km	3,900kUSD
	Marqa-Zarqa (replace to HTLS)	140%	11km	113kUSD/km	1,243kUSD
	HTPS-Zarqa (add HTLS)	119%	11km	450kUSD/km	4,950kUSD
	HIE-Hassan (add HTLS)	102%	15km	450kUSD/km	6,750kUSD
	Manara-Amman South (replace to HTLS)	117%	9.57km	113kUSD/km	1,081kUSD
	Amman South-QAIA	-	-	-	-
	QAIA-Madaba	-	-	-	-
400kV Trasmission line loading in N-1 state	Samra-Amman North	110%	28km	395kUSD/km	11,060kUSD
400kV Substation loading in N-1 state	Amman South	142%	1Tr	4,230kUSD	4,230kUSD
	Amman East	-	-	-	-
	Amman North	103%	1Tr	4,230kUSD	4,230kUSD
	Amman West	-	-	-	-

Source: JICA Study Team

Table 12　Nuclear connection plan 3 with oil-shale connection 2 in 2025

Item	Line/Substation	Current rate	Length/ place	Unit cost	Cost
132kV Transmission line loading in N-1 state	Hizam-Manar	-	-	-	-
	Hizam-Abdali (replace to HTLS)	189%	7.3km	113kUSD/km	825kUSD
	Hizam-Samra (replace to HTLS)	145%	27.3km	113kUSD/km	3,085kUSD
	Bayader-Amman South	152%	26km	150kUSD/km	3,900kUSD
	Marqa-Zarqa (replace to HTLS)	140%	11km	113kUSD/km	1,243kUSD
	HTPS-Zarqa (add HTLS)	119%	11km	450kUSD/km	4,950kUSD
	HIE-Hassan (add HTLS)	102%	15km	450kUSD/km	6,750kUSD
	Manara-Amman South (replace to HTLS)	117%	9.57km	113kUSD/km	1,081kUSD
	Amman South-QAIA	103%	20.63km	150kUSD/km	3,095kUSD
	QAIA-Madaba	-	-	-	-
400kV Trasmission line loading in N-1 state	Samra-Amman North	111%	28km	395kUSD/km	11,060kUSD
400kV Substation loading in N-1 state	Amman South	-	-	-	-
	Amman East	-	-	-	-
	Amman North	-	-	-	-
	Amman West	-	-	-	-

Source: JICA Study Team

Table 13　Nuclear connection plan 3 with oil-shale connection 3 in 2025

Item	Line/Substation	Current rate	Length/ place	Unit cost	Cost
132kV Transmission line loading in N-1 state	Hizam-Manar	-	-	-	-
	Hizam-Abdali (replace to HTLS)	189%	7.3km	113kUSD/km	825kUSD
	Hizam-Samra (replace to HTLS)	144%	27.3km	113kUSD/km	3,085kUSD
	Bayader-Amman South	153%	26km	150kUSD/km	3,900kUSD
	Marqa-Zarqa (replace to HTLS)	140%	11km	113kUSD/km	1,243kUSD
	HTPS-Zarqa (add HTLS)	119%	11km	450kUSD/km	4,950kUSD
	HIE-Hassan (add HTLS)	102%	15km	450kUSD/km	6,750kUSD
	Manara-Amman South (replace to HTLS)	117%	9.57km	113kUSD/km	1,081kUSD
	Amman South-QAIA	-	-	-	-
	QAIA-Madaba	-	-	-	-
400kV Trasmission line loading in N-1 state	Samra-Amman North	110%	28km	395kUSD/km	11,060kUSD
400kV Substation loading in N-1 state	Amman South	138%	1Tr	4,230kUSD	4,230kUSD
	Amman East	-	-	-	-
	Amman North	-	-	-	-
	Amman West	-	-	-	-

Source: JICA Study Team

Table 14　Nuclear connection plan 4 with oil-shale connection 4 in 2025

Item	Line/Substation	Current rate	Length/ place	Unit cost	Cost
132kV Transmission line loading in N-1 state	Hizam-Manar	-	-	-	-
	Hizam-Abdali (replace to HTLS)	196%	7.3km	113kUSD/km	825kUSD
	Hizam-Samra (replace to HTLS)	141%	27.3km	113kUSD/km	3,085kUSD
	Bayader-Amman South	Base case	26km	150kUSD/km	3,900kUSD
	Marqa-Zarqa (replace to HTLS)	141%	11km	113kUSD/km	1,243kUSD
	HTPS-Zarqa (add HTLS)	120%	11km	450kUSD/km	4,950kUSD
	HIE-Hassan (add HTLS)	108%	15km	450kUSD/km	6,750kUSD
	Manara-Amman South (replace to HTLS)	127%	9.57km	113kUSD/km	1,081kUSD
	Amman South-QAIA	-	-	-	-
	QAIA-Madaba	101%	21.07km	150kUSD/km	3,161kUSD
400kV Trasmission line loading in N-1 state	Samra-Amman North		-	-	-
400kV Substation loading in N-1 state	Amman South	100%	1Tr	4,230kUSD	4,230kUSD
	Amman East	-	-	-	-
	Amman North	102%	1Tr	4,230kUSD	4,230kUSD
	Amman West	-	-	-	-

Source: JICA Study Team

Table 15　Nuclear behind schedule (2025)

Item	Line/Substation	Current rate	Length/ place	Unit cost	Cost
132kV Transmission line loading in N-1 state	Hizam-Manar	129%	12.1km	150kUSD/km	1,815kUSD
	Hizam-Abdali (replace to HTLS)	111%	7.3km	113kUSD/km	825kUSD
	Amman South-QAIA	109%	20.63km	150kUSD/km	3,095kUSD
	QAIA-Madaba	115%	21.07km	150kUSD/km	3,160kUSD
400kV Trasmission line loading in N-1 state	New Qatrana-Qatrana	104%	28km	395kUSD/km	11,060kUSD
400kV Substation loading in N-1 state	Amman South	102%	1Tr	4,230kUSD	4,230kUSD
	Amman East		-	-	-
	Amman North	-	-	-	-
	Amman West	-	-	-	-
	Aqaba	143%	1Tr	4,230kUSD	4,230kUSD
	QAIA	123%	1Tr	4,230kUSD	4,230kUSD

Source: JICA Study Team

Table 16 Nuclear on schedule (2030)

Item	Line/Substation	Current rate	Length/ place	Unit cost	Cost
400kV Trasmission line loading in N-1 state	New Ma'an-Aqaba	111%	130km	395kUSD/km	51,350kUSD

Source: JICA Study Team

Table 17 Nuclear behind schedule (2030)

Item	Line/Substation	Current rate	Length/ place	Unit cost	Cost
132kV Trasmission line loading in N-1 state	QAIA-Madba	104%	21.07km	150kUSD/km	3,160kUSD
400kV Trasmission line loading in N-1 state	New Ma'an-Aqaba	111%	130km	395kUSD/km	51,350kUSD
400kV Substation loading in N-1 state	Aqaba	101%	1Tr	4,230kUSD	4,230kUSD

Source: JICA Study Team

Table 18 Nuclear on schedule and 5 years delay (2034)

Item	Line/Substation	Current rate	Length/ place	Unit cost	Cost
132kV Transmission line loading in N-1 state	Hizam-Abdali (replace to HTLS)	113%	7.3km	113kUSD/km	825kUSD
	Marqa-Zarqa (replace to HTLS)	122%	11km	113kUSD/km	1,243kUSD
	South Karak-Qatrana	117%	15.5km	150kUSD/km	2,325kUSD
	Ashrafiah-Manara	118%	6.38km	150kUSD/km	957kUSD
	Bayader-Amman South	103%	26km	150kUSD/km	3,900kUSD
	QAIA-Madaba	107%	21.07km	150kUSD/km	3,160kUSD
	Amman East-Manar	113%	9.58km	150kUSD/km	1,437kUSD
	Tareq-Amman North	110%	5.8km	150kUSD/km	870kUSD
	Suweimeh-Amman West	111%	35km	150kUSD/km	5,250kUSD
400kV Trasmission line loading in N-1 state	Amman North-Samra	113%	28km	395kUSD/km	11,060kUSD
400kV Substation loading in N-1 state	Amman South	-	-	-	-
	Amman East	-	-	-	-
	Amman North	-	-	-	-
	Amman West	103%	1Tr	4,230kUSD	4,230kUSD
	Aqaba	108%	1Tr	4,230kUSD	4,230kUSD
	QAIA	123%	1Tr	4,230kUSD	4,230kUSD
	Qatrana	101%	1Tr	4,230kUSD	4,230kUSD
	HIE	121%	1Tr	4,230kUSD	4,230kUSD

Source: JICA Study Team

Table 19　Nuclear on 10 years delay (2034)

Item	Line/Substation	Current rate	Length/ place	Unit cost	Cost
132kV Transmission line loading in N-1 state	Sabha-Dhuleil	103%	29km	150kUSD/km	4,350kUSD
	Sabha-Mafraq	198%	32.2km	150kUSD/km	4,830kUSD
	Tareq-Amman North	111%	5.8km	150kUSD/km	870kUSD
400kV Trasmission line loading in N-1 state	New Qatrana-Qatrana	113%	28km	395kUSD/km	11,060kUSD
400kV Substation loading in N-1 state	Aqaba	116%	1Tr	4,230kUSD	4,230kUSD

Source: JICA Study Team

Chapter 9 Environmental and Social Considerations

9.1 Appendix 9.2.1 SEA Studies for Generation Development Plan in JICA projects

Table 9.2.1 Comparison of SEA Studies for Generation Development Plan in JICA Project

Country (Region)	Year	Name of Project	Purpose	Generation Development	SEA-1	SEA-2	SEA Legislation	Major Environmental Item	Alternatives /Scenarios
Vietnam	2003	Master Plan Study on Pumped Storage Power Project and Optimization for Peaking Power Generation in Vietnam	Support of the Peak Optimization Power Development Plan	Thermal power (Gas, oil, coal), hydropower, pumped storage hydropower, renewable energy (wind, solar), transmission network	Prioritization of Power Development Plans	Candidate site for pumped storage power generation	Applying EU, World Bank SEA policies	Land acquisition/resettlement, thermal effluent, air pollution, ash, GHG emission etc.	2 scenarios - (a)Hydropower and (b)Thermal power (coal fired).In conclusion, scenario (b) was prioritized considering factors such as economic effect, abundant domestic energy resource, although likely causing more negative impact than than hydropower in terms of environmental and social considerations.
Sri Lanka	2006	Master Plan Study on the Development of Power Generation	Support to formulation of Power Development Master Plan	Thermal power (Gas, oil, coal), hydropower, pumped storage	Prioritization of Power Development	Candidate site/route for hydropower,	Based on the JICA Guidelines	(1) Items of social environment, natural environment, pollution	3 scenarios - (a) No large scale thermal power generation, (b) Hydropower

Country (Region)	Year	Name of Project	Purpose	Generation Development	SEA-1	SEA-2	SEA Legislation	Major Environmental Item	Alternatives /Scenarios
		and Transmission System in Sri Lanka		hydropower, renewable energy (wind, solar), geothermal power, transmission network	Plans	thermal power (coal fired) generation and transmission network			generation, (c) Thermal power by natural gas.
Vietnam	2007	The Study on National Power Development Plan for the period of 2006-2015 in Vietnam	Technical support to the 6th National Power Development Planning	Thermal power (Gas, oil, coal), hydropower, pumped storage hydropower, renewable energy (wind, solar), transmission network	Prioritization of Power Development Plans	Candidate sites for hydropower generation	Law on Environmental Protection 2005 Amended, Decree No.80/2006 /ND-CP (2006.8), Guidelines （2006.8）	Items of social environment, natural environment and pollution	2 scenarios - (a) Selection of hydropower generation sites with less scale of resettlement, or import of electricity, (b) Change from thermal power (imported coal) to hydropower or renewable energy.
Indonesia (Sulawesi)	2008	The Study on Optimal Electric Power Development in Sulawesi in the Republic of Indonesia	Support of Optimal Electric Power Development	Thermal power (Gas, oil, coal), hydropower, geothermal power	Prioritization of Power Development Plans	Out of scope	Based on the JICA Guidelines	(1) Items independent on site location - air quality, GHG emission, solid waste, local economy such as income and employment, (2) Policy, economy,	2 scenarios - (a) Economically oriented, (b) Utilizing local energy.

Country (Region)	Year	Name of Project	Purpose	Generation Development	SEA-1	SEA-2	SEA Legislation	Major Environmental Item	Alternatives /Scenarios
								financial condition and technology, (3) Environmental items.	
Indonesia (Java-Madura-Bali)	2008	The Study on Optimal Electric Power Development in Java-Madura-Bali in the Republic of Indonesia	Support of Optimal Electric Power Development	Thermal power (Gas, oil, coal), hydropower, pumped storage hydropower, renewable energy (wind, solar), nuclear power, transmission network	Prioritization of Power Development Plans	Out of scope	Based on the JICA Guidelines	(1) Amount of NOx, SOx, CO_2 emissions、(2) Air quality, water quality, GHG emission, thermal effluent, river water use, involuntary resettlement,	(1) 4 scenarios - (a) Zero option, (b) Thermal power (coal), (c) diversification of power generation, (d) reduction of CO2 emission. (2) Evaluation indicators - reliability of power supply, cost, environmental and social considerations,
Vietnam	2010	Technical Assistance for Power Development Plan 7 in Vietnam	Technical support of the 6th National Power Development Planning	Thermal power (Gas, oil, coal), hydropower, pumped storage hydropower, renewable energy (wind, solar), nuclear power, transmission network, import of	Review of SEA study by counter part	Out of scope	Law on Environmental Protection 2005 Amended, Decree No.80/2006 /ND-CP (2006.8), Guidelines （2006.8）	Involuntary resettlement, income, cultural and heritage property, biodiversity, natural resources, hydrological condition, climate change, air pollution, solid waste, radioactive	All the generation development plans (thermal power, hydropower, nuclear power, renewable energy, import electricity etc.)

Country (Region)	Year	Name of Project	Purpose	Generation Development	SEA-1	SEA-2	SEA Legislation	Major Environmental Item	Alternatives /Scenarios
				electric power				substances, hazard/risk, landscape, geology etc.	
Zambia	2010	The Study for Power System Development Master Plan in Zambia	Support of Optimal Electric Power Development	Thermal power (Gas, oil, coal), hydropower, transmission/distribution network, electric power interchange	Prioritization of Power Development Plans	Candidate site for pumped storage power generation	Based on the JICA Guidelines	Involuntary resettlement, local economy, land use, infectious diseases, air pollution, soil contamination, solid waste, biodiversity	3 scenarios - (a) domestic energy sources only, (b) Import energy resources and power generation within country, (c) Energy cooperation through SAPP (South African Power Pool).
Sri Lanka	2014	Development Planning on Optimal Power Generation for Peak Demand in Sri Lanka	Support of Optimal Electric Power Development	Thermal power (Gas, oil, coal), hydropower, pumped storage hydropower, renewable energy (wind, solar), nuclear power, transmission network, power cooperation with India, IPP	Prioritization of Power Development Plans	Candidate site for pumped storage power generation	(1) From 2006 all PPP are requested to conduct SEA. (2) SEA Guidelines (2009)	Air pollution, water pollution, GHG emission, eco-system, involuntary resettlement, water use, water rights, fishery, agriculture, tourism, human health	(1) 1st screening - (a) power generations (hydropower, thermal power, renewable energy, pumped storage etc. (b) other options (IPP, demand side management, international transmission linkage with India other than power

Country (Region)	Year	Name of Project	Purpose	Generation Development	SEA-1	SEA-2	SEA Legislation	Major Environmental Item	Alternatives /Scenarios
									generation. (2) 2nd screening - hydropower (expansion), thermal power (LNGCC, gas turbine), pumped storage hydropower in terms of load following capability and power generation, environmental and social considerations, economic efficiency.

Source: Edited by the JICA Study Team referring to major cases of electric sector master plan study through JICA Projects

9.2 Appendix 9.4.1 Confirmation of Environmental and Social Considerations by JICA Environmental Checklist (Matrix of Main Check items vs. Generation Development Plans)

Table 9.4.1 Confirmation of Environmental and Social Considerations by JICA Environmental Checklist (Matrix of Main Check items vs. Generation Development Plans)

Category	Environmental Item	Main Check Items	Thermal Power				Hydro Power	Renewable Energy		Transmission/Distribution
			Gas	Oil	Coal	Oil Shale		Wind Power	Solar Power	
1) Permits and Explanation	(1) SEA/EIA and Environmental Permits	a) Have reports (SEA/EIA) related to environmental impacts due to Policy/Plan/Program/Project (PPPPs) been already prepared in official process?	X	X	X	X	X	X	X	X
		b) Have SEA/EIA reports been approved by authorities of the host country's government?	X	X	X	X	X	X	X	X
		c) Have SEA/EIA reports been unconditionally approved? If conditions are imposed on the approval of EIA reports, are the conditions satisfied?	X	X	X	X	X	X	X	X
		d) In addition to the above approvals, have other required environmental permits been obtained from the appropriate regulatory authorities of the host country's government?	X	X	X	X	X	X	X	X
	(2) Explanation to relevant Stakeholders	a) Have contents of the PPPPs and the potential impacts been adequately explained to relevant stakeholders based on appropriate procedures, including information disclosure? Is understanding obtained from the Local stakeholders?	X	X	X	X	X	X	X	X
		b) Have the comment from the stakeholders been reflected to the PPPPs design?	X	X	X	X	X	X	X	X

	(3) Examination of Alternatives	a) Have alternative plans of the project been examined with social and environmental considerations?	X	X	X	X	X	X	X	X
2) Pollution	(1) Air Quality	1) Do air pollutants, such as sulfur oxides (SOx), nitrogen oxides (NOx), and soot and dust emitted by the power plant operations comply with the country's emission standards? Is there a possibility that air pollutants emitted from the project will cause areas that do not comply with the country's ambient air quality standards? Are any mitigating measures taken?	X	X	X	X	-	-	-	-
		2) Do air pollutants, such as sulfur oxides (SOx), nitrogen oxides (NOx), soot and dust emitted from the ships, vehicles and the facilities like docs comply with the country's emission standards? Are any mitigating measures taken?	X	X	X	X	-	-	-	-
		3) Do air pollutants, such as hydrogen sulfide (H_2S) emitted from geothermal power plants comply with the country's standards? Is there a possibility that the emitted hydrogen sulfide will have the impacts on the surrounding areas, including vegetation? Are any mitigating measures taken?	X	X	X	X	-	-	-	-
		4) In the case of coal-fired power plants, is there a possibility that fugitive dust from the coal piles, coal handling facilities, and dust from the coal ash disposal sites as well as open cast oils shale mining sites will cause air pollution? Are adequate measures taken to prevent the air pollution?	X	X	X	X	-	-	-	-
		5) In the case of oil shale power plants, is there a possibility that fugitive dust from the open cast mining sites, and dust from disposal/stockpiling sites of mining and oil shale processing wastes will cause air pollution? Are adequate measures taken to prevent the air pollution?	-	-	X	X	-	-	-	-

	(2) Water Quality	a1) Do effluents including thermal effluents from the power plant comply with the country's effluent standards? Is there a possibility that the effluents from the project will cause areas that do not comply with the country's ambient water quality standards or cause any significant temperature rise in the receiving waters?	X	X	X	X	-	-	-	-
		b1) In the case of coal-fired power plants, do leachates from the coal piles and coal ash disposal sites comply with the country's effluent standards?	-	-	X	-	-	-	-	-
		b2) In the case of geothermal power plants, is there any possibility that geothermal utilization will cause water pollution by toxicants, such as Arsenic (As) and Mercury (Hg) contained in geothermal fluids? If the water pollution is anticipated, are adequate measures considered?	-	-	X	X	-	-	-	-
		b3) In the case of oil shale power plants, is there a possibility that oil shale utilization willl cause water pollution by toxicantsts, such as Arsenic (As) and Mercury (Hg) contained in geothermal fluids? If the water pollution is anticipated, are adequate measures considered?	-	-	-	X	-	-	-	-
		c) Are adequate measures taken to prevent contamination of surface water, soil, groundwater, and seawater by the effluents?	X	X	X	X	X	-	-	-
		d) Does the water quality of dam pond/reservoir comply with the country's ambient water quality standards? Is there a possibility that proliferation of phytoplankton and zooplankton will occur?	-	-	-	-	X	-	-	-
		e) Does the quality of water discharged from the dam pond/reservoir comply with the country's ambient water quality standards?	-	-	-	-	X	-	-	-
		f) Are adequate measures, such as clearance of woody vegetation from the inundation zone prior to flooding planned to prevent water quality degradation in the dam pond/reservoir?	-	-	-	-	X	-	-	-
		g) Is there a possibility that reduced the river flow downstream will cause water quality degradation resulting in areas that do not comply with the country's ambient water quality standards?	-	-	-	-	X	-	-	-

		h) Is the discharge of water from the lower portion of the dam pond/reservoir (the water temperature of the lower portion is generally lower than the water temperature of the upper portion) planned by considering the impacts to downstream areas?	-	-	-	-	X	-	-	-
		i) Is there any possibility that soil runoff from the bare lands resulting from earthmoving activities, such as cutting and filling will cause water quality degradation in downstream water areas? If the water quality degradation is anticipated, are adequate measures considered?	X	X	X	X	X	X	X	X
		j) Do leachates from the waste disposal sites comply with the country's effluent standards and ambient water quality standards? Are adequate measures taken to prevent contamination of soil, groundwater, and seawater by leachates?	X	X	X	X	X	X	X	X
		k) Is there any possibility that effluent from well excavation would cause water contamination? If water pollution is anticipated, are adequate measures considered?	-	-	X	X	-	-	-	-
		l) Do pollutants, such as Suspended Soils (SS), oils/fats and other toxicants contained in effluents comply with the country's effluent standards (BOD, COD, ph, etc)? Is there a possibility that the effluents from the project will cause areas not to comply with the country's ambient water quality standards?	X	X	X	X	X	-	-	-
		m) Are adequate measures taken to prevent contamination of surface water, groundwater and soil by the effluents from storage areas, including raw materials, chemicals, and wastes?	X	X	X	X	X	-	-	-
	(3) Wastes	a1) Are wastes, (such as waste oils, and waste chemical agents), coal ash, and by-product gypsum from flue gas desulfurization generated by the power plant operations properly treated and disposed of in accordance with the country's regulations?	X	X	X	X	X	-	-	-
		a2) Are wastes generated by the plant operations properly treated and disposed of in accordance with	X	X	X	X	X	-	-	-

		the country's regulations (especially biomass energy projects)?								
		b) Are earth and sand generated by excavation properly treated and disposed of in accordance with the country's regulations?	X	X	X	X	X	-	-	-
		c) Do leachates from the waste disposal sites comply with the country's effluent standards and ambient water quality standards? Are adequate measures taken to prevent contamination of soil, groundwater, and seawater by leachates?	X	X	X	X	X	-	-	-
		d) Are wastes (including hazardous wastes and other industrial wastes) generated from the project facilities properly treated and disposed of in accordance with the country's regulations?	X	X	X	X	X	-	-	-
		e) Are adequate measures taken to prevent contamination of soil and groundwater by leachates from the waste storage/disposal sites?	X	X	X	X	X	-	-	-
	(4) Soil Contamination	a) Has the soil in the project site been contaminated in the past? Are adequate measures taken to prevent soil contamination?	X	X	X	X	X	X	X	X
	(5) Noise and Vibration	a) Do noise and vibrations comply with the country's standards?	X	X	X	X	X	X	X	X
		b) In case of Wind Power Station, does low frequency noise comply with the environmental standard?	-	-	-	-	-	X	-	-
	(6) Subsidence	a) In the case of extraction of a large volume of groundwater, is there a possibility that the extraction of groundwater will cause subsidence?	X	X	X	X	X	X	X	X
	(7) Odor	a) Are there any odor sources? Are adequate odor control measures taken?	X	X	X	X	X	X	X	X
3) Natural	(1) Protected Areas	a) Is the project site located in protected areas designated by the country's laws or international treaties and conventions? Is there a possibility that the project will affect the protected areas?	X	X	X	X	X	X	X	X

	(2) Ecosystem	a) Does the project site encompass primeval forests, tropical rain forests, ecologically valuable habitats (e.g., coral reefs, mangroves, or tidal flats)?	X	X	X	X	X	X	X	X
		b) Does the project site encompass the protected habitats of endangered species designated by the country's laws or international treaties and conventions?	X	X	X	X	X	X	X	X
		c) If significant ecological impacts are anticipated, are adequate protection measures taken to reduce the impacts on the ecosystem?	X	X	X	X	X	X	X	X
		d) Is there a possibility that the amount of water (e.g., surface water, groundwater) used by the project will adversely affect aquatic environments, such as rivers? Are adequate measures taken to reduce the impacts on aquatic environments, such as aquatic organisms?	X	X	X	X	X	X	X	X
		e) Is there a possibility that discharge of thermal effluents, intake of a large volume of cooling water or discharge of leachates will adversely affect the ecosystem of surrounding water areas?	X	X	X	X	X	X	X	X
		f) Is there a possibility that the project will adversely affect downstream aquatic organisms, animals, plants, and ecosystems? Are adequate protection measures taken to reduce the impacts on the ecosystem?	X	X	X	X	X	X	X	X
		g) Is there a possibility that installation of structures, such as dams will block the movement of the migratory fish species (such as salmon, trout and eel those move between rivers and sea for spawning)? Are adequate measures taken to reduce the impacts on these species?	X	X	X	X	X	X	X	X
		h) Is there any possibility that the project will cause the negative impacts, such as destruction of forest, poaching, desertification, reduction in wetland areas, and disturbance of ecosystem due to introduction of exotic (non-native invasive) species and pests? Are adequate measures for preventing such impacts considered?	X	X	X	X	X	X	X	X
		i) Are adequate measures taken to prevent disruption of migration routes and habitat	X	X	X	X	X	X	X	X

		fragmentation of wildlife and livestock?								
		j) Are adequate measures taken to prevent migration birds striking to transmission lines and towers?	X	X	X	X	X	X	X	X
		k) In cases where the project site is located in undeveloped areas, is there any possibility that the new development will result in extensive loss of natural environments?	X	X	X	X	X	X	X	X
		l) Is there a possibility that localized micro-meteorological changes due to wind power generation will affect valuable vegetation in the surrounding areas (Is there valuable vegetation in the vicinity of the wind power generation facilities)? If impacts on vegetation are anticipated, are adequate measures considered?	X	X	X	X	X	X	X	X
		m) Are the wind power generation facilities (wind turbines) sited by considering the habitats and migration routes of sensitive or potentially affected bird species?	X	X	X	X	X	X	X	X
	(3) Hydrology	a) Is there a possibility that hydrologic changes due to installation of the structures, such as weirs will adversely affect the water flows, waves and tides?	X	X	X	X	X	X	X	X
		b) Is there a possibility that hydrologic changes due to the installation of structures, such as weirs will adversely affect the surface and groundwater flows (especially in "run of the river generation" projects)?	X	X	X	X	X	X	X	X
	(4) Topography and Geology	a) Is there any soft ground on the route of power transmission and distribution lines that may cause slope failures or landslides? Are adequate measures considered to prevent slope failures or landslides, where needed?	X	X	X	X	X	X	X	X
		b) Is there a possibility that the project will cause a large-scale alteration of the topographic features and geologic structures in the surrounding areas?	X	X	X	X	X	X	X	X
		c) Is there any possibility that civil works, such as cutting and filling will cause slope failures or landslides? Are adequate measures considered to prevent slope failures or landslides?	X	X	X	X	X	X	X	X
		d) Is there a possibility that soil runoff will result from cut and fill areas, waste soil disposal sites,	X	X	X	X	X	X	X	X

		and borrow sites? Are adequate measures taken to prevent soil runoff?								
		e) Is there a possibility that reductions in sediment loads downstream due to settling of suspended particles in the reservoir will cause impacts, such as scouring of the downstream riverbeds and soil erosion? Is there a possibility that sedimentation of the reservoir will cause loss of the storage capacity, water logging upstream, and formation of sediment deposits at the reservoir entrance? Are the possibilities of the impacts studied, and adequate prevention measures taken?	X	X	X	X	X	X	X	X
		f) Is there a possibility that the project will cause a large-scale alteration of the topographic features and geologic structures in the surrounding areas (especially in run of the river generation projects and geothermal power generation projects)?	X	X	X	X	X	X	X	X
		g) Is the stability of the existing topographic conditions adequately considered for alteration of topographic features, such as cut and fill operations?	X	X	X	X	X	X	X	X
		h) Is there a possibility that soil runoffs will result from cut and fill areas, waste soil disposal sites, and borrow sites? Are adequate mitigation measures taken to prevent soil runoffs?	X	X	X	X	X	X	X	X
		i) In the case of offshore projects, is there any possibility that the project will erode natural beaches?	X	X	X	X	X	X	X	X
4) Social Environment	(1) Resettlement	a) Is involuntary resettlement caused by project implementation? If involuntary resettlement is caused, are efforts made to minimize the impacts caused by the resettlement?	X	X	X	X	X	X	X	X
		b) Is adequate explanation on compensation and resettlement assistance given to affected people prior to resettlement?	X	X	X	X	X	X	X	X
		c) Is the resettlement plan, including compensation with full replacement costs, restoration of livelihoods and living standards developed based on socioeconomic studies on resettlement?	X	X	X	X	X	X	X	X

	d) Are the compensations going to be paid prior to the resettlement?	X	X	X	X	X	X	X	X
	e) Are the compensation policies prepared in document?	X	X	X	X	X	X	X	X
	f) Does the resettlement plan pay particular attention to vulnerable groups or people, including women, children, the elderly, people below the poverty line, ethnic minorities, and indigenous peoples?	X	X	X	X	X	X	X	X
	g) Are agreements with the affected people obtained prior to resettlement?	X	X	X	X	X	X	X	X
	h) Is the organizational framework established to properly implement resettlement? Are the capacity and budget secured to implement the plan?	X	X	X	X	X	X	X	X
	i) Are any plans developed to monitor the impacts of resettlement?	X	X	X	X	X	X	X	X
	j) Is the grievance redress mechanism established?	X	X	X	X	X	X	X	X
(2) Living and Livelihood condition	a) Is there a possibility that the project will adversely affect the living conditions of inhabitants? Are adequate measures considered to reduce the impacts, if necessary?	X	X	X	X	X	X	X	X
	b) Is sufficient infrastructure (e.g., hospitals, schools, and roads) available for the project implementation? If the existing infrastructure is insufficient, are any plans developed to construct new infrastructure or improve the existing infrastructure?	X	X	X	X	X	X	X	X
	c) Is there a possibility that large vehicles traffic for transportation of materials, such as raw materials and products will have impacts on traffic in the surrounding areas, impede the movement of inhabitants, and any cause risks to pedestrians?	X	X	X	X	X	X	X	X
	d) Is there a possibility that diseases, including infectious diseases, such as HIV, will be brought due to the immigration of workers associated with the project? Are adequate considerations given to public health, if necessary?	X	X	X	X	X	X	X	X

	e) Is there a possibility that the amount of water used (e.g., surface water, groundwater) and discharge of thermal effluents by the project will adversely affect existing water uses and uses of water areas (especially fishery)?	X	X	X	X	X	X	X	X
	f) Is there any possibility that the project will adversely affect the living conditions of inhabitants? Are adequate measures considered to reduce the impacts, if necessary?	X	X	X	X	X	X	X	X
	g) Is there any possibility that the project causes the change of land uses in the neighboring areas to affect adversely livelihood of local people?	X	X	X	X	X	X	X	X
	h) Is there any possibility that the project facilities adversely affect the traffic systems?	X	X	X	X	X	X	X	X
	i) Is there any possibility that diseases, including infectious diseases, such as HIV, will be brought due to the immigration of workers associated with the project? Are adequate considerations given to public health, if necessary?	-	-	-	-	X	-	-	-
	j) Is the minimum flow required for maintaining downstream water uses secured?	-	-	-	-	X	-	-	-
	k) Is there any possibility that reductions in water flow downstream or seawater intrusion will have impacts on downstream water and land uses?	-	-	-	-	X	-	-	-
	l) Is there any possibility that water-borne or water-related diseases (e.g., schistosomiasis, malaria, and filariasis) will be introduced?	-	-	-	-	X	-	-	-
	m) Is there any possibility that fishery rights, water usage rights, and common usage rights, etc. would be restricted?	-	-	-	-	X	-	-	-
(3) Heritage	a) Is there a possibility that the project will damage the local archeological, historical, cultural, and religious heritage? Are adequate measures considered to protect these sites in accordance with the country's laws?	X	X	X	X	X	X	X	X
(4) Landscape	a) Is there a possibility that the project will adversely affect the local landscape? Are necessary measures taken?	X	X	X	X	X	X	X	X

	(5) Ethnic Minorities and Indigenous Peoples	a) Are considerations given to reduce impacts on the culture and lifestyle of ethnic minorities and indigenous peoples?	X	X	X	X	X	X	X	X
		b) Are all of the rights of ethnic minorities and indigenous peoples in relation to land and resources respected?	X	X	X	X	X	X	X	X
	(6) Working Conditions	a) Is the project proponent not violating any laws and ordinances associated with the working conditions of the country which the project proponent should observe in the project?	X	X	X	X	X	X	X	X
		b) Are tangible safety considerations in place for individuals involved in the project, such as the installation of safety equipment which prevents industrial accidents, and management of hazardous materials?	X	X	X	X	X	X	X	X
		c) Are intangible measures being planned and implemented for individuals involved in the project, such as the establishment of a safety and health program, and safety training (including traffic safety and public health) for workers etc.?	X	X	X	X	X	X	X	X
		d) Are appropriate measures taken to ensure that security guards involved in the project not to violate safety of other individuals involved, or local residents?	X	X	X	X	X	X	X	X
5) Others	(1) Impacts during Construction	a) Are adequate measures considered to reduce impacts during construction (e.g., noise, vibrations, turbid water, dust, exhaust gases, and wastes)?	X	X	X	X	X	X	X	X
		b) If construction activities adversely affect the natural environment (ecosystem), are adequate measures considered to reduce the impacts?	X	X	X	X	X	X	X	X
		c) If construction activities adversely affect the social environment, are adequate measures considered to reduce the impacts?	X	X	X	X	X	X	X	X
	(2) Accident Prevention Measures	a) In the case of coal-fired power plants, are adequate measures planned to prevent spontaneous combustion at the coal piles (e.g., sprinkler systems)?	X	X	X	X	X	X	X	X
		b) In the case of oil shale power plants, are adequate measures planned to prevent spontaneous combustion at the coal piles (e.g., sprinkler systems)?	X	X	X	X	X	X	X	X

		c) Does the project have any accident prevention equipments and scheme to store, emit and transport toxic and hazardous materials?	X	X	X	X	X	X	X	X
	(3) Monitoring	a) Does the proponent develop and implement monitoring program for the environmental items that are considered to have potential impacts?	X	X	X	X	X	X	X	X
		b) What are the items, methods and frequencies of the monitoring program?	X	X	X	X	X	X	X	X
		c) Does the proponent establish an adequate monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework)?	X	X	X	X	X	X	X	X
		d) Are any regulatory requirements pertaining to the monitoring report system identified, such as the format and frequency of reports from the proponent to the regulatory authorities?	X	X	X	X	X	X	X	X
	(4) Reference to Checklist of Other Sectors	a) Where necessary, pertinent items described in the Power Transmission and Distribution Lines, Road checklist should also be checked (e.g., projects including installation of electric transmission lines and/or electric distribution facilities).	X	X	X	X	X	X	X	X
		b) Where necessary, pertinent items described in the associated infrastructures such as ports/harbors, roads, railways checklist should also be checked (e.g., projects including construction of port and harbor facilities).	X	X	X	X	X	X	X	X
	(5) Note on Using Environmental Checklist	a) If necessary, the impacts to transboundary or global issues should be confirmed (e.g., the project includes factors that may cause problems, such as transboundary waste treatment, acid rain, destruction of the ozone layer, and global warming).	X	X	X	X	X	X	X	X

Note: Items with {x} mark should be checked whether some relation and/or a possibility of causing adverse impacts in terms of environmental and social considerations.

Source: JICA Study Team

9.3 Appendix 9.4.2 Results of SEA Level Check for Each Generation Development Plan

Table 1 Environmental Check Items for IEE in PPP level SEA

Check Items relevant to Generation Development Plan		Check Items of Environmental Impacts	Rating*	Reasons
(1) Planning Process				
1	Contents of PPPs (Policy/Plan/Program) including technical, economic and financial aspects, and alternatives		C	Maturity of technology, cost etc.
2	Baseline environmental information		C	Nationwide environmental data (especially land use and water use)
3	Consistency with upper PPPs/other development PPPs		C	Tourism development plan, regional environmental management plan
4	Consultation with relevant stakeholders		C	Stakeholders to be subjected
5	Information disclosure		C	Contents of disclosure and timing
6	Permit/approval		C	Procedures of approval, responsible agencies (NEPCO, MEMR, MoEnv, MoPIC, ASEZA etc.)
(2) Items inherent in the Generation Development Plan (Operation stage, without site location)				
1) Land/resource/related infrastructure				
1	Use of land/space/right-of-way	Land acquisition, resettlement, leasing, easement/ wayleaves, migration of population	A	Land for power plant and related facilities
2	Use of energy resources	Fuel (gas, oil, coal, oil shale etc.)	A	Use of natural gas or LNG
3	Use of water resources (surface and underground water, wastewater)	Surface water, groundwater and wastewater	A	Process, cooling, wastewater treatment, sprinkling for ash, drinking etc.
4	Associated structures/facilities relating to storage,	Hazardous waste storage/disposal sites, gas pipeline etc.	B	Storage of ash, reservoir, power plant and related facilities

	transport etc.			
2) Generation of Pollutants, Risk, Disturbance etc.				
1	Emission of air pollutants	Air quality	A	Air pollutants including toxic /hazardous components
2	Discharge of wastewater including thermal effluents	Water quality	B	Water pollutants including toxic /hazardous components
3	Generation of solid waste	Storage and disposal of industrial solid waste, hazardous waste etc.	A	Solid wastes including toxic /hazardous components
4	Generation of noise and vibrations	Ambient noise, low frequency vibration	B	Noise and vibration by extraction and burning
5	Emission of greenhouse gases (CO_2, CH_4 etc.)	Global warming, climate change	A	Emission of CO_2, CH_4 etc.
6	Movement of pollutants/waste, cross-border resource and migration	Transboundary pollution	B	Transboundary pollution by air pollutants
7	Disturbance/nuisance	Accidents etc.	A	Safety and security management extraction and power generation
(3) Impacts due to Electric Generation Development Plan as a whole (Site specific, based on detailed plan)				
1) Natural Environment		Protected areas, Important Bird and Biodiversity Area (IBA), special conservation area etc.	C	In general site specific
2) Social Environment		Living and health conditions of local communities and Jordan people	C	In general site specific
3) Construction Work		Pollution (air, water, noise and vibration,	C	Based on detailed plan

	solid waste etc.)		
4) Decommissioning	Pollution (air, water, noise and vibration, solid waste etc.)	C	Based on detailed plan

Note: * {A} - Item with Significant adverse impact is anticipated. {B} - Item with not significant but considerable adverse impact is anticipated. {C} - (i) Item that adverse impact is unknown at present. However, it needs to re-examine extent of impact later. (ii) Item that little impact is anticipated at present. However, there is a possibility to increase in extent of impact later. {D} - No or negligible impact is expected.

Source: JICA Study Team

(2) Thermal Power Generation - Oil

Check Items relevant to Generation Development Plan		**Check Items of Environmental Impacts**	**Rating***	**Reasons**
(1) Planning Process				
1	Contents of PPPs (Policy/Plan/Program) including technical, economic and financial aspects, and alternatives		C	Maturity of technology, cost etc.
2	Baseline environmental information		C	Nationwide environmental data (especially land use and water use)
3	Consistency with upper PPPs/other development PPPs		C	Tourism development plan, regional environmental management plan
4	Consultation with relevant stakeholders		C	Stakeholders to be subjected
5	Information disclosure		C	Contents of disclosure and timing
6	Permit/approval		C	Procedures of approval, responsible agencies (NEPCO, MEMR, MoEnv, MoPIC, ASEZA etc.)
(2) Items inherent in the Generation Development Plan (Operation stage, without site location)				
1) Land/resource/related infrastructure				
1	Use of land/space/right-of-way	Land acquisition, resettlement, leasing, easement/ wayleaves, migration of population	A	Land for power plant and related facilities

2	Use of energy resources	Fuel (gas, oil, coal, oil shale etc.)	A	Use of crude oil or diesel oil
3	Use of water resources (surface and underground water, wastewater)	Surface water, groundwater and wastewater	A	Process, cooling, wastewater treatment, sprinkling for ash, drinking etc.
4	Associated structures/facilities relating to storage, transport etc.	Hazardous waste storage/disposal sites, gas pipeline etc.	B	Storage of ash, reservoir, power plant and related facilities
2) Generation of Pollutants, Risk, Disturbance etc.				
1	Emission of air pollutants	Air quality	A	Air pollutants including toxic /hazardous components
2	Discharge of wastewater including thermal effluents	Water quality	B	Water pollutants including toxic /hazardous components
3	Generation of solid waste	Storage and disposal of industrial solid waste, hazardous waste etc.	A	Solid wastes including toxic /hazardous components
4	Generation of noise and vibrations	Ambient noise, low frequency vibration	B	Noise and vibration by extraction and burning
5	Emission of greenhouse gases (CO_2, CH_4 etc.)	Global warming, climate change	A	Emission of CO_2, CH_4 etc.
6	Movement of pollutants/waste, cross-border resource and migration	Transboundary pollution	B	Transboundary pollution by air pollutants
7	Disturbance/nuisanc e	Accidents etc.	A	Safety and security managmeent extraction and powe r generation
(3) Impacts due to Electric Generation Development Plan as a whole (Site specific, based on detailed plan)				
1) Natural		Protected areas, Important Bird and Biodiversity	C	In general site specific

Environment	Area (IBA), special conservation area etc.		
2) Social Environment	Living and health conditions of local communities and Jordan people	C	In general site specific
3) Construction Work	Pollution (air, water, noise and vibration, solid waste etc.)	C	Based on detailed plan
4) Decommisioning	Pollution (air, water, noise and vibration, solid waste etc.)	C	Based on detailed plan

Source: JICA Study Team

(3) Thermal Power Generation - Coal Fired

Check Items relevant to Generation Development Plan		**Check Items of Environmental Impacts**	**Rating***	**Reasons**
(1) Planning Process				
1	Contents of PPPs (Policy/Plan/Program) including technical, ecomonic and financial aspects, and alternatives		C	Maturity of technology, cost etc.
2	Baseline environmental information		C	Nationwide environmental data (especially land use and water use)
3	Consistency with upper PPPs/other development PPPs		C	Tourism development plan, regional environemental management plan
4	Consultation with relevant stakeholders		C	Stakeholders to be subjected
5	Information disclosure		C	Contents of dsiclosure and timing
6	Permit/approval		C	Procedures of approval, responsible agencies (NEPCO, MEMR, MoEnv, MoPIC, ASEZA etc.)

(2) Items inherent in the Generation Develeopment Plan (Operation stage, without site location)				
1) Land/resource/related infrastructure				
1	Use of land/space/right-of-way	Land acquisition, resettlement, leasing, easement/ wayleaves, migration of population	A	Land for generation plant, coal storage site, coal ash pond,
2	Use of energy resources	Fuel (gas, oil, coal, oil shale etc.)	A	Use of coal
3	Use of water resources (surface and underground water, wastewater)	Surface water, groundwater and wastewater	A	Process, cooling, wastewater treatment, sprinkling for ash,drinking etc.
4	Associated structures/facilities relating to storage, transport etc.	Hazardous waste storage/disposal sites, gas pipeline etc.	B	Storage of ash, reservoir, power plant and related facilities
2) Generation of Pollutants, Risk, Disturbance etc.				
1	Emission of air pollutants	Air quality	A	Air pollutants including toxic /hazardous components
2	Discharge of wastewater including thermal effluents	Water quality	B	Water pollutants including toxic /hazardous components
3	Generation of solid waste	Storage and disposal of industrial solid waste, hazardous waste etc.	A	Solid wastes including toxic /hazardous components
4	Generation of noise and vibrations	Ambient noise, low frequency vibration	B	Noise and vibration by extraction and burning
5	Emission of greenhouse gases (CO_2, CH_4 etc.)	Global warming, climate change	A	Emission of CO_2, CH_4 etc.
6	Movement of pollutants/waste, cross-border resource and	Transboundary pollution	B	Transboundary pollution by air pollutants

	migration			
7	Disturbance/nuisance	Accidents etc.	A	Safety and security managmeent extraction and power generation
(3) Impacts due to Electric Generation Development Plan as a whole (Site specific, based on detailed plan)				
1) Natural Environment		Protected areas, Important Bird and Biodiversity Area (IBA), special conservation area etc.	C	In general site specific
2) Social Environment		Living and health conditions of local communities and Jordan people	C	In general site specific
3) Construction Work		Pollution (air, water, noise and vibration, solid waste etc.)	C	Based on detailed plan
4) Decommisioning		Pollution (air, water, noise and vibration, solid waste etc.)	C	Based on detailed plan

Source: JICA Study Team

(4) Oil Shale Burning Power Generation

Check Items relevant to Generation Development Plan		**Check Items of Environmental Impacts**	**Rating***	**Reasons**
(1) Planning Process				
1	Contents of PPPs (Policy/Plan/Program) including technical, ecomonic and financial aspects, and alternatives		C	Maturity of technology, cost etc.
2	Baseline environmental information		C	Nationwide environmental data (especially land use and water resourecs), distribution data of oil shale mining in Jordan
3	Consistency with upper PPPs/other development PPPs		C	Tourism development plan, regional environemental management plan

4	Consultation with relevant stakeholders		C	Stakeholders to be subjected
5	Information disclosure		C	Contents of dsiclosure and timing
6	Permit/approval		C	Procedures of approval, responsible agencies (NEPCO, MEMR, MoEnv, MoPIC, ASEZA etc.)
(2) Items inherent in the Generation Develeopment Plan (Operation stage, without site location)				
1) Land/resource/related infrastructure				
1	Use of land/space/right-of-way	Land acquisition, resettlement, leasing, easement/ wayleaves, migration of population	A	Use of oil shale mining in Jordan
2	Use of energy resources	Fuel (gas, oil, coal, oil shale etc.)	A	Extraction of shale oil and power generation by burning
3	Use of water resources (surface and underground water, wastewater)	Surface water, groundwater and wastewater	A	Process, cooling, wastewater treatment, sprinkling for ash,drinking etc.
4	Associated structures/facilities relating to storage, transport etc.	Hazardous waste storage/disposal sites, gas pipeline etc.	B	Storage of ash, reservoir, power plant and related facilities
2) Generation of Pollutants, Risk, Disturbance etc.				
1	Emission of air pollutants	Air quality	A	Air pollutants including toxic /hazardous components
2	Discharge of wastewater including thermal effluents	Water quality	B	Water pollutants including toxic /hazardous components
3	Generation of solid waste	Storage and disposal of industrial solid waste, hazardous waste etc.	A	Solid wastes including toxic /hazardous components
4	Generation of noise and vibrations	Ambient noise, low frequency vibration	B	Noise and vibration by extraction and burning

5	Emission of greenhouse gases (CO_2, CH_4 etc.)	Global warming, climate change	A	Emission of CO_2, CH_4 etc.
6	Movement of pollutants/waste, cross-border resource and migration	Transboundary pollution	B	Transboundary pollution by air pollutants
7	Disturbance/nuisance	Accidents etc.	A	Safety and security managmeent extraction and power generation
(3) Impacts due to Electric Generation Development Plan as a whole (Site specific, based on detailed plan)				
1) Natural Environment		Protected areas, Important Bird and Biodiversity Area (IBA), special conservation area etc.	C	In general site specific
2) Social Environment		Living and health conditions of local communities and Jordan people	C	In general site specific
3) Construction Work		Pollution (air, water, noise and vibration, solid waste etc.)	C	Based on detailed plan
4) Decommisioning		Pollution (air, water, noise and vibration, solid waste etc.)	C	Based on detailed plan

Source: JICA Study Team

(5) Pumping Storage Hydropower Generation

Check Items relevant to Generation Development Plan		Check Items of Environmental Impacts	Rating*	Reasons
(1) Planning Process				
1	Contents of PPPs (Policy/Plan/Program) including technical, ecomonic and financial aspects, and alternatives		C	Maturity of technology, cost etc.
2	Baseline environmental information		C	Environmental baseline data of Aqaba bay area
3	Consistency with upper PPPs/other development PPPs		C	Tourism development plan, regional environemental management plan
4	Consultation with relevant stakeholders		C	Stakeholders to be subjected
5	Information disclosure		C	Contents of dsiclosure and timing
6	Permit/approval		C	Procedures of approval, responsible agencies (NEPCO, MEMR, MoEnv, MoPIC, ASEZA etc.)
(2) Items inherent in the Generation Develeopment Plan (Operation stage, without site location)				
1) Land/resource/related infrastructure				
1	Use of land/space/right-of-way	Land acquisition, resettlement, leasing, easement/ wayleaves, migration of population	A	Land for sea water reservoir in inland area
2	Use of energy resources	Fuel (gas, oil, coal, oil shale etc.)	D	No use
3	Use of water resources (surface and underground water, wastewater)	Surface water, groundwater and wastewater	B	Use of sea water
4	Associated structures/facilities relating to storage, transport etc.	Hazardous waste storage/disposal sites, gas pipeline etc.	C	Storage of ash, reservoir, power plant and related facilities

2) Generation of Pollutants, Risk, Disturbance etc.				
1	Emission of air pollutants	Air quality	D	Not expectd
2	Discharge of wastewater including thermal effluents	Water quality	B	Marine water pollution by intake and circulating sea water
3	Generation of solid waste	Storage and disposal of industrial solid waste, hazardous waste etc.	D	Not expectd
4	Generation of noise and vibrations	Ambient noise, low frequency vibration	C	Generation of noise and vibration
5	Emission of greenhouse gases (CO_2, CH_4 etc.)	Global warming, climate change	D	Not expectd
6	Movement of pollutants/waste, cross-border resource and migration	Transboundary pollution	D	Not expectd
7	Disturbance/nuisance	Accidents etc.	C	Little expected
(3) Impacts due to Electric Generation Development Plan as a whole (Site specific, based on detailed plan)				
1) Natural Environment		Protected areas, Important Bird and Biodiversity Area (IBA), special conservation area etc.	C	In general site specific
2) Social Environment		Living and health conditions of local communities and Jordan people	C	In general site specific
3) Construction Work		Pollution (air, water, noise and vibration, solid waste etc.)	C	Based on detailed plan
4) Decommisioning		Pollution (air, water, noise and vibration, solid waste etc.)	C	Based on detailed plan

Source: JICA Study Team

(6) Wind Power Generation

Check Items relevant to Generation Development Plan		Check Items of Environmental Impacts	Rating*	Reasons
(1) Planning Process				
1	Contents of PPPs (Policy/Plan/Program) including technical, ecomonic and financial aspects, and alternatives		C	Maturity of technology, cost etc.
2	Baseline environmental information		C	Nationwide environmental data (especially land use, topographic, meteorological data)
3	Consistency with upper PPPs/other development PPPs		C	Tourism development plan, regional environemental management plan
4	Consultation with relevant stakeholders		C	Stakeholders to be subjected
5	Information disclosure		C	Contents of dsiclosure and timing
6	Permit/approval		C	Procedures of approval, responsible agencies (NEPCO, MEMR, MoEnv, MoPIC, ASEZA etc.)
(2) Items inherent in the Generation Develeopment Plan (Operation stage, without site location)				
1) Land/resource/related infrastructure				
1	Use of land/space/right-of-way	Land acquisition, resettlement, leasing, easement/ wayleaves, migration of population	A	Land/space for installation of wind generators
2	Use of energy resources	Fuel (gas, oil, coal, oil shale etc.)	D	No use
3	Use of water resources (surface and underground water, wastewater)	Surface water, groundwater and wastewater	D	Not expected
4	Associated structures/facilities relating to storage, transport etc.	Hazardous waste storage/disposal sites, gas pipeline etc.	D	Not expected

2) Generation of Pollutants, Risk, Disturbance etc.				
1	Emission of air pollutants	Air quality	D	No emission of air pollutans
2	Discharge of wastewater including thermal effluents	Water quality	D	No discharge of water pollutans
3	Generation of solid waste	Storage and disposal of industrial solid waste, hazardous waste etc.	D	No generation of soild waste
4	Generation of noise and vibrations	Ambient noise, low frequency vibration	B	Some possibility of noise and low frequency sound
5	Emission of greenhouse gases (CO_2, CH_4 etc.)	Global warming, climate change	D	No emission of greenhouse gases
6	Movement of pollutants/waste, cross-border resource and migration	Transboundary pollution	D	Not expected
7	Disturbance/nuisance	Accidents etc.	D	Not expected
(3) Impacts due to Electric Generation Development Plan as a whole (Site specific, based on detailed plan)				
1) Natural Environment		Protected areas, Important Bird and Biodiversity Area (IBA), special conservation area etc.	C	In general site specific
2) Social Environment		Living and health conditions of local communities and Jordan people	C	In general site specific
3) Construction Work		Pollution (air, water, noise and vibration, solid waste etc.)	C	Based on detailed plan
4) Decommisioning		Pollution (air, water, noise and vibration, solid waste etc.)	C	Based on detailed plan

Source: JICA Study Team

(7) Solar Power Generation

Check Items relevant to Generation Development Plan		Check Items of Environmental Impacts	Rating*	Reasons
(1) Planning Process				
1	Contents of PPPs (Policy/Plan/Program) including technical, ecomonic and financial aspects, and alternatives		C	Maturity of technology, cost etc.
2	Baseline environmental information		C	Nationwide environmental data (especially land use, topographic, meteorological data)
3	Consistency with upper PPPs/other development PPPs		C	Tourism development plan, regional environemental management plan
4	Consultation with relevant stakeholders		C	Stakeholders to be subjected
5	Information disclosure		C	Contents of dsiclosure and timing
6	Permit/approval		C	Procedures of approval, responsible agencies (NEPCO, MEMR, MoEnv, MoPIC, ASEZA etc.)
(2) Items inherent in the Generation Develeopment Plan (Operation stage, without site location)				
1) Land/resource/related infrastructure				
1	Use of land/space/right-of-way	Land acquisition, resettlement, leasing, easement/ wayleaves, migration of population	A	Land/space for installation of solar panels
2	Use of energy resources	Fuel (gas, oil, coal, oil shale etc.)	D	No use
3	Use of water resources (surface and underground water, wastewater)	Surface water, groundwater and wastewater	D	Not expected
4	Associated structures/facilities relating to storage, transport etc.	Hazardous waste storage/disposal sites, gas pipeline etc.	B	Storage of disposed solar panel

2) Generation of Pollutants, Risk, Disturbance etc.				
1	Emission of air pollutants	Air quality	D	No emission of air pollutans
2	Discharge of wastewater including thermal effluents	Water quality	D	No discharge of water pollutans
3	Generation of solid waste	Storage and disposal of industrial solid waste, hazardous waste etc.	B	Generation of hazardous waste by disposal of dilapidated solar panel
4	Generation of noise and vibrations	Ambient noise, low frequency vibration	D	Some possibility of low frequency vibration
5	Emission of greenhouse gases (CO_2, CH_4 etc.)	Global warming, climate change	D	No emission of greenhouse gases
6	Movement of pollutants/waste, cross-border resource and migration	Transboundary pollution	D	Not expected
7	Disturbance/nuisance	Accidents etc.	D	Not expected
(3) Impacts due to Electric Generation Development Plan as a whole (Site specific, based on detailed plan)				
1) Natural Environment		Protected areas, Important Bird and Biodiversity Area (IBA), special conservation area etc.	C	In general site specific
2) Social Environment		Living and health conditions of local communities and Jordan people	C	In general site specific
3) Construction Work		Pollution (air, water, noise and vibration, solid waste etc.)	C	Based on detailed plan
4) Decommisioning		Pollution (air, water, noise and vibration, solid waste etc.)	C	Based on detailed plan

Source: JICA Study Team

(8) Transmission and Distributon Line

Check Items relevant to Generation Development Plan		Check Items of Environmental Impacts	Rating*	Reasons
(1) Planning Process				
1	Contents of PPPs (Policy/Plan/Program) including technical, ecomonic and financial aspects, and alternatives		C	Maturity of technology, cost etc.
2	Baseline environmental information		C	Baseline data, especially for land use, natural conservation
3	Consistency with upper PPPs/other development PPPs		C	Tourism development plan, regional environemental management plan
4	Consultation with relevant stakeholders		C	Stakeholders to be subjected
5	Information disclosure		C	Contents of dsiclosure and timing
6	Permit/approval		C	Procedures of approval, responsible agencies (NEPCO, MEMR, MoEnv, MoPIC, ASEZA etc.)
(2) Items inherent in the Generation Develeopment Plan (Operation stage, without site location)				
1) Land/resource/related infrastructure				
1	Use of land/space/right-of-way	Land acquisition, resettlement, leasing, easement/ wayleaves, migration of population	B	Land/space for transmission line, substation
2	Use of energy resources	Fuel (gas, oil, coal, oil shale etc.)	D	No use
3	Use of water resources (surface and underground water, wastewater)	Surface water, groundwater and wastewater	D	Not expected
4	Associated structures/facilities relating to storage, transport etc.	Hazardous waste storage/disposal sites, gas pipeline etc.	D	Not expected
2) Generation of Pollutants, Risk, Disturbance etc.				

1	Emission of air pollutants	Air quality	D	No emission of air pollutans
2	Discharge of wastewater including thermal effluents	Water quality	D	No discharge of water pollutans
3	Generation of solid waste	Storage and disposal of industrial solid waste, hazardous waste etc.	D	No generation of soild waste
4	Generation of noise and vibrations	Ambient noise, low frequency vibration	C	Some possibility of low frequency vibration
5	Emission of greenhouse gases (CO_2, CH_4 etc.)	Global warming, climate change	D	No emission of greenhouse gases
6	Movement of pollutants/waste, cross-border resource and migration	Transboundary pollution	D	Not expected
7	Disturbance/nuisance	Accidents etc.	C	Effect of electro-magnetic field
(3) Impacts due to Electric Generation Development Plan as a whole (Site specific, based on detailed plan)				
1) Natural Environment		Protected areas, Important Bird and Biodiversity Area (IBA), special conservation area etc.	C	In general site specific
2) Social Environment		Living and health conditions of local communities and Jordan people	C	In general site specific
3) Construction Work		Pollution (air, water, noise and vibration, solid waste etc.)	C	Based on detailed plan
4) Decommisioning		Pollution (air, water, noise and vibration, solid waste etc.)	C	Based on detailed plan

Source: JICA Study Team

9.4 Appendix 9.4.3 Preliminary Environmental Scoping for Generation Development Plans

Table 9.4-3 (1) Assumed Activities due to Generation Development Plans

Stage of Implementation	Activities	Thermal Power				Hydropower*	Renewable Energy		Transmission Line
		Gas	Oil	Coal	Oil Shale		Wind	Solar	
I Pre-Construction Stage	Securing land/space for power plants and related facilities	x	x	x	x	x	x	x	x
	Change of land/resource use	x	x	x	x	x	x	x	x
	Securing energy resources	x	x	x	x	x	-	-	-
	Securing water resources	x	x	x	x	x			
	Securing associated facilities/structures	x	x	x	x	x	-	-	-
II Construction Stage	Procurement of construction materials and securing water supply	x	x	x	x	x	x	x	x
	Earth moving work such as excavation, cutting and mounting	x	x	x	x	x	x	x	x
	Construction work for power plant and related facilities	x	x	x	x	x	x	x	x
	Operation of construction machines, vehicles and plants etc.	x	x	x	x	x	x	x	x
	Residence of construction workers and their working activities	x	x	x	x	x	x	x	x
III Operation Stage	Operation of power plants and related facilities	x	x	x	x	x	x	x	x
	Spatial occupancy of power plants and related facilities	x	x	x	x	x	x	x	x
	Operation of associated facilities/structures	x	x	x	x	x	-	-	-
	Spatial occupancy of power plants and related facilities	x	x	x	x	x	-	-	-
IV Decom	Procurement of construction materials and securing water supply	x	x	x	x	x	x	x	x

missioning Stage	Earth moving work such as excavation, cutting and mounting	x	x	x	x	x	x	x	x
	Construction work for power plant and related facilities	x	x	x	x	x	x	x	x
	Operation of construction machines, vehicles and plants etc.	x	x	x	x	x	x	x	x

Note 1 : * Hydropower – Pumped Storage Hydropower (Sea water)
Note 2: {x} indicates some relation.
Source: JICA Study Team

(1) Thermal Power (Natural gas/LNG)

Table 9.4.3 (2) Matrix Expression of Negative Impacts

Environmental item *, **	Rating ***, ****				
	T	I	II	III	IV
(1) Social Environment					
1) Land acquisition and resettlement (Involuntary resettlement)	A/B	A/B	B	B	B
2) Local economy such as employment and livelihood etc.	C	C	C	C	C
3) Energy use	B	B	B	B	C
4) Water use	A/B	A/B	A/B	A/B	C
5) Land use and utilization of local resources	A/B	A/B	A/B	A/B	C
6) Social institutions such as social infrastructure and local decision-making institutions, a split of communities	C	C	C	C	C
7) Existing social infrastructures and services	C	C	C	C	C
8) The poor, indigenous of ethnic people	C	C	C	C	C
9) Misdistribution of benefit and damage (Equality of benefits and losses and equality involved in development process)	C	C	C	C	C
10) Local conflict of interests	C	C	C	C	C
11) Cultural property and heritage	B	D	B	C	C
12) Fishing rights, water rights and rights of common	C	C	C	C	C
13) Public health and Sanitation	B/C	D	B	B	C
14) Infectious diseases such as HIV/AIDS	C	D	C	C	C
15) Working condition including occupational safety	C	D	C	C	C
16) Hazard/risk (disaster, security)	B	B	B	B	B

17) Accidents	A/B	D	B	A/B	B
(2) Natural Environment					
18) Topography and Geology	C	D	C	C	C
19) Soil erosion/sand movement	C	D	C	C	C
20) Movement of water/Hydrological situation	C	D	C	C	C
21) Coastal zone	B	D	B	B	C
22) Environmentally sensitive areas (Protected Areas, IBAs etc.)	B	D	B	B	C
23) Flora, Fauna, Ecosystem and Biodiversity	B	D	B	B	C
24) Landscape	B	D	B	B	C
25) Micro-climate	C	D	C	C	C
26) Global Warming	A/B	D	B	A/B	B
(3) Environmental Pollution					
27) Air pollution	A/B	D	B	A/B	B
28) Water pollution	A/B	D	B	A/B	B
29) Soil contamination	B	D	B	B	B
30) Bottom sediment	B	D	B	B	C
31) Soild waste	B	D	B	B	B
32) Noise and Vibration	B	D	B	B	C
33) Ground Subsidence	C	D	C	C	C
34) Offensive odor	C	D	C	C	C
35) Sunshine inhibition/Reflection of sunlight	C	D	C	C	C
36) Electromagnetic interference	C	D	C	C	C
37) Safety from Electromagnetic Field	C	D	C	C	C
(4) Permit, Explanation and Others					
Subject	C				

Source: JICA Study Team

Table 9.4.3 (3) AnticipatedNegative Impacts and Necessary Information/Date and Possible Mitigation Measures

Environmental item *, **	**Rating ***, ********	**Reasons**	**Further Necessary Information/Data**	**Possible Mitigation Measures**
(1) Social Environment				
1) Land acquisition and resettlement (Involuntary resettlement)	A/B	(T) To secure the lands/spaces for planned thermal power plants and related facilities, there is a possibility of involuntary resettlement including land acquisition and resettlement as well as wayleaves, generation of Project Affected Persons (PAPs), although it depends on the details of the plan (site location/route, scale, components etc.).	(T) 1) Laws and regulations for involuntary resettlement (land acquisition and resettlement) and easement/wayleaves . 2) Land use regulation and existing land use in Jordan and planned area. 3) Cases and causes of involuntary resettlement in Jordan and planned area. 4) Anticipated land area and location for the site to be secured by the plan.	(T) 1) Consider alternative plans to avoid and/or minimize the occurrence of involuntary resettlement. 2) Detailed inventory survey on plots, facilities, structures and peoples living along the planned railway routes. 3) Survey on encroachment on ROW (Right Of Way) of the planned site/alignment. 4) Examine procedure and condition of involuntary resettlement and compensation to PAPs taking relevant laws in Jordan and the JICA Guidelines into considerations. 5) From early stage of the project, pay attention to information disclosure and consultation with stakeholders including PAPs for thorough understanding of the issues or to make agreement as much as possible. 6) Elaborate Resettlement Action Plan (RAP), if involuntary resettlement is unavoidable.
3) Energy use	B	(I, III) To procure natural gas/LNG for fuel by uploading and transportation, there is a possibility to generate	(I, III) Procurement plan of natural gas/LNG as fuel source.	(I, III) 1) Consider preventive measures for leakage of natural gas/LNG during uploading/transportation. 2) Consider preventive

		negative impact on environment. However, extent of impact depends on the plan of power plants and related facilities.		measuresfor exhaust emission from trucks.
4) Water use	A/B	(T) Jordan has very limited water resources and available water resources continue to fall with population growth everywhere in the country. Thus, to secure water supply for use such as processing, cooling, sprinkling etc. of power plants and related facilities, it is expected to face severe competence with other water supply.	(T) 1) Laws and regulations for water use and water extraction form water resources. 2) Water demand and supply in Jordan and planned area. 3) Anticipated water use in construction and decommissioning work and in operation of power plants and related facilities.	(T) 1) Consider minimize water use in construction and decommissioning work and in operation of power plants and related facilities in the plan. 2) Monitor water consumption in the plan.
5) Land use and utilization of local resources	A/B	(V) Some alteration of existing land use and utilization of local resources is expected. However, extent of impact depends on the plan of power plants and related facilities.	(T) 1) Laws and regulation for use of land and resources. 2) Existing and future land and resources use in Jordan and planned area.	(T) Consider appropriate and effective utilization of land and resources in the plan.
6) Social institutions such as social infrastructure and local decision-making institutions, a split of communities	C	(T) Beneficial impacts such as contribute to creation of employment opportunity for construction and decommissioning work and improvement living condition by supply of electricity through power	(T) Information of administrative and social structures and decision-making process and institutions in Jordan and planned area.	(T) Information disclosure and public participation should be fully considered for stakeholders including decision-makers of the communities from early stage of planning for obtaining thorough understanding and consensus of the people and

		plants and related facilities. However, there is a possibility of missing acceptance by the communities, if the plan is not properly informed to relevant stakeholders including community based organizations for participating.		communities by promoting that the plan may contribute to improvement of local economy and upgrading living conditions.
11) Cultural property and heritage	B	(II, III,) In Jordan sites of cultural properties and heritages are distributed in the whole country. Thus, adverse impact on them is expected, if the site of power plants and related facilities is located within or close to the site.	(II, III) 1) Laws and regulations of cultural property and heritage site. 2) Distribution of cultural property and heritage site in Jordan and the planned area.	(T) 1) Avoid the site and route penetrating or close to the sites of cultural properties, heritages and archaeological importance in the plan. 2) If any buried cultural properties are found at construction work, report and consult with concerned organizations such as Ministry of Tourism and Antiquities without delay.
13) Public health and Sanitation	B/C	(II, III, IV) There is a possibility of deterioration respiratory functions due to inhalation of air pollutants such as NOx and PM2.5, if control of pollutants emission in construction and decommissioning work and operation of power plants and related facilities is not conducted appropriately.	(II, III, IV) 1) Laws and regulations of public health and sanitation. 2) Public health condition including respiratory disease and distribution of medical facilities in Jordan and planned area.	(T) 1) Preventive measures to control air pollutants emission in construction and decommissioning work and in operation of power plants and related facilities. 2) Monitor public health condition by medical examination.
16) Hazard/risk (disaster, security)	B	(T) No additional risk of disaster and public security are expected due to installation of power	(T) 1) Cases and causes of hazard risks due to disaster in Jordan and the	(T) 1) Monitor uncertain condition of neighboring countries. 2) Prepare emergency action plan for

		plant and related facilities. However, there is a possibility of increase in disaster and security risk, if the site is located to close to neighboring countries in conflict.	planned area. 2) Existing condition of public security due to uncertain political situation and conflict of neighboring countries.	hazard and public security risks.
17) Accidents	A/B	(II, III, IV) Occurrence of accidents is expected somewhat, if inappropriate handling and management of construction and decommissioning work, and insufficient operation of installed power plants and related facilities are carried out.	(II, III, IV) 1) Cases and causes of accidents in Jordan and planned area in construction and decommissioning work and in operation of power plants and related facilities.	(II, III, IV) 1) Preventive measures to accidents in construction and decommissioning work and in operation of power plants and related facilities. 2) Prepare emergency action plan for accidents.
(2) Natural Environment				
21) Coastal zone	B	(II, III, IV) There is a possibility that change in oceanographic conditions and coastal erosion/sedimentation due to development of coastal area for landing work of fuels and other materials at port and/or water storage by pumping up at hydropower plant. However, extent of impact is unknown at present.	(II, III, IV) 1) Regulation of development and environmental conservation in coastal area. 2) Existing environmental condition of coastal area.	(II, III, IV) 1) Appropriate preventive measures against coastal erosion, and sedimentation of sand and soil in the plan. 2) Monitor oceanographic conditions, and coastal erosion and sedimentation of sand by physical observation and utilizing satellite image map.
22) Environmentally sensitive areas (Protected	B	(II, III, IV) In Jordan designated Protected Areas and Important Bird and Biodiversity	(II, III, IV) 1) Distribution of designated Protected Areas,	(II, III, IV) To avoid site location within or close to the designated Protected Areas and

Areas, IBAs etc.)		Conservation Areas (IBAs) are distributed in the whole country. Thus, adverse impact on them is expected, if the site of power plants and related facilities is located within or close to the area.	natural reserves and IBAs as well as parks in Jordan and the planned area. 2) Regulations for conservation of natural environment.	parks.
23) Flora, Fauna, Ecosystem and Biodiversity	B	(II, III, IV) In Jordan there are found many precious plant and animal species as well as important areas of valuable ecosystem and biodiversity. Thus, adverse impact on them is expected, if the site of power plants and related facilities is located within or close to the area.	(II, III, IV) 1) Distribution of site with valuable plant and animal species, ecosystem and biodiversity in Jordan and the planned area. 2) Regulations for conservation of plant, animal species and biodiversity.	(II, III, IV) To avoid site location within or close to distribution areas of valuable plant and animal species, and environmentally sensitive areas.
24) Landscape	B	(III) In Jordan cultural and heritage sites are distributed in the whole country and they consist of attractive landscape. Thus, there is a possibility of deterioration aesthetic value of landscape by spatial occupancy of power plants and related facilities.	(III) 1) Distribution of site with valuable landscape in Jordan and the planned area. 2) Regulation for preserving valuable landscape.	(III) 1) To avoid site location close to existing important landscape. 2) Measures to harmonize power plants and related facilities with surrounding landscape by design and tree planting in the plan.
26) Global Warming	A/B	(II, III, IV) Emission of greenhouse gases (GHG) such as CO_2, CH_4, which may affect consequently global warming and climate change is	(II, III, IV) 1) Existing data of greenhouse gases emission in Jordan and planned area. 2) Anticipated	(II, III, IV) Preventive measures to reduce greenhouse gases emission in construction and decommissioning work and in operation of power plants and related facilities.

		expected from construction vehicles and machines during construction and decommissioning stage, and from power plants and related facilities during operation stage. However, extent of emission and kind of greenhouse gases depend on specifications and features of power plants and related facilities.	greenhouse gases emission from power plants and related facilities.	
(3) Environmental Pollution				
27) Air pollution	A/B	(II, III, IV) Generation of air pollutants such as dust, PM10, PM2.5, SOx, NOx are expected due to earth moving and engineering works during construction and decommissioning stage, and from power plant and related facilities during operation stage. However, extent of generation and kind of pollutants depend on specifications and features of power plants and related facilities.	(II, III, IV) 1) Regulation of air pollution including air quality and emission standards. 2) Existing air quality in Jordan and planned area. 3) Anticipated emission of air pollutants from power plants and related facilities.	(II, III, IV) 1) Preventive measures to control air pollutants emission in construction and decommissioning work and in operation of power plants and related facilities. 2) Monitor air pollutants emission and ambient air quality.
28) Water pollution	A/B	(II, III, IV) Generation of water pollutants such as SS, BOD, COD, oil & grease, and other organic and inorganic substances as well as thermal effluent, are expected due	(II, III, IV) 1) Regulation of water pollution including water quality and effluent standards. 2) Existing water quality in Jordan	(II, III, IV) 1) Preventive measures to control water pollutants discharge in construction and decommissioning work and in operation of power plants and related facilities. 2) Monitor

		to earth moving and engineering works during construction and decommissioning stage, and from power plant and related facilities during operation stage. However, extent of generation and kind of pollutants depend on specifications and features of power plants and related facilities.	and planned area. 3) Anticipated discharge of water pollutants from power plants and related facilities.	water pollutants discharge and environmental water quality.
29) Soil contamination	B	(II, III, IV) There is a possibility of soil contamination due to leakage of toxic or hazardous materials from construction and decommissioning work, and from operation of power plant and related facilities. However, features of the contamination is unknown at present.	(II, III, IV) 1) Regulation of soil contamination. 2) Cases and causes of soil contamination in Jordan and planned area.	(II, III, IV) 1) Preventive measures to avoid leakage toxic/hazardous materials in construction and decommissioning work and in operation of power plants and related facilities. 2) Monitor soil contamination.
30) Bottom sediment	B	(II, III, IV) There is a possibility of bottom sediment contamination due to leakage of fuels and other materials during landing work at the port. However, features of the contamination is unknown at present.	(II, III, IV) 1) Regulation of bottom sediment contamination. 2) Cases and causes of bottom sediment contamination.	(II, III, IV) Monitoring bottom sediment contamination.
31) Soild waste	B	(II, III, IV) Generation of solid wastes is expected from are expected due to	(II, III, IV) 1) Regulation for solid waste management.	(II, III, IV) 1) Preventive measures for reduction, proper treatment and disposal of solid

		earth moving and engineering works during construction and decommissioning stage, and from power plant and related facilities such as fly ash during operation stage. However, extent of generation depends on specifications and features of power plants and related facilities.	2) Existing situation of solid waste management in Jordan and planned area. 3) Anticipated generation of sold waste from construction and decommissioning work. 4) Anticipated solid waste generation including fly ash from power plants and related facilities.	waste during construction/decommissioning stage and operation stage in the plan. 2) Reflect concept of 3R (Reduce, reuse and recycle) to the plan. 3) Enlighten awareness of waste management to workers and employees.
32) Noise and Vibration	B	(II, III, IV) Generation of noise and vibration are expected from are expected due to earth moving and engineering works during construction and decommissioning stage, and from power plant and related facilities during operation stage. However, extent of generation depends on specifications and features of power plants and related facilities.	(II, III, IV) 1) Regulation of noise and vibration. 2) Generation and ambient level of noise and vibration in Jordan and planned area. 3) Anticipated generation of noise and vibration from power plants and related facilities.	(II, III, IV) Preventive measures against generation of noise and vibration during operation of power plants and related facilities as well as during construction and decommissioning work.
(4) Permit, Explanation and Others				
Subject	C		(T) 1) Methodology of Environmental Impact Assessment in Jordan. 2) Items and Procedures for Permit/Approval. 3)	(T) Comparison of Alternative Plans. 2) Environmental Management Plan, Environmental Monitoring Plan, Emergency Action Plan etc.

			Information disclosure. 4) Stakeholder participation. 5) International Treaties, Agreements, Convention.	

Source: JICA Study Team

(2) Thermal power plant – Oil fired (Heavy fuel oil/diesel)

Table 9.4.3 (4) Matrix Expression of Negative Impacts

Environmental item *, **	Rating ***, ****				
	T	I	II	III	IV
(1) Social Environment					
1) Land acquisition and resettlement (Involuntary resettlement)	A/B	A/B	B	B	B
2) Local economy such as employment and livelihood etc.	C	C	C	C	C
3) Energy use	B	B	B	B	C
4) Water use	A/B	A/B	A/B	A/B	C
5) Land use and utilization of local resources	A/B	A/B	A/B	A/B	C
6) Social institutions such as social infrastructure and local decision-making institutions, a split of communities	C	C	C	C	C
7) Existing social infrastructures and services	C	C	C	C	C
8) The poor, indigenous of ethnic people	C	C	C	C	C
9) Misdistribution of benefit and damage (Equality of benefits and losses and equality involved in development process)	C	C	C	C	C
10) Local conflict of interests	C	C	C	C	C
11) Cultural property and heritage	B	D	B	C	C
12) Fishing rights, water rights and rights of common	C	C	C	C	C
13) Public health and Sanitation	B/C	D	B	B/C	C

14) Infectious diseases such as HIV/AIDS	C	D	C	C	C
15) Working condition including occupational safety	C	D	C	C	C
16) Hazard/risk (disaster, security)	B	B	B	B	B
17) Accidents	A/B	D	B	A/B	B
(2) Natural Environment					
18) Topography and Geology	C	D	C	C	C
19) Soil erosion/sand movement	C	D	C	C	C
20) Movement of water/Hydrological situation	C	D	C	C	C
21) Coastal zone	B	D	B	B	C
22) Environmentally sensitive areas (Protected Areas, IBAs etc.)	B	D	B	B	C
23) Flora, Fauna, Ecosystem and Biodiversity	B	D	B	B	C
24) Landscape	B	D	B	B	C
25) Micro-climate	C	D	C	C	C
26) Global Warming	A/B	D	B	A/B	B
(3) Environmental Pollution					
27) Air pollution	A/B	D	B	A/B	C
28) Water pollution	A/B	D	B	A/B	C
29) Soil contamination	B	D	B	B	C
30) Bottom sediment	B	D	B	B	C
31) Soild waste	A/B	D	B	A/B	B
32) Noise and Vibration	B	D	B	B	C
33) Ground Subsidence	C	D	C	C	C
34) Offensive odor	C	D	C	C	C
35) Sunshine inhibition/Reflection of sunlight	C	D	C	C	C
36) Electromagnetic interference	C	D	C	C	C
37) Safety from Electromagnetic Field	C	D	C	C	C

(4) Permit, Explanation and Others					
Subject	C				

Source: JICA Study Team

Table 9.4.3 (5) AnticipatedNegative Impacts and Necessary Information/Date and Possible Mitigation Measures

Environmental item *, **	Rating ***, ****	Reasons	Further Necessary Information/Data	Possible Mitigation Measures
(1) Social Environment				
1) Land acquisition and resettlement (Involuntary resettlement)	A/B	(T) To secure the lands/spaces for planned power plants and related facilities, there is a possibility of involuntary resettlement including land acquisition and resettlement as well as wayleaves, generation of Project Affected Persons (PAPs), although it depends on the details of the plan (site location/route, scale, components etc.).	(T) 1) Laws and regulations for involuntary resettlement (land acquisition and resettlement) and easement/wayleaves. 2) Land use regulation and existing land use in Jordan and planned area. 3) Cases and causes of involuntary resettlement in Jordan and planned area. 4) Anticipated land area and location for the site to be secured by the plan.	(T) 1) Consider alternative plans to avoid and/or minimize the occurrence of involuntary resettlement. 2) Detailed inventory survey on plots, facilities, structures and peoples living along the planned railway routes. 3) Survey on encroachment on ROW (Right Of Way) of the planned site/alignment. 4) Examine procedure and condition of involuntary resettlement and compensation to PAPs taking relevant laws in Jordan and the JICA Guidelines into considerations. 5) From early stage of the project, pay attention to information disclosure and consultation with stakeholders including PAPs for thorough understanding of the issues or to make agreement as much as possible. 6) Elaborate Resettlement

				Action Plan (RAP), if involuntary resettlement is unavoidable.
3) Energy use	B	(I, III) To procure heavy oil/diesel oil for fuel by uploading and transportation, there is a possibility to generate negative impact on environment. However, extent of impact depends on the plan of power plants and related facilities.	(I, III) Procurement plan of heavy oil/diesel oil as fuel source.	(I, III) 1) Consider preventive measures for leakage of heavy oil/diesel oil during uploading/transportation. 2) Consider preventive measures for exhaust emission from trucks.
4) Water use	A/B	(T) Jordan has very limited water resources and available water resources continue to fall with population growth everywhere in the country. Thus, to secure water supply for use such as processing, cooling, sprinkling etc. of power plants and related facilities, it is expected to face severe competence with other water supply.	(T) 1) Laws and regulations for water use and water extraction form water resources. 2) Water demand and supply in Jordan and planned area. 3) Anticipated water use in construction and decommissioning work and in operation of power plants and related facilities.	(T) 1) Consider minimize water use in construction and decommissioning work and in operation of power plants and related facilities in the plan. 2) Monitor water consumption in the plan.
5) Land use and utilization of local resources	A/B	(V) Some alteration of existing land use and utilization of local resources is expected. However, extent of impact depends on the plan of power plants and related facilities.	(T) 1) Laws and regulation for use of land and resources. 2) Existing and future land and resources use in Jordan and planned area.	(T) Consider appropriate and effective utilization of land and resources in the plan.

11) Cultural property and heritage	B	(II, III,) In Jordan sites of cultural properties and heritages are distributed in the whole country. Thus, adverse impact on them is expected, if the site of power plants and related facilities is located within or close to the site.	(II, III) 1) Laws and regulations of cultural property and heritage site. 2) Distribution of cultural property and heritage site in Jordan and the planned area.	(T) 1) Avoid the site and route penetrating or close to the sites of cultural properties, heritages and archaeological importance in the plan. 2) If any buried cultural properties are found at construction work, report and consult with concerned organizations such as Ministry of Tourism and Antiquities without delay.
16) Hazard/risk (disaster, security)	B	(T) No additional risk of disaster and public security are expected due to installation of power plant and related facilities. However, there is a possibility of increase in disaster and security risk, if the site is located to close to neighboring countries in conflict.	(T) 1) Cases and causes of hazard risks due to disaster in Jordan and the planned area. 2) Existing condition of public security due to uncertain political situation and conflict of neighboring countries.	(T) 1) Monitor uncertain condition of neighboring countries. 2) Prepare emergency action plan for hazard and public security risks.
17) Accidents	A/B	(II, III, IV) Occurrence of accidents is expected somewhat, if inappropriate handling and management of construction and decommissioning work, and insufficient operation of installed power plants and related facilities are carried out.	(II, III, IV) 1) Cases and causes of accidents in Jordan and planned area in construction and decommissioning work and in operation of power plants and related facilities.	(II, III, IV) 1) Preventive measures to accidents in construction and decommissioning work and in operation of power plants and related facilities. 2) Prepare emergency action plan for accidents.
(2) Natural Environment				
21) Coastal	B	(II, III, IV) There is a possibility that change	(II, III, IV) 1) Regulation of development and	(II, III, IV) 1) Appropriate preventive measures against

zone		in oceanographic conditions and coastal erosion/sedimentation due to development of coastal area for landing work of fuels and other materials at port and/or water storage by pumping up at hydropower plant. However, extent of impact is unknown at present.	environmental conservation in coastal area. 2) Existing environmental condition of coastal area.	coastal erosion, and sedimentation of sand and soil in the plan. 2) Monitor oceanographic conditions, and coastal erosion and sedimentation of sand by physical observation and utilizing satellite image map.
22) Environmentally sensitive areas (Protected Areas, IBAs etc.)	B	(II, III, IV) In Jordan designated Protected Areas and Important Bird and Biodiversity Conservation Areas (IBAs) are distributed in the whole country. Thus, adverse impact on them is expected, if the site of power plants and related facilities is located within or close to the area.	(II, III, IV) 1) Distribution of designated Protected Areas, natural reserves and IBAs as well as parks in Jordan and the planned area. 2) Regulations for conservation of natural environment.	(II, III, IV) To avoid site location within or close to the designated Protected Areas and parks.
23) Flora, Fauna, Ecosystem and Biodiversity	B	(II, III, IV) In Jordan there are found many precious plant and animal species as well as important areas of valuable ecosystem and biodiversity. Thus, adverse impact on them is expected, if the site of power plants and related facilities is located within or close to the area.	(II, III, IV) 1) Distribution of site with valuable plant and animal species, ecosystem and biodiversity in Jordan and the planned area. 2) Regulations for conservation of plant, animal species and biodiversity.	(II, III, IV) To avoid site location within or close to distribution areas of valuable plant and animal species, and environmentally sensitive areas.

24) Landscape	B	(III) In Jordan cultural and heritage sites are distributed in the whole country and they consist of attractive landscape. Thus, there is a possibility of deterioration aesthetic value of landscape by spatial occupancy of power plants and related facilities.	(III) 1) Distribution of site with valuable landscape in Jordan and the planned area. 2) Regulation for preserving valuable landscape.	(III) 1) To avoid site location close to existing important landscape. 2) Measures to harmonize power plants and related facilities with surrounding landscape by design and tree planting in the plan.
26) Global Warming	A/B	(II, III, IV) Emission of greenhouse gases (GHG) such as CO_2, CH_4, which may affect consequently global warming and climate change is expected from construction vehicles and machines during construction and decommissioning stage, and from power plants and related facilities during operation stage. However, extent of emission and kind of greenhouse gases depend on specifications and features of power plants and related facilities.	(II, III, IV) 1) Existing data of greenhouse gases emission in Jordan and planned area. 2) Anticipated greenhouse gases emission from power plants and related facilities.	(II, III, IV) Preventive measures to reduce greenhouse gases emission in construction and decommissioning work and in operation of power plants and related facilities.
(3) Environmental Pollution				
27) Air pollution	A/B	(II, III, IV) Generation of air pollutants such as dust, PM10, PM2.5, SOx, NOx are expected due to earth moving	(II, III, IV) 1) Regulation of air pollution including air quality and emission standards. 2) Existing air quality in Jordan and	(II, III, IV) 1) Preventive measures to control air pollutants emission in construction and decommissioning work and

		and engineering works during construction and decommissioning stage, and from power plant and related facilities during operation stage. However, extent of generation and kind of pollutants depend on specifications and features of power plants and related facilities.	planned area. 3) Anticipated emission of air pollutants from power plants and related facilities.	in operation of power plants and related facilities. 2) Monitor air pollutants emission and ambient air quality.
28) Water pollution	A/B	(II, III, IV) Generation of water pollutants such as SS, BOD, COD, oil & grease, and other organic and inorganic substances as well as thermal effluent, are expected due to earth moving and engineering works during construction and decommissioning stage, and from power plant and related facilities during operation stage. However, extent of generation and kind of pollutants depend on specifications and features of power plants and related facilities.	(II, III, IV) 1) Regulation of water pollution including water quality and effluent standards. 2) Existing water quality in Jordan and planned area. 3) Anticipated discharge of water pollutants from power plants and related facilities.	(II, III, IV) 1) Preventive measures to control water pollutants discharge in construction and decommissioning work and in operation of power plants and related facilities. 2) Monitor water pollutants discharge and environmental water quality.
29) Soil contaminatio n	B	(II, III, IV) There is a possibility of soil contamination due to leakage of toxic or hazardous materials from construction and decommissioning work,	(II, III, IV) 1) Regulation of soil contamination. 2) Cases and causes of soil contamination in Jordan and planned area.	(II, III, IV) 1) Preventive measures to avoid leakage toxic/hazardous materials in construction and decommissioning work and in operation of power plants and related facilities. 2)

		and from operation of power plant and related facilities. However, features of the contamination is unknown at present.		Monitor soil contamination.
30) Bottom sediment	B	(II, III, IV) There is a possibility of bottom sediment contamination due to leakage of fuels and other materials during landing work at the port. However, features of the contamination is unknown at present.	(II, III, IV) 1) Regulation of bottom sediment contamination. 2) Cases and causes of bottom sediment contamination.	(II, III, IV) Monitoring bottom sediment contamination.
31) Solid waste	A/B	(II, III, IV) Generation of solid wastes is expected from are expected due to earth moving and engineering works during construction and decommissioning stage, and from power plant and related facilities such as fly ash during operation stage. However, extent of generation depends on specifications and features of power plants and related facilities.	(II, III, IV) 1) Regulation for solid waste management. 2) Existing situation of solid waste management in Jordan and planned area. 3) Anticipated generation of sold waste from construction and decommissioning work. 4) Anticipated solid waste generation including fly ash from power plants and related facilities.	(II, III, IV) 1) Preventive measures for reduction, proper treatment and disposal of solid waste during construction/decommissioning stage and operation stage in the plan. 2) Reflect concept of 3R (Reduce, reuse and recycle) to the plan. 3) Enlighten awareness of waste management to workers and employees.
32) Noise and Vibration	B	(II, III, IV) Generation of noise and vibration are expected from are expected due to earth moving and engineering works	(II, III, IV) 1) Regulation of noise and vibration. 2) Generation and ambient level of noise and vibration in Jordan and planned area. 3)	(II, III, IV) Preventive measures against generation of noise and vibration during operation of power plants and related facilities as well as during construction and

		during construction and decommissioning stage, and from power plant and related facilities during operation stage. However, extent of generation depends on specifications and features of power plants and related facilities.	Anticipated generation of noise and vibration from power plants and related facilities.	decommissioning work.
(4) Permit, Explanation and Others				
Subject	C		(T) 1) Methodology of Environmental Impact Assessment in Jordan. 2) Items and Procedures for Permit/Approval. 3) Information disclosure. 4) Stakeholder participation. 5) International Treaties, Agreements, Convention.	(T) Comparison of Alternative Plans. 2) Environmental Management Plan, Environmental Monitoring Plan, Emergency Action Plan etc.

Source: JICA Study Team

(3) Thermal power – Coal Fired

Table 9.4.3 (6) Matrix Expression of Negative Impacts

Environmental item *, **	Rating ***, ****				
	T	I	II	III	IV
(1) Social Environment					
1) Land acquisition and resettlement (Involuntary resettlement)	A/B	A/B	B	B	B
2) Local economy such as employment and livelihood etc.	C	C	C	C	C
3) Energy use	B	B	B	B	C
4) Water use	A/B	A/B	A/B	A/B	C
5) Land use and utilization of local resources	A/B	A/B	A/B	A/B	C
6) Social institutions such as social infrastructure and local	C	C	C	C	C

decision-making institutions, a split of communities					
7) Existing social infrastructures and services	C	C	C	C	C
8) The poor, indigenous of ethnic people	C	C	C	C	C
9) Misdistribution of benefit and damage (Equality of benefits and losses and equality involved in development process)	C	C	C	C	C
10) Local conflict of interests	C	C	C	C	C
11) Cultural property and heritage	B	D	B	C	C
12) Fishing rights, water rights and rights of common	C	C	C	C	C
13) Public health and Sanitation	B/C	D	B	B/C	C
14) Infectious diseases such as HIV/AIDS	C	D	C	C	C
15) Working condition including occupational safety	C	D	C	C	C
16) Hazard/risk (disaster, security)	B	B	B	B	B
17) Accidents	A/B	D	B	A/B	B
(2) Natural Environment					
18) Topography and Geology	C	D	C	C	C
19) Soil erosion/sand movement	C	D	C	C	C
20) Movement of water/Hydrological situation	C	D	C	C	C
21) Coastal zone	B	D	B	B	C
22) Environmentally sensitive areas (Protected Areas, IBAs etc.)	B	D	B	B	C
23) Flora, Fauna, Ecosystem and Biodiversity	B	D	B	B	C
24) Landscape	B	D	B	B	C
25) Micro-climate	C	D	C	C	C
26) Global Warming	A/B	D	B	A/B	B
(3) Environmental Pollution					
27) Air pollution	A/B	D	B	A/B	C
28) Water pollution	A/B	D	B	A/B	C
29) Soil contamination	B	D	B	B	C

30) Bottom sediment	B	D	B	B	C
31) Soild waste	A/B	D	B	A/B	B
32) Noise and Vibration	B	D	B	B	C
33) Ground Subsidence	C	D	C	C	C
34) Offensive odor	C	D	C	C	C
35) Sunshine inhibition/Reflection of sunlight	C	D	C	C	C
36) Electromagnetic interference	C	D	C	C	C
37) Safety from Electromagnetic Field	C	D	C	C	C
(4) Permit, Explanation and Others					
Subject	C				

Table 9.4.3 (7) AnticipatedNegative Impacts and Necessary Information/Date and Possible Mitigation Measures

Environmental item *, **	**Rating ***, ******	**Reasons**	**Further Necessary Information/Data**	**Possible Mitigation Measures**
(1) Social Environment				
1) Land acquisition and resettlement (Involuntary resettlement)	A/B	(T) To secure the lands/spaces for planned power plants and related facilities, there is a possibility of involuntary resettlement including land acquisition and resettlement as well as wayleaves, generation of Project Affected Persons (PAPs), although it depends on the details of the plan (site location/route, scale, components etc.).	(T) 1) Laws and regulations for involuntary resettlement (land acquisition and resettlement) and easement/wayleaves. 2) Land use regulation and existing land use in Jordan and planned area. 3) Cases and causes of involuntary resettlement in Jordan and planned area. 4) Anticipated land area and location for the site to be secured by the plan.	(T) 1) Consider alternative plans to avoid and/or minimize the occurrence of involuntary resettlement. 2) Detailed inventory survey on plots, facilities, structures and peoples living along the planned railway routes. 3) Survey on encroachment on ROW (Right Of Way) of the planned site/alignment. 4) Examine procedure and condition of involuntary resettlement and compensation to PAPs taking relevant laws in

				Jordan and the JICA Guidelines into considerations. 5) From early stage of the project, pay attention to information disclosure and consultation with stakeholders including PAPs for thorough understanding of the issues or to make agreement as much as possible. 6) Elaborate Resettlement Action Plan (RAP), if involuntary resettlement is unavoidable.
2) Local economy such as employment and livelihood etc.	C	(T) Beneficial impacts are expected on local economy; (i) creation of employment opportunity for civil work during construction and decommissioning stage, (ii) new power generation may improve living condition. However, extent of impact is unknown at present.	(T) 1) Development PPPs of Jordan and other sectors (tourism, industry, mining, regional development etc.) 2) Labor force and employment and working needs in planned area.	(T) 1) Promote consistency and synergy with other development plans (PPPs) by whole country and other sectors.
3) Energy use	B	(I, III) To procure coal by uploading and transportation, there is a possibility to generate negative impact on environment. However, extent of impact depends on the plan of power plants and related facilities.	(I, III) Procurement plan of coal as fuel source.	(I, III) 1) Consider preventive measures for leakage of coal during uploading/transportation. 2) Consider preventive measuresfor exhaust emission from trucks.
4) Water use	A/B	(T) Jordan has very limited water resources and available water resources continue to fall with population growth everywhere in the country. Thus, to secure water supply	(T) 1) Laws and regulations for water use and water extraction form water resources. 2) Water demand and supply in Jordan and	(T) 1) Consider minimize water use in construction and decommissioning work and in operation of power plants and related facilities in the plan. 2) Monitor

		for use such as processing, cooling, sprinkling etc. of power plants and related facilities, it is expected to face severe competence with other water supply.	planned area. 3) Anticipated water use in construction and decommissioning work and in operation of power plants and related facilities.	water consumption in the plan.
5) Land use and utilization of local resources	A/B	(V) Some alteration of existing land use and utilization of local resources is expected. However, extent of impact depends on the plan of power plants and related facilities.	(T) 1) Laws and regulation for use of land and resources. 2) Existing and future land and resources use in Jordan and planned area.	(T) Consider appropriate and effective utilization of land and resources in the plan.
6) Social institutions such as social infrastructure and local decision-making institutions, a split of communities	C	(T) Beneficial impacts such as contribute to creation of employment opportunity for construction and decommissioning work and improvement living condition by supply of electricity through power plants and related facilities. However, there is a possibility of missing acceptance by the communities, if the plan is not properly informed to relevant stakeholders including community based organizations for participating.	(T) Information of administrative and social structures and decision-making process and institutions in Jordan and planned area.	(T) Information disclosure and public participation should be fully considered for stakeholders including decision-makers of the communities from early stage of planning for obtaining thorough understanding and consensus of the people and communities by promoting that the plan may contribute to improvement of local economy and upgrading living conditions.
7) Existing social infrastructures and services	C	(T) There is a possibility of missing acceptance by the communities and causing split of community, if the plan is not properly informed to relevant stakeholders including community based organizations for	(T) 1) Laws and regulations for social infrastructures and services. 2) Existing situation of social infrastructures and services in Jordan and planned area.	(T) 1) Avoid or minimize disturbance existing social infrastructures and services in the plan. 2) Promote synergy with plans for other social infrastructure and services.

		participation.		
8) The poor, indigenous of ethnic people	C	(T) Power plants and related facilities is expected to contribute to creation of employment opportunity for construction and decommissioning work and improvement living condition by supply of electricity. However, it is unknown whether the poor and vulnerables are able to enjoy the benefit equally or not at present.	(T) 1) Data of vulnerable groups such as the poor, female, children, elders, disabled, refugees and indigenous ethnic people in Jordan and planned area. 2) Supporting activities to living and livelihood condition by Jordan Government and donors.	(T) 1) Give higher priority to the vulnerable groups in the planned area with having a chance to get jobs and training to get working skills in the plan. 2) The vulnerable people should be taken fully considerations to compensate properly or support to restore the present living condition in case of involuntary resettlement, even if they are illegal occupants.
9) Misdistribution of benefit and damage (Equality of benefits and losses and equality involved in development process)	C	(T) Beneficial impacts such as contribute to creation of employment opportunity for construction and decommissioning work and improvement living condition by supply of electricity through power plants and related facilities. However, there is a possibility of misdistribution of benefit and damage, if the plan is not appropriately accepted to relevant stakeholders including communities through proper information disclosure and public participation.	(T) Cases and causes of misdistribution of benefit and damage by the development plans of electric sector and others in Jordan and planned area.	(T) Information disclosure and public participation should be fully considered from early stage to obtain thorough understanding the plan and consensus among the communities and PAPs in order to share with benefit and damage equally.
10) Local conflict of interests	C	(T) Beneficial impacts such as contribute to creation of employment opportunity for construction and	(T) Cases and causes of local conflict of interests by the development plans of electric sector and	(T) Information disclosure and public participation should be fully considered from early stage to obtain

		decommissioning work and improvement living condition by supply of electricity through power plants and related facilities. However, there is a possibility of generation of local conflict, if the plan is not appropriately accepted to relevant stakeholders including communities through proper information disclosure and public participation.	others in Jordan and planned area.	thorough understanding the plan and consensus among the communities and PAPs in order to avoid or minimize local conflict of interests.
11) Cultural property and heritage	B	(II, III,) In Jordan sites of cultural properties and heritages are distributed in the whole country. Thus, adverse impact on them is expected, if the site of power plants and related facilities is located within or close to the site.	(II, III) 1) Laws and regulations of cultural property and heritage site. 2) Distribution of cultural property and heritage site in Jordan and the planned area.	(T) 1) Avoid the site and route penetrating or close to the sites of cultural properties, heritages and archaeological importance in the plan. 2) If any buried cultural properties are found at construction work, report and consult with concerned organizations such as Ministry of Tourism and Antiquities without delay.
12) Fishing rights, water rights and rights of common	C	(T) There is a possibility of disturbing fishing rights, water rights and rights of common depending on the project plan. However, extent of impact is unknown at present.	(T) Situation of fishing rights, water rights and rights of common in Jordan and planned area.	(T) Promote participation of those who have the rights in order to get their opinion and ensuring understanding and making consent in the course of the stakeholder meeting from the planning stage
13) Public health and Sanitation	B/C	(II, III, IV) There is a possibility of deterioration respiratory functions due to inhalation of air pollutants such as NOx and PM2.5, if control of pollutants emission	(II, III, IV) 1) Laws and regulations of public health and sanitation. 2) Public health condition including respiratory disease and distribution	(T) 1) Preventive measures to control air pollutants emission in construction and decommissioning work and in operation of power plants and related facilities. 2)

		in construction and decommissioning work and operation of power plants and related facilities is not conducted appropriately.	of medical facilities in Jordan and planned area.	Monitor public health condition by medical examination.
14) Infectious diseases such as HIV/AIDS	C	(II, IV) In many developing countries spreading of infectious diseases such as HIV/AIDS were often reported due to contact of workers with affected peoples at their camp in construction work. Thus, it is expected somewhat spreading of infectious diseases during construction and decommissioning stage. However, extent of impact is unknown at present.	(II、IV) 1) Regulations for infectious diseases. 2) Cases and causes of infectious diseases such as HIV/AIDS in Jordan and planned area.	(II, IV) 1) Enlightenment and education of infectious diseases to people and workers. 2) Monitoring prevalence and safety shoes and hats. (3) Regular check of occupational safety and health condition.
15) Working condition including occupational safety	C	(II, III, IV) Adverse impacts on working condition including occupational safety are expected somewhat due to insufficient management of workers at construction and decommissioning work, and at operation of power plants and related facilities. However, extent of impact is unknown at present.	(II, III, IV) 1) Regulation for labor and occupational health and safety. 2) Cases and causes of working condition issues including occupational health and safety in Jordan and planned area. 3) Management plan for working condition in construction and decommissioning work, and in operation of power plants and related facilities.	(II, III, IV) 1) Prepare tangible safety considerations in place for individuals involved in the plan, such as the installation of safety equipment which prevents accidents, and management of hazardous materials. 2) Plan and implement intangible measures for individuals involved in the plan, such as the establishment of a safety and health program, and safety training for workers etc. 3) Monitoring occupational health and safety condition.

16) Hazard/risk (disaster, security)	B	(T) No additional risk of disaster and public security are expected due to installation of power plant and related facilities. However, there is a possibility of increase in disaster and security risk, if the site is located to close to neighboring countries in conflict.	(T) 1) Cases and causes of hazard risks due to disaster in Jordan and the planned area. 2) Existing condition of public security due to uncertain political situation and conflict of neighboring countries.	(T) 1) Monitor uncertain condition of neighboring countries. 2) Prepare emergency action plan for hazard and public security risks.
17) Accidents	A/B	(II, III, IV) Occurrence of accidents is expected somewhat, if inappropriate handling and management of construction and decommissioning work, and insufficient operation of installed power plants and related facilities are carried out.	(II, III, IV) 1) Cases and causes of accidents in Jordan and planned area in construction and decommissioning work and in operation of power plants and related facilities.	(II, III, IV) 1) Preventive measures to accidents in construction and decommissioning work and in operation of power plants and related facilities. 2) Prepare emergency action plan for accidents.
(2) Natural Environment				
21) Coastal zone	B	(II, III, IV) There is a possibility that change in oceanographic conditions and coastal erosion/sedimentation due to development of coastal area for landing work of fuels and other materials at port and/or water storage by pumping up at hydropower plant. However, extent of impact is unknown at present.	(II, III, IV) 1) Regulation of development and environmental conservation in coastal area. 2) Existing environmental condition of coastal area.	(II, III, IV) 1) Appropriate preventive measures against coastal erosion, and sedimentation of sand and soil in the plan. 2) Monitor oceanographic conditions, and coastal erosion and sedimentation of sand by physical observation and utilizing satellite image map.
22) Environmentally sensitive areas (Protected	B	(II, III, IV) In Jordan designated Protected Areas and Important Bird and Biodiversity Conservation Areas (IBAs) are distributed in the whole country. Thus,	(II, III, IV) 1) Distribution of designated Protected Areas, natural reserves and IBAs as well as parks in Jordan and the	(II, III, IV) To avoid site location within or close to the designated Protected Areas and parks.

Areas, IBAs etc.)		adverse impact on them is expected, if the site of power plants and related facilities is located within or close to the area.	planned area. 2) Regulations for conservation of natural environment.	
23) Flora, Fauna, Ecosystem and Biodiversity	B	(II, III, IV) In Jordan there are found many precious plant and animal species as well as important areas of valuable ecosystem and biodiversity. Thus, adverse impact on them is expected, if the site of power plants and related facilities is located within or close to the area.	(II, III, IV) 1) Distribution of site with valuable plant and animal species, ecosystem and biodiversity in Jordan and the planned area. 2) Regulations for conservation of plant, animal species and biodiversity.	(II, III, IV) To avoid site location within or close to distribution areas of valuable plant and animal species, and environmentally sensitive areas.
24) Landscape	B	(III) In Jordan cultural and heritage sites are distributed in the whole country and they consist of attractive landscape. Thus, there is a possibility of deterioration aesthetic value of landscape by spatial occupancy of power plants and related facilities.	(III) 1) Distribution of site with valuable landscape in Jordan and the planned area. 2) Regulation for preserving valuable landscape.	(III) 1) To avoid site location close to existing important landscape. 2) Measures to harmonize power plants and related facilities with surrounding landscape by design and tree planting in the plan.
26) Global Warming	A/B	(II, III, IV) Emission of greenhouse gases (GHG) such as CO_2, CH_4, which may affect consequently global warming and climate change is expected from construction vehicles and machines during construction and decommissioning stage, and from power plants and related facilities during operation stage. However, extent of emission and kind of greenhouse gases depend on	(II, III, IV) 1) Existing data of greenhouse gases emission in Jordan and planned area. 2) Anticipated greenhouse gases emission from power plants and related facilities.	(II, III, IV) Preventive measures to reduce greenhouse gases emission in construction and decommissioning work and in operation of power plants and related facilities.

		specifications and features of power plants and related facilities.		
(3) Environmental Pollution				
27) Air pollution	A/B	(II, III, IV) Generation of air pollutants such as dust, PM10, PM2.5, SOx, NOx are expected due to earth moving and engineering works during construction and decommissioning stage, and from power plant and related facilities during operation stage. However, extent of generation and kind of pollutants depend on specifications and features of power plants and related facilities.	(II, III, IV) 1) Regulation of air pollution including air quality and emission standards. 2) Existing air quality in Jordan and planned area. 3) Anticipated emission of air pollutants from power plants and related facilities.	(II, III, IV) 1) Preventive measures to control air pollutants emission in construction and decommissioning work and in operation of power plants and related facilities. 2) Monitor air pollutants emission and ambient air quality.
28) Water pollution	A/B	(II, III, IV) Generation of water pollutants such as SS, BOD, COD, oil & grease, and other organic and inorganic substances as well as thermal effluent, are expected due to earth moving and engineering works during construction and decommissioning stage, and from power plant and related facilities during operation stage. However, extent of generation and kind of pollutants depend on specifications and features of power plants and related facilities.	(II, III, IV) 1) Regulation of water pollution including water quality and effluent standards. 2) Existing water quality in Jordan and planned area. 3) Anticipated discharge of water pollutants from power plants and related facilities.	(II, III, IV) 1) Preventive measures to control water pollutants discharge in construction and decommissioning work and in operation of power plants and related facilities. 2) Monitor water pollutants discharge and environmental water quality.

29) Soil contamination	B	(II, III, IV) There is a possibility of soil contamination due to leakage of toxic or hazardous materials from construction and decommissioning work, and from operation of power plant and related facilities. However, features of the contamination is unknown at present.	(II, III, IV) 1) Regulation of soil contamination. 2) Cases and causes of soil contamination in Jordan and planned area.	(II, III, IV) 1) Preventive measures to avoid leakage toxic/hazardous materials in construction and decommissioning work and in operation of power plants and related facilities. 2) Monitor soil contamination.
30) Bottom sediment	B	(II, III, IV) There is a possibility of bottom sediment contamination due to leakage of fuels and other materials during landing work at the port. However, features of the contamination is unknown at present.	(II, III, IV) 1) Regulation of bottom sediment contamination. 2) Cases and causes of bottom sediment contamination.	(II, III, IV) Monitoring bottom sediment contamination.
31) Soild waste	A/B	(II, III, IV) Generation of solid wastes is expected from are expected due to earth moving and engineering works during construction and decommissioning stage, and from power plant and related facilities such as fly ash during operation stage. However, extent of generation depends on specifications and features of power plants and related facilities.	(II, III, IV) 1) Regulation for solid waste management. 2) Existing situation of solid waste management in Jordan and planned area. 3) Anticipated generation of sold waste from construction and decommissioning work. 4) Anticipated solid waste generation including fly ash from power plants and related facilities.	(II, III, IV) 1) Preventive measures for reduction, proper treatment and disposal of solid waste during construction/decommissioning stage and operation stage in the plan. 2) Reflect concept of 3R (Reduce, reuse and recycle) to the plan. 3) Enlighten awareness of waste management to workers and employees.
32) Noise and Vibration	B	(II, III, IV) Generation of noise and vibration are expected from are expected due to earth moving and engineering works during	(II, III, IV) 1) Regulation of noise and vibration. 2) Generation and ambient level of noise and vibration in Jordan and	(II, III, IV) Preventive measures against generation of noise and vibration during operation of power plants and related facilities

		construction and decommissioning stage, and from power plant and related facilities during operation stage. However, extent of generation depends on specifications and features of power plants and related facilities.	planned area. 3) Anticipated generation of noise and vibration from power plants and related facilities.	as well as during construction and decommissioning work.
(4) Permit, Explanation and Others				
Subject	C		(T) 1) Methodology of Environmental Impact Assessment in Jordan. 2) Items and Procedures for Permit/Approval. 3) Information disclosure. 4) Stakeholder participation. 5) International Treaties, Agreements, Convention.	(T) Comparison of Alternative Plans. 2) Environmental Management Plan, Environmental Monitoring Plan, Emergency Action Plan etc.

Source: JICA Study Team

(4) Thermal Power –Oil Shale Burning

Table 9.4.3 (8) Matrix Expression of Negative Impacts

Environmental item *, **	**Rating ***, ******				
(1) Social Environment	**T**	**I**	**II**	**III**	**IV**
1) Land acquisition and resettlement (Involuntary resettlement)	A/B	A/B	B	B	B
2) Local economy such as employment and livelihood etc.	C	C	C	C	C
3) Energy use	B	D	C	B	C
4) Water use	A/B	A/B	A/B	A/B	C
5) Land use and utilization of local resources	A/B	A/B	A/B	A/B	C
6) Social institutions such as social infrastructure and local decision-making institutions, a split of communities	C	C	C	C	C

7) Existing social infrastructures and services	C	C	C	C	C
8) The poor, indigenous of ethnic people	C	C	C	C	C
9) Misdistribution of benefit and damage (Equality of benefits and losses and equality involved in development process)	C	C	C	C	C
10) Local conflict of interests	C	C	C	C	C
11) Cultural property and heritage	B	D	B	C	C
12) Fishing rights, water rights and rights of common	C	C	C	C	C
13) Public health and Sanitation	B/C	D	B	B/C	C
14) Infectious diseases such as HIV/AIDS	C	D	C	C	C
15) Working condition including occupational safety	C	D	C	C	C
16) Hazard/risk (disaster, security)	B	B	B	B	B
17) Accidents	A/B	D	B	A/B	B
(2) Natural Environment					
18) Topography and Geology	C	D	C	C	C
19) Soil erosion/sand movement	C	D	C	C	C
20) Movement of water/Hydrological situation	C	D	C	C	C
21) Coastal zone	C	D	C	C	C
22) Environmentally sensitive areas (Protected Areas, IBAs etc.)	B	D	B	B	C
23) Flora, Fauna, Ecosystem and Biodiversity	B	D	B	B	C
24) Landscape	B	D	B	B	C
25) Micro-climate	C	D	C	C	C
26) Global Warming	A/B	D	B	A/B	B
(3) Environmental Pollution					
27) Air pollution	A/B	D	B	A/B	C
28) Water pollution	A/B	D	B	A/B	C
29) Soil contamination	B	D	B	B	C
30) Bottom sediment	C	D	C	C	C

31) Soild waste	A/B	D	B	A/B	B
32) Noise and Vibration	B	D	B	B	C
33) Ground Subsidence	C	D	C	C	C
34) Offensive odor	C	D	C	C	C
35) Sunshine inhibition/Reflection of sunlight	C	D	C	C	C
36) Electromagnetic interference	C	D	C	C	C
37) Safety from Electromagnetic Field	C	D	C	C	C
(4) Permit, Explanation and Others					
Subject	C				

Source: JICA Study Team

Table 9.4.3 (9) AnticipatedNegative Impacts and Necessary Information/Date and Possible Mitigation Measures

Environmental item *, **	Rating ***, ****	Reasons	Further Necessary Information/Data	Possible Mitigation Measures
(1) Social Environment				
1) Land acquisition and resettlement (Involuntary resettlement)	A/B	(T) To secure the lands/spaces for planned thermal power plant by burning oil shale and related facilities, there is a possibility of involuntary resettlement including land acquisition and resettlement as well as wayleaves, generation of Project Affected Persons (PAPs), although it depends on the details of the plan (site location/route, scale, components etc.).	(T) 1) Laws and regulations for involuntary resettlement (land acquisition and resettlement) and easement/wayleaves. 2) Land use regulation and existing land use in Jordan and planned area. 3) Cases and causes of involuntary resettlement in Jordan and planned area. 4) Anticipated land area and location for the site to be secured by the plan.	(T) 1) Consider alternative plans to avoid and/or minimize the occurrence of involuntary resettlement. 2) Detailed inventory survey on plots, facilities, structures and peoples living along the planned railway routes. 3) Survey on encroachment on ROW (Right Of Way) of the planned site/alignment. 4) Examine procedure and condition of involuntary resettlement and compensation to PAPs taking relevant laws in Jordan and the JICA

				Guidelines into considerations. 5) From early stage of the project, pay attention to information disclosure and consultation with stakeholders including PAPs for thorough understanding of the issues or to make agreement as much as possible. 6) Elaborate Resettlement Action Plan (RAP), if involuntary resettlement is unavoidable.
3) Energy use	B	(T) To procure oil shale by exploitation, storage and/or transportation, there is a possibility to generate hazardous materials from oil shake mining and exhaust gas emission from truck. However, extent of impact depends on the plan of the power plants and related facilities.	(III) Procurement plan of oil shale.	(III) 1) Consider preventive measures for mining pollution due to exploitation of oil shale. 2) Consider preventive measures for exhaust emission from trucks.
4) Water use	A/B	(T) Jordan has very limited water resources and available water resources continue to fall with population growth everywhere in the country. Thus, to secure water supply for use such as processing, cooling, sprinkling etc. of power plants and related facilities, it is expected to face severe competence with other water supply.	(T) 1) Laws and regulations for water use and water extraction form water resources. 2) Water demand and supply in Jordan and planned area. 3) Anticipated water use in construction and decommissioning work and in operation of power plants and related facilities.	(T) 1) Consider minimize water use in construction and decommissioning work and in operation of power plants and related facilities in the plan. 2) Monitor water consumption in the plan.

5) Land use and utilization of local resources	A/B	(V) Some alteration of existing land use and utilization of local resources is expected. However, extent of impact depends on the plan of power plants and related facilities.	(T) 1) Laws and regulation for use of land and resources. 2) Existing and future land and resources use in Jordan and planned area.	(T) Consider appropriate and effective utilization of land and resources in the plan.
11) Cultural property and heritage	B	(II, III,) In Jordan sites of cultural properties and heritages are distributed in the whole country. Thus, adverse impact on them is expected, if the site of power plants and related facilities is located within or close to the site.	(II, III) 1) Laws and regulations of cultural property and heritage site. 2) Distribution of cultural property and heritage site in Jordan and the planned area.	(T) 1) Avoid the site and route penetrating or close to the sites of cultural properties, heritages and archaeological importance in the plan. 2) If any buried cultural properties are found at construction work, report and consult with concerned organizations such as Ministry of Tourism and Antiquities without delay.
16) Hazard/risk (disaster, security)	B	(T) No additional risk of disaster and public security are expected due to installation of power plant and related facilities. However, there is a possibility of increase in disaster and security risk, if the site is located to close to neighboring countries in conflict.	(T) 1) Cases and causes of hazard risks due to disaster in Jordan and the planned area. 2) Existing condition of public security due to uncertain political situation and conflict of neighboring countries.	(T) 1) Monitor uncertain condition of neighboring countries. 2) Prepare emergency action plan for hazard and public security risks.
17) Accidents	A/B	(II, III, IV) Occurrence of accidents is expected somewhat, if inappropriate handling and management of construction and decommissioning work, and insufficient operation of installed power plants	(II, III, IV) 1) Cases and causes of accidents in Jordan and planned area in construction and decommissioning work and in operation of power plants and related facilities.	(II, III, IV) 1) Preventive measures to accidents in construction and decommissioning work and in operation of power plants and related facilities. 2) Prepare emergency action plan for accidents.

		and related facilities are carried out.		
(2) Natural Environment				
22) Environmentally sensitive areas (Protected Areas, IBAs etc.)	B	(II, III, IV) In Jordan designated Protected Areas and Important Bird and Biodiversity Conservation Areas (IBAs) are distributed in the whole country. Thus, adverse impact on them is expected, if the site of power plants and related facilities is located within or close to the area.	(II, III, IV) 1) Distribution of designated Protected Areas, natural reserves and IBAs as well as parks in Jordan and the planned area. 2) Regulations for conservation of natural environment.	(II, III, IV) To avoid site location within or close to the designated Protected Areas and parks.
23) Flora, Fauna, Ecosystem and Biodiversity	B	(II, III, IV) In Jordan there are found many precious plant and animal species as well as important areas of valuable ecosystem and biodiversity. Thus, adverse impact on them is expected, if the site of power plants and related facilities is located within or close to the area.	(II, III, IV) 1) Distribution of site with valuable plant and animal species, ecosystem and biodiversity in Jordan and the planned area. 2) Regulations for conservation of plant, animal species and biodiversity.	(II, III, IV) To avoid site location within or close to distribution areas of valuable plant and animal species, and environmentally sensitive areas.
24) Landscape	B	(III) In Jordan cultural and heritage sites are distributed in the whole country and they consist of attractive landscape. Thus, there is a possibility of deterioration aesthetic value of landscape by spatial occupancy of power plants and related facilities.	(III) 1) Distribution of site with valuable landscape in Jordan and the planned area. 2) Regulation for preserving valuable landscape.	(III) 1) To avoid site location close to existing important landscape. 2) Measures to harmonize power plants and related facilities with surrounding landscape by design and tree planting in the plan.

26) Global Warming	A/B	(II, III, IV) Emission of greenhouse gases (GHG) such as CO_2, CH_4, which may affect consequently global warming and climate change is expected from construction vehicles and machines during construction and decommissioning stage, and from power plants and related facilities during operation stage. However, extent of emission and kind of greenhouse gases depend on specifications and features of power plants and related facilities.	(II, III, IV) 1) Existing data of greenhouse gases emission in Jordan and planned area. 2) Anticipated greenhouse gases emission from power plants and related facilities.	(II, III, IV) Preventive measures to reduce greenhouse gases emission in construction and decommissioning work and in operation of power plants and related facilities.
(3) Environmental Pollution				
27) Air pollution	A/B	(II, III, IV) Generation of air pollutants such as dust, PM10, PM2.5, SOx, NOx are expected due to earth moving and engineering works during construction and decommissioning stage, and from power plant and related facilities during operation stage. However, extent of generation and kind of pollutants depend on specifications and features of power plants and related facilities.	(II, III, IV) 1) Regulation of air pollution including air quality and emission standards. 2) Existing air quality in Jordan and planned area. 3) Anticipated emission of air pollutants from power plants and related facilities.	(II, III, IV) 1) Preventive measures to control air pollutants emission in construction and decommissioning work and in operation of power plants and related facilities. 2) Monitor air pollutants emission and ambient air quality.

28) Water pollution	A/B	(II, III, IV) Generation of water pollutants such as SS, BOD, COD, oil & grease, and other organic and inorganic substances as well as thermal effluent, are expected due to earth moving and engineering works during construction and decommissioning stage, and from power plant and related facilities during operation stage. However, extent of generation and kind of pollutants depend on specifications and features of power plants and related facilities.	(II, III, IV) 1) Regulation of water pollution including water quality and effluent standards. 2) Existing water quality in Jordan and planned area. 3) Anticipated discharge of water pollutants from power plants and related facilities.	(II, III, IV) 1) Preventive measures to control water pollutants discharge in construction and decommissioning work and in operation of power plants and related facilities. 2) Monitor water pollutants discharge and environmental water quality.
29) Soil contaminatio n	B	(II, III, IV) There is a possibility of soil contamination due to leakage of toxic or hazardous materials from construction and decommissioning work, and from operation of power plant and related facilities. However, features of the contamination is unknown at present.	(II, III, IV) 1) Regulation of soil contamination. 2) Cases and causes of soil contamination in Jordan and planned area.	(II, III, IV) 1) Preventive measures to avoid leakage toxic/hazardous materials in construction and decommissioning work and in operation of power plants and related facilities. 2) Monitor soil contamination.
31) Soild waste	A/B	(II, III, IV) Generation of solid wastes is expected from are expected due to earth moving and engineering works during construction and decommissioning stage, and from power plant and	(II, III, IV) 1) Regulation for solid waste management. 2) Existing situation of solid waste management in Jordan and planned area. 3) Anticipated generation of sold waste from	(II, III, IV) 1) Preventive measures for reduction, proper treatment and disposal of solid waste during construction/decommissioni ng stage and operation stage in the plan. 2) Reflect

		related facilities such as fly ash during operation stage. However, extent of generation depends on specifications and features of power plants and related facilities.	construction and decommissioning work. 4) Anticipated solid waste generation including fly ash from power plants and related facilities.	concept of 3R (Reduce, reuse and recycle) to the plan. 3) Enlighten awareness of waste management to workers and employees.
32) Noise and Vibration	B	(II, III, IV) Generation of noise and vibration are expected from are expected due to earth moving and engineering works during construction and decommissioning stage, and from power plant and related facilities during operation stage. However, extent of generation depends on specifications and features of power plants and related facilities.	(II, III, IV) 1) Regulation of noise and vibration. 2) Generation and ambient level of noise and vibration in Jordan and planned area. 3) Anticipated generation of noise and vibration from power plants and related facilities.	(II, III, IV) Preventive measures against generation of noise and vibration during operation of power plants and related facilities as well as during construction and decommissioning work.
(4) Permit, Explanation and Others				
Subject	C		(T) 1) Methodology of Environmental Impact Assessment in Jordan. 2) Items and Procedures for Permit/Approval. 3) Information disclosure. 4) Stakeholder participation. 5) International Treaties, Agreements, Convention.	(T) Comparison of Alternative Plans. 2) Environmental Management Plan, Environmental Monitoring Plan, Emergency Action Plan etc.

Source: JICA Study Team

(5) Pumped Storage Hydropower (Sea water)

Table 9.4.3 (10) Matrix Expression of Negative Impacts

Environmental item *, **	Rating ***, ****				
	T	I	II	III	IV
(1) Social Environment					
1) Land acquisition and resettlement (Involuntary resettlement)	A/B	A/B	B	B	B
2) Local economy such as employment and livelihood etc.	C	C	C	C	C
3) Energy use	B	D	C	B	C
4) Water use	A/B	A/B	A/B	A/B	C
5) Land use and utilization of local resources	A/B	A/B	A/B	A/B	C
6) Social institutions such as social infrastructure and local decision-making institutions, a split of communities	C	C	C	C	C
7) Existing social infrastructures and services	C	C	C	C	C
8) The poor, indigenous of ethnic people	C	C	C	C	C
9) Misdistribution of benefit and damage (Equality of benefits and losses and equality involved in development process)	C	C	C	C	C
10) Local conflict of interests	C	C	C	C	C
11) Cultural property and heritage	B	D	B	C	C
12) Fishing rights, water rights and rights of common	C	C	C	C	C
13) Public health and Sanitation	B/C	D	B	B/C	C
14) Infectious diseases such as HIV/AIDS	C	D	C	C	C
15) Working condition including occupational safety	C	D	C	C	C
16) Hazard/risk (disaster, security)	B	B	B	B	B
17) Accidents	A/B	D	B	A/B	B
(2) Natural Environment					
18) Topography and Geology	C	D	C	C	C
19) Soil erosion/sand movement	C	D	C	C	C
20) Movement of water/Hydrological situation	C	D	C	C	C

21) Coastal zone	C	D	C	C	C
22) Environmentally sensitive areas (Protected Areas, IBAs etc.)	B	D	B	B	C
23) Flora, Fauna, Ecosystem and Biodiversity	B	D	B	B	C
24) Landscape	B	D	B	B	C
25) Micro-climate	C	D	C	C	C
26) Global Warming	A/B	D	B	A/B	B
(3) Environmental Pollution					
27) Air pollution	A/B	D	B	A/B	C
28) Water pollution	A/B	D	B	A/B	C
29) Soil contamination	B	D	B	B	C
30) Bottom sediment	C	D	C	C	C
31) Soild waste	A/B	D	B	A/B	B
32) Noise and Vibration	B	D	B	B	C
33) Ground Subsidence	C	D	C	C	C
34) Offensive odor	C	D	C	C	C
35) Sunshine inhibition/Reflection of sunlight	C	D	C	C	C
36) Electromagnetic interference	C	D	C	C	C
37) Safety from Electromagnetic Field	C	D	C	C	C
(4) Permit, Explanation and Others					
Subject	C				

Source: JICA Study Team

Table 9.4.3 (11) AnticipatedNegative Impacts and Necessary Information/Date and Possible Mitigation Measures

Environmental item *, **	Rating ***, ****	Reasons	Further Necessary Information/Data	Possible Mitigation Measures
(1) Social Environment				
1) Land acquisition and resettlement (Involuntary resettlement)	A/B	(T) To secure the lands/spaces for planned power plants and related facilities, there is a possibility of involuntary resettlement including land acquisition and resettlement as well as wayleaves, generation of Project Affected Persons (PAPs), although it depends on the details of the plan (site location/route, scale, components etc.).	(T) 1) Laws and regulations for involuntary resettlement (land acquisition and resettlement) and easement/wayleaves. 2) Land use regulation and existing land use in Jordan and planned area. 3) Cases and causes of involuntary resettlement in Jordan and planned area. 4) Anticipated land area and location for the site to be secured by the plan.	(T) 1) Consider alternative plans to avoid and/or minimize the occurrence of involuntary resettlement. 2) Detailed inventory survey on plots, facilities, structures and peoples living along the planned railway routes. 3) Survey on encroachment on ROW (Right Of Way) of the planned site/alignment. 4) Examine procedure and condition of involuntary resettlement and compensation to PAPs taking relevant laws in Jordan and the JICA Guidelines into considerations. 5) From early stage of the project, pay attention to information disclosure and consultation with stakeholders including PAPs for thorough understanding of the issues or to make agreement as much as possible. 6) Elaborate Resettlement Action Plan (RAP), if involuntary resettlement is unavoidable.

2) Local economy such as employment and livelihood etc.	C	(T) Beneficial impacts are expected on local economy; (i) creation of employment opportunity for civil work during construction and decommissioning stage, (ii) new power generation may improve living condition. However, extent of impact is unknown at present.	(T) 1) Development PPPs of Jordan and other sectors (tourism, industry, mining, regional development etc.) 2) Labor force and employment and working needs in planned area.	(T) 1) Promote consistency and synergy with other development plans (PPPs) by whole country and other sectors.
3) Energy use	C	(I, III) To procure supplementary power source.	(I, III) Procurement plan of supplementary power source.	Not required.
4) Water use	B	(T) Jordan has very limited water resources and available water resources continue to fall with population growth everywhere in the country. Thus, to secure water supply for use such as processing, cooling, sprinkling etc. of power plants and related facilities, it is expected to face severe competence with other water supply.	(T) 1) Laws and regulations for water use and water extraction form water resources. 2) Water demand and supply in Jordan and planned area. 3) Anticipated water use in construction and decommissioning work and in operation of power plants and related facilities.	(T) 1) Consider minimize water use in construction and decommissioning work and in operation of power plants and related facilities in the plan. 2) Monitor water consumption in the plan.
5) Land use and utilization of local resources	A/B	(V) Some alteration of existing land use and utilization of local resources is expected. However, extent of impact depends on the plan of power plants and related facilities.	(T) 1) Laws and regulation for use of land and resources. 2) Existing and future land and resources use in Jordan and planned area.	(T) Consider appropriate and effective utilization of land and resources in the plan.

6) Social institutions such as social infrastructure and local decision-making institutions, a split of communities	C	(T) Beneficial impacts such as contribute to creation of employment opportunity for construction and decommissioning work and improvement living condition by supply of electricity through power plants and related facilities. However, there is a possibility of missing acceptance by the communities, if the plan is not properly informed to relevant stakeholders including community based organizations for participating.	(T) Information of administrative and social structures and decision-making process and institutions in Jordan and planned area.	(T) Information disclosure and public participation should be fully considered for stakeholders including decision-makers of the communities from early stage of planning for obtaining thorough understanding and consensus of the people and communities by promoting that the plan may contribute to improvement of local economy and upgrading living conditions.
7) Existing social infrastructures and services	C	(T) There is a possibility of missing acceptance by the communities and causing split of community, if the plan is not properly informed to relevant stakeholders including community based organizations for participation.	(T) 1) Laws and regulations for social infrastructures and services. 2) Existing situation of social infrastructures and services in Jordan and planned area.	(T) 1) Avoid or minimize disturbance existing social infrastructures and services in the plan. 2) Promote synergy with plans for other social infrastructure and services.
8) The poor, indigenous of ethnic people	C	(T) Power plants and related facilities is expected to contribute to creation of employment opportunity for construction and decommissioning work and improvement living condition by supply of electricity. However, it is unknown whether the poor and vulnerables are able to enjoy the benefit equally or	(T) 1) Data of vulnerable groups such as the poor, female, children, elders, disabled, refugees and indigenous ethnic people in Jordan and planned area. 2) Supporting activities to living and livelihood condition by Jordan Government and	(T) 1) Give higher priority to the vulnerable groups in the planned area with having a chance to get jobs and training to get working skills in the plan. 2) The vulnerable people should be taken fully considerations to compensate properly or support to restore the present living condition in case of involuntary resettlement,

		not at present.	donors.	even if they are illegal occupants.
9) Misdistribution of benefit and damage (Equality of benefits and losses and equality involved in development process)	C	(T) Beneficial impacts such as contribute to creation of employment opportunity for construction and decommissioning work and improvement living condition by supply of electricity through power plants and related facilities. However, there is a possibility of misdistribution of benefit and damage, if the plan is not appropriately accepted to relevant stakeholders including communities through proper information disclosure and public participation.	(T) Cases and causes of misdistribution of benefit and damage by the development plans of electric sector and others in Jordan and planned area.	(T) Information disclosure and public participation should be fully considered from early stage to obtain thorough understanding the plan and consensus among the communities and PAPs in order to share with benefit and damage equally.
10) Local conflict of interests	C	(T) Beneficial impacts such as contribute to creation of employment opportunity for construction and decommissioning work and improvement living condition by supply of electricity through power plants and related facilities. However, there is a possibility of generation of local conflict, if the plan is not appropriately accepted to relevant stakeholders including communities through proper information disclosure and public	(T) Cases and causes of local conflict of interests by the development plans of electric sector and others in Jordan and planned area.	(T) Information disclosure and public participation should be fully considered from early stage to obtain thorough understanding the plan and consensus among the communities and PAPs in order to avoid or minimize local conflict of interests.

		participation.		
11) Cultural property and heritage	B	(II, III,) In Jordan sites of cultural properties and heritages are distributed in the whole country. Thus, adverse impact on them is expected, if the site of power plants and related facilities is located within or close to the site.	(II, III) 1) Laws and regulations of cultural property and heritage site. 2) Distribution of cultural property and heritage site in Jordan and the planned area.	(T) 1) Avoid the site and route penetrating or close to the sites of cultural properties, heritages and archaeological importance in the plan. 2) If any buried cultural properties are found at construction work, report and consult with concerned organizations such as Ministry of Tourism and Antiquities without delay.
12) Fishing rights, water rights and rights of common	C	(T) There is a possibility of disturbing fishing rights, water rights and rights of common depending on the project plan. However, extent of impact is unknown at present.	(T) Situation of fishing rights, water rights and rights of common in Jordan and planned area.	(T) Promote participation of those who have the rights in order to get their opinion and ensuring understanding and making consent in the course of the stakeholder meeting from the planning stage
13) Public health and Sanitation	C	(II, IV) There is a possibility of deterioration respiratory functions due to inhalation of air pollutants such as NOx and PM10, if control of pollutants emission in construction and decommissioning work is not conducted appropriately. However, at present extent of impact is unknown.	(II, III, IV) 1) Laws and regulations of public health and sanitation. 2) Public health condition including respiratory disease and distribution of medical facilities in Jordan and planned area.	(T) 1) Preventive measures to control air pollutants emission in construction and decommissioning work and in operation of power plants and related facilities. 2) Monitor public health condition by medical examination.
14) Infectious diseases such as HIV/AIDS	C	(II, IV) In many developing countries spreading of infectious diseases such as HIV/AIDS were often reported due to contact of	(II、IV) 1) Regulations for infectious diseases. 2) Cases and causes of infectious diseases such as HIV/AIDS in Jordan	(II, IV) 1) Enlightenment and education of infectious diseases to people and workers. 2) Monitoring prevalence and safety shoes

		workers with affected peoples at their camp in construction work. Thus, it is expected somewhat spreading of infectious diseases during construction and decommissioning stage. However, extent of impact is unknown at present.	and planned area.	and hats. (3) Regular check of occupational safety and health condition.
15) Working condition including occupational safety	C	(II, III, IV) Adverse impacts on working condition including occupational safety are expected somewhat due to insufficient management of workers at construction and decommissioning work, and at operation of power plants and related facilities. However, extent of impact is unknown at present.	(II, III, IV) 1) Regulation for labor and occupational health and safety. 2) Cases and causes of working condition issues including occupational health and safety in Jordan and planned area. 3) Management plan for working condition in construction and decommissioning work, and in operation of power plants and related facilities.	(II, III, IV) 1) Prepare tangible safety considerations in place for individuals involved in the plan, such as the installation of safety equipment which prevents accidents, and management of hazardous materials. 2) Plan and implement intangible measures for individuals involved in the plan, such as the establishment of a safety and health program, and safety training for workers etc. 3) Monitoring occupational health and safety condition.
16) Hazard/risk (disaster, security)	B	(T) No additional risk of disaster and public security are expected due to installation of power plant and related facilities. However, there is a possibility of increase in disaster and security risk, if the site is located to close to neighboring countries in conflict.	(T) 1) Cases and causes of hazard risks due to disaster in Jordan and the planned area. 2) Existing condition of public security due to uncertain political situation and conflict of neighboring countries.	(T) 1) Monitor uncertain condition of neighboring countries. 2) Prepare emergency action plan for hazard and public security risks.

17) Accidents	B	(II, III, IV) Occurrence of accidents is expected somewhat, if inappropriate handling and management of construction and decommissioning work, and insufficient operation of installed power plants and related facilities are carried out.	(II, III, IV) 1) Cases and causes of accidents in Jordan and planned area in construction and decommissioning work and in operation of power plants and related facilities.	(II, III, IV) 1) Preventive measures to accidents in construction and decommissioning work and in operation of power plants and related facilities. 2) Prepare emergency action plan for accidents.
(2) Natural Environment				
18) Topography and Geology	C	(II, IV) There is a possibility of causing adverse impact, if that a large-scale alteration of topographic and geologic features are included in construction plan of power plants and related facilities. However, extent of impact is unknown at present.	(II, IV) 1) Topographical and geological data in Jordan and planned area. 2) Anticipated amount of construction materials for procurement and removal of soil and stones for land clearance of power plants and related facilities.	(II, IV) 1) To avoid site and route with unstable and easy to collapsing condition. 2) To avoid land with topographical or geological importance.
19) Soil erosion/sand movement	C	(II, IV) There is a possibility of occurrence of soil erosion, if that a large-scale alteration of topographic and geologic features as well as cutting and filling of surface soil are included in construction plan of power plants and related facilities. However, extent of impact is unknown at present.	(II, IV) 1) Regulation for soil erosion and land slide. 2) Cases and causes of soil erosion and land slide in Jordan and planned area.	(II, IV) To avoid site and route with unstable soil condition in the area likely to occurrence of soil erosion and land slide.

20) Movement of water/Hydrological situation	C	(III) There is a possibility that hydrological conditions such as water flow and water level are adversely affected due to pumping up and discharging sea water for the power plant operation. However, extent of impact is unknown at present.	(II, III, IV) 1) Hydrological condition data in Jordan and planned area. 2) Distribution of surface water bodies (rivers, Wadis, etc.) and groundwater basin in planned area.	(II, III, IV) Monitoring hydrological condition of rivers, Wadis and groundwater
21) Coastal zone	B	(II, III, IV) There is a possibility that change in oceanographic conditions and coastal erosion/sedimentation due to construction and decommissioning work and pumping up sea water for storage inland reservoir at operation stage. However, extent of impact is unknown at present.	(II, III, IV) 1) Regulation of development and environmental conservation in coastal area. 2) Existing environmental condition of coastal area.	(II, III, IV) 1) Appropriate preventive measures against coastal erosion, and sedimentation of sand and soil in the plan. 2) Monitor oceanographic conditions, and coastal erosion and sedimentation of sand by physical observation and utilizing satellite image map.
22) Environmentally sensitive areas (Protected Areas, IBAs etc.)	B	(II, III, IV) In Jordan designated Protected Areas and Important Bird and Biodiversity Conservation Areas (IBAs) are distributed in the whole country. Thus, adverse impact on them is expected, if the site of power plants and related facilities is located within or close to the area.	(II, III, IV) 1) Distribution of designated Protected Areas, natural reserves and IBAs as well as parks in Jordan and the planned area. 2) Regulations for conservation of natural environment.	(II, III, IV) To avoid site location within or close to the designated Protected Areas and parks.
23) Flora, Fauna, Ecosystem and Biodiversity	B	(II, III, IV) In Jordan there are found many precious plant and animal species as well as important areas of valuable ecosystem and	(II, III, IV) 1) Distribution of site with valuable plant and animal species, ecosystem and	(II, III, IV) To avoid site location within or close to distribution areas of valuable plant and animal species, and environmentally

		biodiversity. Thus, adverse impact on them is expected, if the site of power plants and related facilities is located within or close to the area.	biodiversity in Jordan and the planned area. 2) Regulations for conservation of plant, animal species and biodiversity.	sensitive areas.
24) Landscape	B	(III) In Jordan cultural and heritage sites are distributed in the whole country and they consist of attractive landscape. Thus, there is a possibility of deterioration aesthetic value of landscape by spatial occupancy of power plants and related facilities.	(III) 1) Distribution of site with valuable landscape in Jordan and the planned area. 2) Regulation for preserving valuable landscape.	(III) 1) To avoid site location close to existing important landscape. 2) Measures to harmonize power plants and related facilities with surrounding landscape by design and tree planting in the plan.
25) Micro-climate	C	(II, III, IV) Most areas of Jordan are topographically flat and occupied by desert. Thus even a small change of topographical features such as appearance of new structures and facilities may cause influence to microclimate condition such as wind. However, extent of impact is unknown at present.	(II, III, IV) Meteorological data in Jordan and planned area including cases and causes of change in micro-climate in Jordan and planned area.	(II, III, IV) Monitor micro-climate by meteorological data and physical observation.
26) Global Warming	B	(II, IV) Generation of greenhouse gases (GHG) such as CO_2 and CH_4 is not exepcted from operation of wind power plant. However, generation of GHG is expected from construction vehicles and machines during construction and decommissioning stage.	(II, IV) 1) Existing data of greenhouse gases emission in Jordan and planned area. 2) Anticipated greenhouse gases emission from construction and decommissioning work.	(II, IV) Preventive measures to reduce greenhouse gases emission in construction and decommissioning work.

		However, extent of emission is not known at present		
(3) Environmental Pollution				
27) Air pollution	B	(II, IV) Generation of air pollutants such as dust and NOx are expected due to earth moving and engineering works during construction and decommissioning stage.	(II, IV) 1) Regulation of air pollution including air quality and emission standards. 2) Existing air quality in Jordan and planned area. 3) Anticipated emission of air pollutants from construction and decommissioning work	(II, IV) 1) Preventive measures to control air pollutants emission in construction and decommissioning work. 2) Monitor air pollutants emission and ambient air quality.
28) Water pollution	B	(II, IV) Generation of water pollutants such as SS and BOD is expected due to earth moving and engineering works during construction and decommissioning stage.	(II, IV) 1) Regulation of water pollution including water quality and effluent standards. 2) Existing water quality in Jordan and planned area. 3) Anticipated discharge of water pollutants from construction and decommissioning work	(II, IV) 1) Preventive measures to control water pollutants discharge in construction and decommissioning work. 2) Monitor water pollutants discharge and environmental water quality.
29) Soil contaminatio n	B	(II, IV) There is a possibility of soil contamination due to leakage of toxic or hazardous materials from construction and decommissioning work. However, features of the contamination is unknown at present.	(II, IV) 1) Regulation of soil contamination. 2) Cases and causes of soil contamination in Jordan and planned area.	(II, IV) 1) Preventive measures to avoid leakage toxic/hazardous materials in construction and decommissioning work. 2) Monitor soil contamination.

30) Bottom sediment	C	(II, IV) In case of power facility is located in coastal area, some impact on coastal conditions is expected due toconstruction and decommissioning work. However, extent of impact is unknown at present.	(II, IV) 1) Regulation of bottom sediment contamination. 2) Cases and causes of bottom sediment contamination.	(II, IV) Monitoring bottom sediment contamination.
31) Soild waste	B	(II, IV) Generation of solid wastes is expected from are expected due to earth moving and engineering works during construction and decommissioning stage.	(II, IV) 1) Regulation for solid waste management. 2) Existing situation of solid waste management in Jordan and planned area. 3) Anticipated generation of sold waste from construction and decommissioning work.	(II, IV) 1) Preventive measures for reduction, proper treatment and disposal of solid waste during construction/decommissioning stage in the plan. 2) Reflect concept of 3R (Reduce, reuse and recycle) to the plan. 3) Enlighten awareness of waste management to workers and employees.
32) Noise and Vibration	B	(II, IV) Generation of noise and vibration are expected from are expected due to earth moving and engineering works during construction and decommissioning stage.	(II, IV) 1) Regulation of noise and vibration. 2) Generation and ambient level of noise and vibration in Jordan and planned area. 3) Anticipated generation of noise and vibration from from construction and decommissioning work.	(II, IV) Preventive measures against generation of noise and vibration during operation of power plants and related facilities as well as during construction and decommissioning work.
33) Ground Subsidence	C	(II, III) There is a possibility of ground subsidence if extraction of a large scale extraction of groundwater is included in the project plan. However,	(II, III) 1) Regulation of ground subsidence. 2) Cases and causes ground subsidence in Jordan and planned area.	(II, III) Monitor occurrence of ground subsidence by physical observation.

		at present iti is unknown.		
34) Offensive odor	C	(II, IV) There is a possibility of offensive odor due to mal-functioned vehicles and construction machines during construction and decommissioning stage. However, at present it is unknown.	(II, IV) 1) Regulation of offensive odor. 2) Cases and causes of offensive odor issues in Jordan and planned area.	(II, IV) Preventive measures for generation of offensive odor from construction and decommissioning work.
35) Sunshine inhibition/Reflection of sunlight	C	(III) 1) If the power plants and related facilities are installed in densely populated area and surrounded by tall buildings, sunshine inhibition is somewhat expected. However, at present it is unknown. 2) As the solar panel is not installed, reflction of sunlight is not expected.	(III) 1) Regulation of sunshine inhibition. 2) Cases and causes of sunshine inhibition in Jordan and planned area.	(III) 1) To avoid site location close to densely populated area and tall buildings.
36) Electromagnetic interference	C	(III) If the power plants and related facilities are installed in densely populated area and surrounded by tall buildings, electromagnetic interference is somewhat expected. However, at present it is unknown.	(III) 1) Regulation of electromagnetic interference. 2) Cases and causes of electromagnetic interference issues in Jordan and planned area.	(III) 2) To avoid site location close to densely populated area and tall buildings.
37) Safety from Electromagnetic Field	C	(III) If the power plants and related facilities are installed keeping with sufficient distance and height from houses and other structures, it is expected that strength of	(III) 1) Regulation of safety from electromagnetic field. 2) Cases and causes of safety issues from electromagnetic filed in Jordan and planned	(III) 3) To keep location of power plants and related facilities with sufficient distance and height from houses and other structures.

		the electromagnetic field in ground level and upper floor level will be above the public electromagnetic exposure limit of the ICNIRP (International Commission for Non-Ionizing Radiation Protection). However, at present it is unknown.	area.	
(4) Permit, Explanation and Others				
Subject	C		(T) 1) Methodology of Environmental Impact Assessment in Jordan. 2) Items and Procedures for Permit/Approval. 3) Information disclosure. 4) Stakeholder participation. 5) International Treaties, Agreements, Convention.	(T) Comparison of Alternative Plans. 2) Environmental Management Plan, Environmental Monitoring Plan, Emergency Action Plan etc.

Source: JICA Study Team

(6) Wind Power Generation

Table 9.4.3 (12) Matrix Expression of Negative Impacts

**Environmental item *, ** **	**Rating ***, **** **				
	T	**I**	**II**	**III**	**IV**
(1) Social Environment					
1) Land acquisition and resettlement (Involuntary resettlement)	A/B	A/B	B	B	B
2) Local economy such as employment and livelihood etc.	C	C	C	C	C
3) Energy use	C	C	C	C	C
4) Water use	B	B	B	B	B

5) Land use and utilization of local resources	A/B	A/B	A/B	A/B	C
6) Social institutions such as social infrastructure and local decision-making institutions, a split of communities	C	C	C	C	C
7) Existing social infrastructures and services	C	C	C	C	C
8) The poor, indigenous of ethnic people	C	C	C	C	C
9) Misdistribution of benefit and damage (Equality of benefits and losses and equality involved in development process)	C	C	C	C	C
10) Local conflict of interests	C	C	C	C	C
11) Cultural property and heritage	B	D	B	C	C
12) Fishing rights, water rights and rights of common	C	C	C	C	C
13) Public health and Sanitation	C	D	C	C	C
14) Infectious diseases such as HIV/AIDS	C	D	C	C	C
15) Working condition including occupational safety	C	D	C	C	C
16) Hazard/risk (disaster, security)	B	B	B	B	B
17) Accidents	B	D	B	B	B
(2) Natural Environment					
18) Topography and Geology	C	D	C	C	C
19) Soil erosion/sand movement	C	D	C	C	C
20) Movement of water/Hydrological situation	C	D	C	C	C
21) Coastal zone	B	D	B	B	B
22) Environmentally sensitive areas (Protected Areas, IBAs etc.)	B	D	B	B	C
23) Flora, Fauna, Ecosystem and Biodiversity	B	D	B	B	C
24) Landscape	B	D	B	B	C
25) Micro-climate	C	D	C	C	C
26) Global Warming	B	D	B	C	B
(3) Environmental Pollution					
27) Air pollution	B	D	B	D	B

28) Water pollution	B	D	B	D	B
29) Soil contamination	B	D	B	B	C
30) Bottom sediment	C	D	C	C	C
31) Soild waste	B	D	B	C	B
32) Noise and Vibration	B	D	B	B	C
33) Ground Subsidence	C	D	C	C	C
34) Offensive odor	C	D	C	C	C
35) Sunshine inhibition/Reflection of sunlight	C	D	C	B	C
36) Electromagnetic interference	C	D	C	C	C
37) Safety from Electromagnetic Field	C	D	C	C	C
(4) Permit, Explanation and Others					
Subject	C				

Source: JICA Study Team

Table 9.4.3 (13) AnticipatedNegative Impacts and Necessary Information/Date and Possible Mitigation Measures

Environmental item *, **	**Rating ***, ******	**Reasons**	**Further Necessary Information/Data**	**Possible Mitigation Measures**
(1) Social Environment				
1) Land acquisition and resettlement (Involuntary resettlement)	A/B	(T) To secure the lands/spaces for planned wind power plants and related facilities, there is a possibility of involuntary resettlement including land acquisition and resettlement as well as wayleaves, generation of Project Affected Persons (PAPs), although it depends on the details of the plan (site	(T) 1) Laws and regulations for involuntary resettlement (land acquisition and resettlement) and easement/wayleaves. 2) Land use regulation and existing land use in Jordan and planned area. 3) Cases and causes of involuntary resettlement in Jordan and planned	(T) 1) Consider alternative plans to avoid and/or minimize the occurrence of involuntary resettlement. 2) Detailed inventory survey on plots, facilities, structures and peoples living along the planned railway routes. 3) Survey on encroachment on ROW (Right Of Way) of the planned

		location/route, scale, components etc.).	area. 4) Anticipated land area and location for the site to be secured by the plan.	site/alignment. 4) Examine procedure and condition of involuntary resettlement and compensation to PAPs taking relevant laws in Jordan and the JICA Guidelines into considerations. 5) From early stage of the project, pay attention to information disclosure and consultation with stakeholders including PAPs for thorough understanding of the issues or to make agreement as much as possible. 6) Elaborate Resettlement Action Plan (RAP), if involuntary resettlement is unavoidable.
2) Local economy such as employment and livelihood etc.	C	(T) Beneficial impacts are expected on local economy; (i) creation of employment opportunity for civil work during construction and decommissioning stage, (ii) new power generation may improve living condition. However, extent of impact is unknown at present.	(T) 1) Development PPPs of Jordan and other sectors (tourism, industry, mining, regional development etc.) 2) Labor force and employment and working needs in planned area.	(T) 1) Promote consistency and synergy with other development plans (PPPs) by whole country and other sectors.
3) Energy use	C	(T) As the wind power is used for energy source, no negative impact is expected.	(T) Meteorological data about wind conditions.	(T) Consider the plan to select site location with good wind conditions.
4) Water use	B	(II, IV) Jordan has very limited water resources and available water resources continue to fall with	(T) 1) Laws and regulations for water use and water extraction form water resources. 2)	(T) 1) Consider minimize water use in construction and decommissioning work and in operation of

		population growth everywhere in the country. Thus, water supply for construction and decommissioning work is expected to face severe competence with other water supply.	Water demand and supply in Jordan and planned area. 3) Anticipated water use in construction and decommissioning work and in operation of power plants and related facilities.	power plants and related facilities in the plan. 2) Monitor water consumption in the plan.
5) Land use and utilization of local resources	A/B	(V) Some alteration of existing land use and utilization of local resources is expected. However, extent of impact depends on the plan of power plants and related facilities.	(T) 1) Laws and regulation for use of land and resources. 2) Existing and future land and resources use in Jordan and planned area.	(T) Consider appropriate and effective utilization of land and resources in the plan.
6) Social institutions such as social infrastructure and local decision-making institutions, a split of communities	C	(T) There is a possibility of missing acceptance by the communities and causing split of community, if the plan is not properly informed to relevant stakeholders including community based organizations for participation.	(T) Information of administrative and social structures and decision-making process and institutions in Jordan and planned area.	(T) Information disclosure and public participation should be fully considered for stakeholders including decision-makers of the communities from early stage of planning for obtaining thorough understanding and consensus of the people and communities by promoting that the plan may contribute to improvement of local economy and upgrading living conditions.
7) Existing social infrastructures and services	C	(T) Electricity supply by power plants and related facilities will contribute to improvement condition of basic infrastructure and at the same time to upgrading social services. However,	(T) 1) Laws and regulations for social infrastructures and services. 2) Existing situation of social infrastructures and services in Jordan and	(T) 1) Avoid or minimize disturbance existing social infrastructures and services in the plan. 2) Promote synergy with plans for other social infrastructure and services.

		extent of impact is unknown at present.	planned area.	
8) The poor, indigenous of ethnic people	C	(T) Power plants and related facilities is expected to contribute to creation of employment opportunity for construction and decommissioning work and improvement living condition by supply of electricity. However, it is unknown whether the poor and vulnerables are able to enjoy the benefit equally or not at present.	(T) 1) Data of vulnerable groups such as the poor, female, children, elders, disabled, refugees and indigenous ethnic people in Jordan and planned area. 2) Supporting activities to living and livelihood condition by Jordan Government and donors.	(T) 1) Give higher priority to the vulnerable groups in the planned area with having a chance to get jobs and training to get working skills in the plan. 2) The vulnerable people should be taken fully considerations to compensate properly or support to restore the present living condition in case of involuntary resettlement, even if they are illegal occupants.
9) Misdistribution of benefit and damage (Equality of benefits and losses and equality involved in development process)	C	(T) Beneficial impacts such as contribute to creation of employment opportunity for construction and decommissioning work and improvement living condition by supply of electricity through power plants and related facilities. However, there is a possibility of misdistribution of benefit and damage, if the plan is not appropriately accepted to relevant stakeholders including communities through proper information disclosure and public participation.	(T) Cases and causes of misdistribution of benefit and damage by the development plans of electric sector and others in Jordan and planned area.	(T) Information disclosure and public participation should be fully considered from early stage to obtain thorough understanding the plan and consensus among the communities and PAPs in order to share with benefit and damage equally.
10) Local conflict of interests	C	(T) Beneficial impacts such as contribute to creation of employment opportunity for construction and	(T) Cases and causes of local conflict of interests by the development plans of electric sector and	(T) Information disclosure and public participation should be fully considered from early stage to obtain

		decommissioning work and improvement living condition by supply of electricity through power plants and related facilities. However, there is a possibility of generation of local conflict, if the plan is not appropriately accepted to relevant stakeholders including communities through proper information disclosure and public participation.	others in Jordan and planned area.	thorough understanding the plan and consensus among the communities and PAPs in order to avoid or minimize local conflict of interests.
11) Cultural property and heritage	B	(II, III,) In Jordan sites of cultural properties and heritages are distributed in the whole country. Thus, adverse impact on them is expected, if the site of power plants and related facilities is located within or close to the site.	(II, III) 1) Laws and regulations of cultural property and heritage site. 2) Distribution of cultural property and heritage site in Jordan and the planned area.	(T) 1) Avoid the site and route penetrating or close to the sites of cultural properties, heritages and archaeological importance in the plan. 2) If any buried cultural properties are found at construction work, report and consult with concerned organizations such as Ministry of Tourism and Antiquities without delay.
12) Fishing rights, water rights and rights of common	C	(T) There is a possibility of disturbing fishing rights, water rights and rights of common depending on the project plan. However, extent of impact is unknown at present.	(T) Situation of fishing rights, water rights and rights of common in Jordan and planned area.	(T) Promote participation of those who have the rights in order to get their opinion and ensuring understanding and making consent in the course of the stakeholder meeting from the planning stage
13) Public health and Sanitation	B	(II, IV) There is a possibility of deterioration respiratory functions due to inhalation of air pollutants such as NOx and PM10, if control of	(II, III, IV) 1) Laws and regulations of public health and sanitation. 2) Public health condition including respiratory	(T) 1) Preventive measures to control air pollutants emission in construction and decommissioning work

		pollutants emission in construction and decommissioning work is not conducted appropriately. However, at present extent of impact is unknown.	disease and distribution of medical facilities in Jordan and planned area.	and in operation of power plants and related facilities. 2) Monitor public health condition by medical examination.
14) Infectious diseases such as HIV/AIDS	C	(II, IV) In many developing countries spreading of infectious diseases such as HIV/AIDS were often reported due to contact of workers with affected peoples at their camp in construction work. Thus, it is expected somewhat spreading of infectious diseases during construction and decommissioning stage. However, extent of impact is unknown at present.	(II、IV) 1) Regulations for infectious diseases. 2) Cases and causes of infectious diseases such as HIV/AIDS in Jordan and planned area.	(II, IV) 1) Enlightenment and education of infectious diseases to people and workers. 2) Monitoring prevalence and safety shoes and hats. (3) Regular check of occupational safety and health condition.
15) Working condition including occupational safety	C	(II, III, IV) Adverse impacts on working condition including occupational safety are expected somewhat due to insufficient management of workers at construction and decommissioning work, and at operation of power plants and related facilities. However, extent of impact is unknown at present.	(II, III, IV) 1) Regulation for labor and occupational health and safety. 2) Cases and causes of working condition issues including occupational health and safety in Jordan and planned area. 3) Management plan for working condition in construction and decommissioning work, and in operation of power plants and related facilities.	(II, III, IV) 1) Prepare tangible safety considerations in place for individuals involved in the plan, such as the installation of safety equipment which prevents accidents, and management of hazardous materials. 2) Plan and implement intangible measures for individuals involved in the plan, such as the establishment of a safety and health program, and safety training for workers etc. 3) Monitoring occupational health and safety condition.

16) Hazard/risk (disaster, security)	B	(T) No additional risk of disaster and public security are expected due to installation of power plant and related facilities. However, there is a possibility of increase in disaster and security risk, if the site is located to close to neighboring countries in conflict.	(T) 1) Cases and causes of hazard risks due to disaster in Jordan and the planned area. 2) Existing condition of public security due to uncertain political situation and conflict of neighboring countries.	(T) 1) Monitor uncertain condition of neighboring countries. 2) Prepare emergency action plan for hazard and public security risks.
17) Accidents	B	(II, III, IV) Occurrence of accidents is expected somewhat, if inappropriate handling and management of construction and decommissioning work, and insufficient operation of installed power plants and related facilities are carried out.	(II, III, IV) 1) Cases and causes of accidents in Jordan and planned area in construction and decommissioning work and in operation of power plants and related facilities.	(II, III, IV) 1) Preventive measures to accidents in construction and decommissioning work and in operation of power plants and related facilities. 2) Prepare emergency action plan for accidents.
(2) Natural Environment				
18) Topography and Geology	C	(II, IV) There is a possibility of causing adverse impact, if that a large-scale alteration of topographic and geologic features are included in construction plan of power plants and related facilities. However, extent of impact is unknown at present.	(II, IV) 1) Topographical and geological data in Jordan and planned area. 2) Anticipated amount of construction materials for procurement and removal of soil and stones for land clearance of power plants and related facilities.	(II, IV) 1) To avoid site and route with unstable and easy to collapsing condition. 2) To avoid land with topographical or geological importance.
19) Soil erosion/sand movement	C	(II, IV) There is a possibility of occurrence of soil erosion, if that a large-scale alteration of topographic and geologic features as well as cutting and filling of surface soil are included in construction plan	(II, IV) 1) Regulation for soil erosion and land slide. 2) Cases and causes of soil erosion and land slide in Jordan and planned area.	(II, IV) To avoid site and route with unstable soil condition in the area likely to occurrence of soil erosion and land slide.

		of power plants and related facilities. However, extent of impact is unknown at present.		
20) Movement of water/Hydrological situation	C	(II, III, IV) There is a possibility that hydrological conditions such as water flow and water level are adversely affected due to landing work of fuels and other materials at port and/or water storage by pumping up at hydropower plant. However, extent of impact is unknown at present.	(II, III, IV) 1) Hydrological condition data in Jordan and planned area. 2) Distribution of surface water bodies (rivers, Wadis, etc.) and groundwater basin in planned area.	(II, III, IV) Monitoring hydrological condition of rivers, Wadis and groundwater
21) Coastal zone	C	(II, IV) In case of power facility is located in coastal area, some impact on coastal conditions is expected due toconstruction and decommissioning work. However, extent of impact is unknown at present.	(II, IV) 1) Regulation of development and environmental conservation in coastal area. 2) Existing environmental condition of coastal area.	(II, IV) 1) Appropriate preventive measures against coastal erosion, and sedimentation of sand and soil in the plan. 2) Monitor oceanographic conditions, and coastal erosion and sedimentation of sand by physical observation and utilizing satellite image map.
22) Environmentally sensitive areas (Protected Areas, IBAs etc.)	B	(II, III, IV) 1) In Jordan designated Protected Areas and Important Bird and Biodiversity Conservation Areas (IBAs) are distributed in the whole country. Thus, adverse impact on them is expected, if the site of power plants and related facilities is located within or close to the area. 2) In addition, hill and mountainous areas are transfer route of transboundary migratory birds between Europe/Asia	(II, III, IV) 1) Distribution of designated Protected Areas, natural reserves and IBAs as well as parks in Jordan and the planned area. 2) Regulations for conservation of natural environment.	(II, III, IV) To avoid site location within or close to the designated Protected Areas and parks.

		and Africa. Therefore, there is a possibility of migratory birds striking to wind tower.		
23) Flora, Fauna, Ecosystem and Biodiversity	B	(II, III, IV) 1) In Jordan there are found many precious plant and animal species as well as important areas of valuable ecosystem and biodiversity. Thus, adverse impact on them is expected, if the site of power plants and related facilities is located within or close to the area. 2) In addition, hill and mountainous areas are transfer route of transboundary migratory birds between Europe/Asia and Africa. Therefore, there is a possibility of migratory birds striking to wind tower.	(II, III, IV) 1) Distribution of site with valuable plant and animal species, ecosystem and biodiversity in Jordan and the planned area. 2) Regulations for conservation of plant, animal species and biodiversity.	(II, III, IV) To avoid site location within or close to distribution areas of valuable plant and animal species, and environmentally sensitive areas.
24) Landscape	B	(III) In Jordan cultural and heritage sites are distributed in the whole country and they consist of attractive landscape. Thus, there is a possibility of deterioration aesthetic value of landscape by spatial occupancy of wind tower.	(III) 1) Distribution of site with valuable landscape in Jordan and the planned area. 2) Regulation for preserving valuable landscape.	(III) 1) To avoid site location close to existing important landscape. 2) Measures to harmonize power plants and related facilities with surrounding landscape by design and tree planting in the plan.
25) Micro-clima te	C	(II, III, IV) Most areas of Jordan are topographically flat and occupied by desert. Thus even a small change of topographical features such as appearance of new structures and facilities may cause influence to microclimate condition such	(II, III, IV) Meteorological data in Jordan and planned area including cases and causes of change in micro-climate in Jordan and planned area.	(II, III, IV) Monitor micro-climate by meteorological data and physical observation.

		as wind. However, extent of impact is unknown at present.		
26) Global Warming	B	(II, IV) Generation of greenhouse gases (GHG) such as CO_2 and CH_4 is not expected from operation of wind power plant. However, generation of GHG is expected from construction vehicles and machines during construction and decommissioning stage. However, extent of emission is not known at present	(II, IV) 1) Existing data of greenhouse gases emission in Jordan and planned area. 2) Anticipated greenhouse gases emission from construction and decommissioning work.	(II, IV) Preventive measures to reduce greenhouse gases emission in construction and decommissioning work.
(3) Environmental Pollution				
27) Air pollution	B	(II, IV) Generation of air pollutants such as dust and NOx are expected due to earth moving and engineering works during construction and decommissioning stage.	(II, IV) 1) Regulation of air pollution including air quality and emission standards. 2) Existing air quality in Jordan and planned area. 3) Anticipated emission of air pollutants from construction and decommissioning work	(II, IV) 1) Preventive measures to control air pollutants emission in construction and decommissioning work. 2) Monitor air pollutants emission and ambient air quality.
28) Water pollution	B	(II, IV) Generation of water pollutants such as SS and BOD is expected due to earth moving and engineering works during construction and decommissioning stage.	(II, IV) 1) Regulation of water pollution including water quality and effluent standards. 2) Existing water quality in Jordan and planned area. 3) Anticipated discharge of water pollutants from construction and decommissioning work	(II, IV) 1) Preventive measures to control water pollutants discharge in construction and decommissioning work. 2) Monitor water pollutants discharge and environmental water quality.

29) Soil contaminatio n	B	(II, IV) There is a possibility of soil contamination due to leakage of toxic or hazardous materials from construction and decommissioning work. However, features of the contamination is unknown at present.	(II, IV) 1) Regulation of soil contamination. 2) Cases and causes of soil contamination in Jordan and planned area.	(II, IV) 1) Preventive measures to avoid leakage toxic/hazardous materials in construction and decommissioning work. 2) Monitor soil contamination.
30) Bottom sediment	B	(II, IV) In case of power facility is located in coastal area, some impact on coastal conditions is expected due to construction and decommissioning work. However, extent of impact is unknown at present.	(II, IV) 1) Regulation of bottom sediment contamination. 2) Cases and causes of bottom sediment contamination.	(II, IV) Monitoring bottom sediment contamination.
31) Solid waste	B	(II, IV) Generation of solid wastes is expected from are expected due to earth moving and engineering works during construction and decommissioning stage.	(II, IV) 1) Regulation for solid waste management. 2) Existing situation of solid waste management in Jordan and planned area. 3) Anticipated generation of solid waste from construction and decommissioning work.	(II, IV) 1) Preventive measures for reduction, proper treatment and disposal of solid waste during construction/decommissio ning stage in the plan. 2) Reflect concept of 3R (Reduce, reuse and recycle) to the plan. 3) Enlighten awareness of waste management to workers and employees.
32) Noise and Vibration	B	(II, IV) Generation of noise and vibration are expected from are expected due to earth moving and engineering works during construction and decommissioning stage.	(II, IV) 1) Regulation of noise and vibration. 2) Generation and ambient level of noise and vibration in Jordan and planned area. 3) Anticipated generation of noise and vibration from construction and decommissioning work.	(II, IV) Preventive measures against generation of noise and vibration during operation of power plants and related facilities as well as during construction and decommissioning work.

33) Ground Subsidence	C	(II, III) There is a possibility of ground subsidence if extraction of a large scale extraction of groundwater is included in the project plan. However, at present iti is unknown.	(II, III) 1) Regulation of ground subsidence. 2) Cases and causes ground subsidence in Jordan and planned area.	(II, III) Monitor occurrence of ground subsidence by physical observation.
34) Offensive odor	C	(II, IV) There is a possibility of offensive odor due to mal-functioned vehicles and construction machines during construction and decommissioning stage. However, at present it is unknown.	(II, IV) 1) Regulation of offensive odor. 2) Cases and causes of offensive odor issues in Jordan and planned area.	(II, IV) Preventive measures for generation of offensive odor from construction and decommissioning work.
35) Sunshine inhibition/reflection	C	(III) 1) If the power plants and related facilities are installed in densely populated area and surrounded by tall buildings, sunshine inhibition is somewhat expected. However, at present it is unknown. 2) As the solar panel is not installed, reflection of sunlight is not expected.	(III) 1) Regulation of sunshine inhibition. 2) Cases and causes of sunshine inhibition in Jordan and planned area.	(III) 1) To avoid site location close to densely populated area and tall buildings.
36) Electromagnetic interference	C	(III) If the power plants and related facilities are installed in densely populated area and surrounded by tall buildings, electromagnetic interference is somewhat expected. However, at present it is unknown.	(III) 1) Regulation of electromagnetic interference. 2) Cases and causes of electromagnetic interference issues in Jordan and planned area.	(III) 2) To avoid site location close to densely populated area and tall buildings.
37) Safety from Electromagnetic Field	C	(III) If the power plants and related facilities are installed keeping with sufficient distance and height from houses and other structures, it	(III) 1) Regulation of safety from electromagnetic field. 2) Cases and causes of safety issues from	(III) 3) To keep location of power plants and related facilities with sufficient distance and height from houses and other

		is expected that strength of the electromagnetic field in ground level and upper floor level will be above the public electromagnetic exposure limit of the ICNIRP (International Commission for Non-Ionizing Radiation Protection). However, at present it is unknown.	electromagnetic filed in Jordan and planned area.	structures.
(4) Permit, Explanation and Others				
Subject	C		(T) 1) Methodology of Environmental Impact Assessment in Jordan. 2) Items and Procedures for Permit/Approval. 3) Information disclosure. 4) Stakeholder participation. 5) International Treaties, Agreements, Convention.	(T) Comparison of Alternative Plans. 2) Environmental Management Plan, Environmental Monitoring Plan, Emergency Action Plan etc.

Source: JICA Study Team

(7) Solar Power Generation

Table 9.4.3 (14) Matrix Expression of Negative Impacts

**Environmental item *, ** **	**Rating ***, ******				
	T	**I**	**II**	**III**	**IV**
(1) Social Environment					
1) Land acquisition and resettlement (Involuntary resettlement)	A/B	A/B	B	B	B
2) Local economy such as employment and livelihood etc.	C	C	C	C	C
3) Energy use	C	C	D	D	D
4) Water use	B	C	B	C	B
5) Land use and utilization of local resources	B	B	B	D	B
6) Social institutions such as social infrastructure and local	C	C	C	C	C

decision-making institutions, a split of communities					
7) Existing social infrastructures and services	C	C	C	C	C
8) The poor, indigenous of ethnic people	C	C	C	C	C
9) Misdistribution of benefit and damage (Equality of benefits and losses and equality involved in development process)	C	C	C	C	C
10) Local conflict of interests	C	C	C	C	C
11) Cultural property and heritage	B	D	B	C	C
12) Fishing rights, water rights and rights of common	C	C	C	C	C
13) Public health and Sanitation	B	D	B	C	B
14) Infectious diseases such as HIV/AIDS	C	D	C	C	C
15) Working condition including occupational safety	C	D	C	C	C
16) Hazard/risk (disaster, security)	B	B	B	B	B
17) Accidents	B	D	B	B	B
(2) Natural Environment					
18) Topography and Geology	C	D	C	C	C
19) Soil erosion/sand movement	C	D	C	C	C
20) Movement of water/Hydrological situation	C	D	C	C	C
21) Coastal zone	C	D	C	D	C
22) Environmentally sensitive areas (Protected Areas, IBAs etc.)	B	D	B	B	C
23) Flora, Fauna, Ecosystem and Biodiversity	B	D	B	B	C
24) Landscape	B	D	B	B	C
25) Micro-climate	B	D	C	B	C
26) Global Warming	B	D	B	D	B
(3) Environmental Pollution					
27) Air pollution	B	D	B	D	B
28) Water pollution	B	D	B	D	B
29) Soil contamination	B	D	B	B	C

30) Bottom sediment	C	D	C	C	C
31) Soild waste	B	D	B	C	B
32) Noise and Vibration	B	D	B	B	C
33) Ground Subsidence	C	D	C	C	C
34) Offensive odor	C	D	C	C	C
35) Sunshine inhibition/Reflection of sunlight	C	D	C	B	C
36) Electromagnetic interference	C	D	C	C	C
37) Safety from Electromagnetic Field	C	D	C	C	C
(4) Permit, Explanation and Others					
Subject	C				

Source: JICA Study Team

Table 9.4.3 (15) AnticipatedNegative Impacts and Necessary Information/Date and Possible Mitigation Measures

Environmental item *, ****	**Rating ***, ********	**Reasons**	**Further Necessary Information/Data**	**Possible Mitigation Measures**
(1) Social Environment				
1) Land acquisition and resettlement (Involuntary resettlement)	A/B	(T) To secure the lands/spaces for planned solar photovoltaic power plants and related facilities, there is a possibility of involuntary resettlement including land acquisition and resettlement as well as wayleaves, generation of Project Affected Persons (PAPs), although it depends on the details of the plan (site location/route, scale,	(T) 1) Laws and regulations for involuntary resettlement (land acquisition and resettlement) and easement/wayleaves. 2) Land use regulation and existing land use in Jordan and planned area. 3) Cases and causes of involuntary resettlement in Jordan and planned area. 4) Anticipated land area and location for the site to be	(T) 1) Consider alternative plans to avoid and/or minimize the occurrence of involuntary resettlement. 2) Detailed inventory survey on plots, facilities, structures and peoples living along the planned railway routes. 3) Survey on encroachment on ROW (Right Of Way) of the planned site/alignment. 4) Examine procedure and condition of involuntary resettlement and compensation to PAPs taking relevant laws in Jordan and the

		components etc.).	secured by the plan.	JICA Guidelines into considerations. 5) From early stage of the project, pay attention to information disclosure and consultation with stakeholders including PAPs for thorough understanding of the issues or to make agreement as much as possible. 6) Elaborate Resettlement Action Plan (RAP), if involuntary resettlement is unavoidable.
4) Water use	B	(II, IV) Jordan has very limited water resources and available water resources continue to fall with population growth everywhere in the country. Thus, water supply for construction and decommissioning work is expected to face severe competence with other water supply.	(T) 1) Laws and regulations for water use and water extraction form water resources. 2) Water demand and supply in Jordan and planned area. 3) Anticipated water use in construction and decommissioning work and in operation of power plants and related facilities.	(T) 1) Consider minimize water use in construction and decommissioning work and in operation of power plants and related facilities in the plan. 2) Monitor water consumption in the plan.
5) Land use and utilizatio n of local resources	B	(V) Some alteration of existing land use and utilization of local resources is expected. Especially to generate a large scale solar photovoltaic power, there is a possibility of a large scale land reclamation.	(T) 1) Laws and regulation for use of land and resources. 2) Existing and future land and resources use in Jordan and planned area.	(T) Consider appropriate and effective utilization of land and resources in the plan.
11) Cultural property and heritage	B	(II, III,) In Jordan sites of cultural properties and heritages are distributed in the whole country. Thus, adverse impact on them is expected, if the	(II, III) 1) Laws and regulations of cultural property and heritage site. 2) Distribution of cultural property and heritage site in Jordan and the planned	(T) 1) Avoid the site and route penetrating or close to the sites of cultural properties, heritages and archaeological importance in the plan. 2) If any buried cultural properties are found at

		site of power plants and related facilities is located within or close to the site.	area.	construction work, report and consult with concerned organizations such as Ministry of Tourism and Antiquities without delay.
16) Hazard/risk (disaster, security)	B	(T) No additional risk of disaster and public security are expected due to installation of power plant and related facilities. However, there is a possibility of increase in disaster and security risk, if the site is located to close to neighboring countries in conflict.	(T) 1) Cases and causes of hazard risks due to disaster in Jordan and the planned area. 2) Existing condition of public security due to uncertain political situation and conflict of neighboring countries.	(T) 1) Monitor uncertain condition of neighboring countries. 2) Prepare emergency action plan for hazard and public security risks.
17) Accidents	B	(II, III, IV) Occurrence of accidents is expected somewhat, if inappropriate handling and management of construction and decommissioning work, and insufficient operation of installed power plants and related facilities are carried out.	(II, III, IV) 1) Cases and causes of accidents in Jordan and planned area in construction and decommissioning work and in operation of power plants and related facilities.	(II, III, IV) 1) Preventive measures to accidents in construction and decommissioning work and in operation of power plants and related facilities. 2) Prepare emergency action plan for accidents.
(2) Natural Environment				
22) Environmentally sensitive areas (Protected Areas, IBAs etc.)	B	(II, III, IV) 1) In Jordan designated Protected Areas and Important Bird and Biodiversity Conservation Areas (IBAs) are distributed in the whole country. Thus, adverse impact on them is expected, if the site of power plants and related	(II, III, IV) 1) Distribution of designated Protected Areas, natural reserves and IBAs as well as parks in Jordan and the planned area. 2) Regulations for conservation of natural environment.	(II, III, IV) To avoid site location within or close to the designated Protected Areas and parks.

		facilities is located within or close to the area. 2) In addition, hill and mountainous areas are transfer route of transboundary migratory birds between Europe/Asia and Africa. Therefore, there is a possibility of migratory birds striking to solar power panel.		
23) Flora, Fauna, Ecosystem and Biodiversity	B	(II, III, IV) 1) In Jordan there are found many precious plant and animal species as well as important areas of valuable ecosystem and biodiversity. Thus, adverse impact on them is expected, if the site of power plants and related facilities is located within or close to the area. 2) In addition, hill and mountainous areas are transfer route of transboundary migratory birds between Europe/Asia and Africa. Therefore, there is a possibility of migratory birds striking to solar power panel.	(II, III, IV) 1) Distribution of site with valuable plant and animal species, ecosystem and biodiversity in Jordan and the planned area. 2) Regulations for conservation of plant, animal species and biodiversity.	(II, III, IV) To avoid site location within or close to distribution areas of valuable plant and animal species, and environmentally sensitive areas.
24) Landscape	B	(III) In Jordan cultural and heritage sites are distributed in the whole country and they consist of attractive landscape. Thus, there is a	(III) 1) Distribution of site with valuable landscape in Jordan and the planned area. 2) Regulation for preserving valuable	(III) 1) To avoid site location close to existing important landscape. 2) Measures to harmonize power plants and related facilities with surrounding landscape by

		possibility of deterioration aesthetic value of landscape by spatial occupancy of a large scale solar power panels.	landscape.	design and tree planting in the plan.
26) Global Warming	B	(II, IV) Generation of greenhouse gases (GHG) such as CO_2 and CH_4 is not exepcted from operation of solar power plant. However, generation of GHG is expected from construction vehicles and machines during construction and decommissioning stage. However, extent of emission is not known at present	(II, IV) 1) Existing data of greenhouse gases emission in Jordan and planned area. 2) Anticipated greenhouse gases emission from construction and decommissioning work.	(II, IV) Preventive measures to reduce greenhouse gases emission in construction and decommissioning work.
(3) Environmental Pollution				
27) Air pollution	B	(II, IV) Generation of air pollutants such as dust and NOx are expected due to earth moving and engineering works during construction and decommissioning stage.	(II, IV) 1) Regulation of air pollution including air quality and emission standards. 2) Existing air quality in Jordan and planned area. 3) Anticipated emission of air pollutants from construction and decommissioning work	(II, IV) 1) Preventive measures to control air pollutants emission in construction and decommissioning work. 2) Monitor air pollutants emission and ambient air quality.
28) Water pollution	B	(II, IV) Generation of water pollutants such as SS and BOD is expected due to earth moving and engineering works during construction and	(II, IV) 1) Regulation of water pollution including water quality and effluent standards. 2) Existing water quality in Jordan and planned area. 3) Anticipated discharge of	(II, IV) 1) Preventive measures to control water pollutants discharge in construction and decommissioning work. 2) Monitor water pollutants discharge and environmental

		decommissioning stage.	water pollutants from construction and decommissioning work	water quality.
29) Soil contamination	B	(II, IV) There is a possibility of soil contamination due to leakage of toxic or hazardous materials from construction and decommissioning work. However, features of the contamination is unknown at present.	(II, IV) 1) Regulation of soil contamination. 2) Cases and causes of soil contamination in Jordan and planned area.	(II, IV) 1) Preventive measures to avoid leakage toxic/hazardous materials in construction and decommissioning work. 2) Monitor soil contamination.
31) Soild waste	B	(II, IV) Generation of solid wastes is expected from are expected due to earth moving and engineering works during construction and decommissioning stage.	(II, IV) 1) Regulation for solid waste management. 2) Existing situation of solid waste management in Jordan and planned area. 3) Anticipated generation of sold waste from construction and decommissioning work.	(II, IV) 1) Preventive measures for reduction, proper treatment and disposal of solid waste during construction/decommissioning stage in the plan. 2) Reflect concept of 3R (Reduce, reuse and recycle) to the plan. 3) Enlighten awareness of waste management to workers and employees.
32) Noise and Vibration	B	(II, IV) Generation of noise and vibration are expected from are expected due to earth moving and engineering works during construction and decommissioning stage.	(II, IV) 1) Regulation of noise and vibration. 2) Generation and ambient level of noise and vibration in Jordan and planned area. 3) Anticipated generation of noise and vibration from from construction and decommissioning work.	(II, IV) Preventive measures against generation of noise and vibration during operation of power plants and related facilities as well as during construction and decommissioning work.

35) Sunshine inhibition /Reflection of sunlight	B	(III) 1) If the power plants and related facilities are installed in densely populated area and surrounded by tall buildings, sunshine inhibition is somewhat expected. However, at present it is unknown. 2) There is a possibility of dazzling impact due to sunlight reflection by solar panel, if the panel is not installed appropriately.	(III) 1) Regulation of sunshine inhibition. 2) Cases and causes of sunshine inhibition in Jordan and planned area.	(III) 1) To avoid site location close to densely populated area and tall buildings. 2) To install solar panel with sufficient distance from surrounding facilirties and structures, and setting angle of the panel to minimize sunlight reflection.
(4) Permit, Explanation and Others				
Subject	C		(T) 1) Methodology of Environmental Impact Assessment in Jordan. 2) Items and Procedures for Permit/Approval. 3) Information disclosure. 4) Stakeholder participation. 5) International Treaties, Agreements, Convention.	(T) Comparison of Alternative Plans. 2) Environmental Management Plan, Environmental Monitoring Plan, Emergency Action Plan etc.

Source: JICA Study Team

(8) Transmission and Distribution Network System

Table 9.4.3 (16) Matrix Expression of Negative Impacts

Environmental item *, **	Rating ***, ****				
	T	I	II	III	IV
(1) Social Environment					
1) Land acquisition and resettlement (Involuntary resettlement)	A/B	A/B	B	B	B
2) Local economy such as employment and livelihood etc.	C	C	C	C	C
3) Energy use	C	C	D	D	D

4) Water use	B	C	B	C	B
5) Land use and utilization of local resources	B	B	B	C	C
6) Social institutions such as social infrastructure and local decision-making institutions, a split of communities	C	C	C	C	C
7) Existing social infrastructures and services	C	C	C	C	C
8) The poor, indigenous of ethnic people	C	C	C	C	C
9) Misdistribution of benefit and damage (Equality of benefits and losses and equality involved in development process)	C	C	C	C	C
10) Local conflict of interests	C	C	C	C	C
11) Cultural property and heritage	B	D	B	C	C
12) Fishing rights, water rights and rights of common	C	C	C	C	C
13) Public health and Sanitation	B/C	D	B	C	B
14) Infectious diseases such as HIV/AIDS	C	D	C	C	C
15) Working condition including occupational safety	C	D	C	C	C
16) Hazard/risk (disaster, security)	B	B	B	B	B
17) Accidents	B	D	B	B	B
(2) Natural Environment					
18) Topography and Geology	C	D	C	C	C
19) Soil erosion/sand movement	C	D	C	C	C
20) Movement of water/Hydrological situation	C	D	C	C	C
21) Coastal zone	C	D	C	D	C
22) Environmentally sensitive areas (Protected Areas, IBAs etc.)	B	D	B	B	C
23) Flora, Fauna, Ecosystem and Biodiversity	B	D	B	B	C
24) Landscape	B	D	B	B	C
25) Micro-climate	C	D	C	C	C
26) Global Warming	B	D	B	C	B
(3) Environmental Pollution					

27) Air pollution	B	D	B	D	B
28) Water pollution	B	D	B	D	B
29) Soil contamination	B	D	B	B	C
30) Bottom sediment	C	D	C	C	C
31) Soild waste	B	D	B	C	B
32) Noise and Vibration	B	D	B	B	C
33) Ground Subsidence	C	D	C	C	C
34) Offensive odor	C	D	C	C	C
35) Sunshine inhibition/Reflection of sunlight	C	D	C	B	C
36) Electromagnetic interference	C	D	C	C	C
37) Safety from Electromagnetic Field	C	D	C	C	C
(4) Permit, Explanation and Others					
Subject					

Source: JICA Study Team

Table 9.4.3 (17) AnticipatedNegative Impacts and Necessary Information/Date and Possible Mitigation Measures

Environmental item *, **	**Rating ***, ******	**Reasons**	**Further Necessary Information/Data**	**Possible Mitigation Measures**
(1) Social Environment				
1) Land acquisition and resettlement (Involuntary resettlement)	A/B	(T) To secure the lands/spaces for planned power network system (transmission/distribution line, substation and related facilities), there is a possibility of involuntary resettlement including land acquisition and resettlement as well as	(T) 1) Laws and regulations for involuntary resettlement (land acquisition and resettlement) and easement/wayleaves. 2) Land use regulation and existing land use in Jordan and planned area. 3) Cases and causes of involuntary resettlement in Jordan and planned area. 4)	(T) 1) Consider alternative plans to avoid and/or minimize the occurrence of involuntary resettlement. 2) Detailed inventory survey on plots, facilities, structures and peoples living along the planned railway routes. 3) Survey on encroachment on ROW (Right Of Way) of the planned site/alignment. 4) Examine procedure and condition of

		wayleaves, generation of Project Affected Persons (PAPs), although it depends on the details of the plan (site location/route, scale, components etc.).	Anticipated land area and location for the site to be secured by the plan.	involuntary resettlement and compensation to PAPs taking relevant laws in Jordan and the JICA Guidelines into considerations. 5) From early stage of the project, pay attention to information disclosure and consultation with stakeholders including PAPs for thorough understanding of the issues or to make agreement as much as possible. 6) Elaborate Resettlement Action Plan (RAP), if involuntary resettlement is unavoidable.
4) Water use	B	(II, IV) Jordan has very limited water resources and available water resources continue to fall with population growth everywhere in the country. Thus, water supply for construction and decommissioning work is expected to face severe competence with other water supply.	(T) 1) Laws and regulations for water use and water extraction form water resources. 2) Water demand and supply in Jordan and planned area. 3) Anticipated water use in construction and decommissioning work and in operation of power plants and related facilities.	(T) 1) Consider minimize water use in construction and decommissioning work and in operation of power plants and related facilities in the plan. 2) Monitor water consumption in the plan.
5) Land use and utilization of local resources	B	(V) Some alteration of existing land use and utilization of local resources is expected. However, extent of impact depends on the plan of power plants and related facilities.	(T) 1) Laws and regulation for use of land and resources. 2) Existing and future land and resources use in Jordan and planned area.	(T) Consider appropriate and effective utilization of land and resources in the plan.
11) Cultural property	B	(II, III,) In Jordan sites of cultural properties and heritages are	(II, III) 1) Laws and regulations of cultural property and heritage site.	(T) 1) Avoid the site and route penetrating or close to the sites of cultural properties, heritages

and heritage		distributed in the whole country. Thus, adverse impact on them is expected, if the site of power plants and related facilities is located within or close to the site.	2) Distribution of cultural property and heritage site in Jordan and the planned area.	and archaeological importance in the plan. 2) If any buried cultural properties are found at construction work, report and consult with concerned organizations such as Ministry of Tourism and Antiquities without delay.
13) Public health and Sanitation	B	(II, IV) There is a possibility of deterioration respiratory functions due to inhalation of air pollutants such as NOx and PM10, if control of pollutants emission in construction and decommissioning work is not conducted appropriately. However, at present extent of impact is unknown.	(II, III, IV) 1) Laws and regulations of public health and sanitation. 2) Public health condition including respiratory disease and distribution of medical facilities in Jordan and planned area.	(T) 1) Preventive measures to control air pollutants emission in construction and decommissioning work and in operation of power plants and related facilities. 2) Monitor public health condition by medical examination.
16) Hazard/risk (disaster, security)	B	(T) No additional risk of disaster and public security are expected due to installation of power plant and related facilities. However, there is a possibility of increase in disaster and security risk, if the site is located to close to neighboring countries in conflict.	(T) 1) Cases and causes of hazard risks due to disaster in Jordan and the planned area. 2) Existing condition of public security due to uncertain political situation and conflict of neighboring countries.	(T) 1) Monitor uncertain condition of neighboring countries. 2) Prepare emergency action plan for hazard and public security risks.
17) Accidents	B	(II, III, IV) Occurrence of accidents is expected somewhat, if inappropriate handling	(II, III, IV) 1) Cases and causes of accidents in Jordan and planned area in construction and	(II, III, IV) 1) Preventive measures to accidents in construction and decommissioning work and in

		and management of construction and decommissioning work, and insufficient operation of installed power plants and related facilities are carried out.	decommissioning work and in operation of power plants and related facilities.	operation of power plants and related facilities. 2) Prepare emergency action plan for accidents.
(2) Natural Environment				
22) Environmentally sensitive areas (Protected Areas, IBAs etc.)	B	(II, III, IV) 1) In Jordan designated Protected Areas and Important Bird and Biodiversity Conservation Areas (IBAs) are distributed in the whole country. Thus, adverse impact on them is expected, if the site of power plants and related facilities is located within or close to the area. 2) In addition, hill and mountainous areas are transfer route of transboundary migratory birds between Europe/Asia and Africa. Therefore, there is a possibility of migratory birds striking to transmiision/distributio n line and tower.	(II, III, IV) 1) Distribution of designated Protected Areas, natural reserves and IBAs as well as parks in Jordan and the planned area. 2) Regulations for conservation of natural environment.	(II, III, IV) To avoid site location within or close to the designated Protected Areas and parks.
23) Flora, Fauna, Ecosystem and Biodiversit	B	(II, III, IV) 1) In Jordan there are found many precious plant and animal species as well as important areas of	(II, III, IV) 1) Distribution of site with valuable plant and animal species, ecosystem and biodiversity in Jordan and the planned	(II, III, IV) To avoid site location within or close to distribution areas of valuable plant and animal species, and environmentally sensitive areas.

y		valuable ecosystem and biodiversity. Thus, adverse impact on them is expected, if the site of power plants and related facilities is located within or close to the area. 2) In addition, hill and mountainous areas are transfer route of transboundary migratory birds between Europe/Asia and Africa. Therefore, there is a possibility of migratory birds striking to transmission/distributio n line and tower.	area. 2) Regulations for conservation of plant, animal species and biodiversity.	
24) Landscape	B	(III) In Jordan cultural and heritage sites are distributed in the whole country and they consist of attractive landscape. Thus, there is a possibility of deterioration aesthetic value of landscape by spatial occupancy of transmission/distributio n line and tower.	(III) 1) Distribution of site with valuable landscape in Jordan and the planned area. 2) Regulation for preserving valuable landscape.	(III) 1) To avoid site location close to existing important landscape. 2) Measures to harmonize power plants and related facilities with surrounding landscape by design and tree planting in the plan.
25) Micro-clim ate	C	(II, III, IV) Most areas of Jordan are topographically flat and occupied by desert. Thus even a small change of topographical features such as appearance of	(II, III, IV) Meteorological data in Jordan and planned area including cases and causes of change in micro-climate in Jordan and planned area.	(II, III, IV) Monitor micro-climate by meteorological data and physical observation.

		new structures and facilities may cause influence to microclimate condition such as wind. However, extent of impact is unknown at present.		
26) Global Warming	B	(II, IV) Generation of greenhouse gases (GHG) such as CO_2 and CH_4 is not expected from operation of transmission/distribution line. However, generation of GHG is expected from construction vehicles and machines during construction and decommissioning stage. However, extent of emission is not known at present	(II, IV) 1) Existing data of greenhouse gases emission in Jordan and planned area. 2) Anticipated greenhouse gases emission from construction and decommissioning work.	(II, IV) Preventive measures to reduce greenhouse gases emission in construction and decommissioning work.
(3) Environmental Pollution				
27) Air pollution	B	(II, IV) Generation of air pollutants such as dust and NOx are expected due to earth moving and engineering works during construction and decommissioning stage.	(II, IV) 1) Regulation of air pollution including air quality and emission standards. 2) Existing air quality in Jordan and planned area. 3) Anticipated emission of air pollutants from construction and decommissioning work	(II, IV) 1) Preventive measures to control air pollutants emission in construction and decommissioning work. 2) Monitor air pollutants emission and ambient air quality.
28) Water pollution	B	(II, IV) Generation of water pollutants such as SS and BOD is expected due to earth moving and	(II, IV) 1) Regulation of water pollution including water quality and effluent standards. 2) Existing water quality in Jordan and	(II, IV) 1) Preventive measures to control water pollutants discharge in construction and decommissioning work. 2) Monitor water pollutants

		engineering works during construction and decommissioning stage.	planned area. 3) Anticipated discharge of water pollutants from construction and decommissioning work	discharge and environmental water quality.
29) Soil contamination	B	(II, IV) There is a possibility of soil contamination due to leakage of toxic or hazardous materials from construction and decommissioning work. However, features of the contamination is unknown at present.	(II, IV) 1) Regulation of soil contamination. 2) Cases and causes of soil contamination in Jordan and planned area.	(II, IV) 1) Preventive measures to avoid leakage toxic/hazardous materials in construction and decommissioning work. 2) Monitor soil contamination.
30) Bottom sediment	C	(II, IV) In case of power facility is located in coastal area, some impact on coastal conditions is expected due toconstruction and decommissioning work. However, extent of impact is unknown at present.	(II, IV) 1) Regulation of bottom sediment contamination. 2) Cases and causes of bottom sediment contamination.	(II, IV) Monitoring bottom sediment contamination.
31) Soild waste	B	(II, IV) Generation of solid wastes is expected from are expected due to earth moving and engineering works during construction and decommissioning stage.	(II, IV) 1) Regulation for solid waste management. 2) Existing situation of solid waste management in Jordan and planned area. 3) Anticipated generation of sold waste from construction and decommissioning work.	(II, IV) 1) Preventive measures for reduction, proper treatment and disposal of solid waste during construction/decommissioning stage in the plan. 2) Reflect concept of 3R (Reduce, reuse and recycle) to the plan. 3) Enlighten awareness of waste management to workers and employees.

32) Noise and Vibration	B	(II, IV) Generation of noise and vibration are expected from are expected due to earth moving and engineering works during construction and decommissioning stage.	(II, IV) 1) Regulation of noise and vibration. 2) Generation and ambient level of noise and vibration in Jordan and planned area. 3) Anticipated generation of noise and vibration from from construction and decommissioning work.	(II, IV) Preventive measures against generation of noise and vibration during operation of power plants and related facilities as well as during construction and decommissioning work.
(4) Permit, Explanation and Others				
Subject			(T) 1) Methodology of Environmental Impact Assessment in Jordan. 2) Items and Procedures for Permit/Approval. 3) Information disclosure. 4) Stakeholder participation. 5) International Treaties, Agreements, Convention.	(T) Comparison of Alternative Plans. 2) Environmental Management Plan, Environmental Monitoring Plan, Emergency Action Plan etc.

Source: JICA Study Team

Chapter 10 Economic and Financial Analysis

10.1 Project resource statement

Table 10.1 Project resource statement

Investment in 2015

(Unit: millions of 2015 USD)

Years		2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Item	Initial amount																					
A. Investment schedule																						
Construction of distribution facilities	23	23																				
I. Total	23	23																				
B. Working capital	2/12 of the annual cost		13																			
II. Working capital			13																			-13
C. Annual costs	Annual amount																					
Incremental power purchase			70	70	70	69	69	69	69	69	69	69	68	68	68	68	68	68	68	67	67	67
Incremental power purchase (GWh)			846	844	843	841	839	837	836	834	832	830	829	827	825	823	822	820	818	817	815	815
Shadow price (2015 US¢/kWh)	JD0.047 as of 2010		8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3
O&M (% of the construction cost)	2%		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Overhead	10% of the CGS		7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
III. Total			78	77	77	77	77	77	77	76	76	76	76	76	76	75	75	75	75	75	75	75
D. Benefits	Annual amount																					
Incremental energy sales			81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81
Energy sales of the project (GWh)			738	738	738	738	738	738	738	738	738	738	738	738	738	738	738	738	738	738	738	738
Energy sales of the whole system (GWh)		18,889	19,626	20,506	21,529	22,606	23,735	24,924	26,206	27,533	28,967	30,500	32,096	33,919	35,868	37,949	40,176	42,541	45,073	47,771	50,667	50,667
Shadow price (2015 US¢/kWh)	JD0.063 as of 2010		11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
Benefit of loss reduction			4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Contribution of the project (GWh)			48	46	44	44	44	44	45	45	46	46	47	48	48	49	50	50	51	52	53	53
Total loss reduction (GWh)			48	100	157	219	287	361	442	530	626	731	844	971	1,110	1,262	1,429	1,611	1,809	2,026	2,264	2,264
Loss reduction achieved (%)			0.2%	0.4%	0.6%	0.7%	0.9%	1.1%	1.3%	1.5%	1.7%	1.9%	2.0%	2.2%	2.4%	2.6%	2.8%	3.0%	3.1%	3.3%	3.5%	3.5%
Distribution loss (%)		13%	12.8%	12.6%	12.4%	12.3%	12.1%	11.9%	11.7%	11.5%	11.3%	11.1%	11.0%	10.8%	10.6%	10.4%	10.2%	10.0%	9.9%	9.7%	9.5%	9.5%
IV. Total			85	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85	86	86
E. Net benefits																						
IV-I-II-III		-23	-5	8	8	8	8	8	8	9	9	9	9	9	10	10	10	10	10	11	11	24
Discount rate	12%																					
Net present value	30	-23	-5	6	5	5	5	4	4	3	3	3	3	2	2	2	2	2	2	1	1	2
Internal rate of return	24%	-23	-4	5	4	3	3	2	2	2	1	1	1	1	1	0	0	0	0	0	0	0

1/ US$1 = JD0.708

2/ CGS: Cost of goods sold

Investment in 2016

(Unit: millions of 2015 USD)

Years		2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Item	Initial amount																					
A. Investment schedule																						
Construction of distribution facilities	27	27																				
I. Total	27	27																				
B. Working capital	2/12 of the annual cost		15																			
II. Working capital			15																			−15
C. Annual costs	Annual amount																					
Incremental power purchase			83	83	83	83	82	82	82	82	82	82	81	81	81	81	81	81	80	80	80	80
Incremental power purchase (GWh)			1,007	1,005	1,003	1,000	998	996	994	992	990	988	986	984	982	980	978	976	974	972	972	972
Shadow price (2015 US¢/kWh)	JD0.047 as of 2010		8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3
O&M (% of the construction cost)	2%		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Overhead	10% of the CGS		9	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
III. Total			92	92	92	92	91	91	91	91	91	91	90	90	90	90	90	89	89	89	89	89
D. Benefits	Annual amount																					
Incremental energy sales			97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97
Energy sales of the project (GWh)			880	880	880	880	880	880	880	880	880	880	880	880	880	880	880	880	880	880	880	880
Energy sales of the whole system (GWh)		19,626	20,506	21,529	22,606	23,735	24,924	26,206	27,533	28,967	30,500	32,096	33,919	35,868	37,949	40,176	42,541	45,073	47,771	50,667	50,667	50,667
Shadow price (2015 US¢/kWh)	JD0.063 as of 2010		11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
Benefit of loss reduction			4	4	4	4	4	4	4	5	5	5	5	5	5	5	5	5	5	5	5	5
Contribution of the project (GWh)			54	52	52	52	53	53	54	55	55	56	57	58	58	59	60	61	62	63	63	63
Total loss reduction (GWh)			100	157	219	287	361	442	530	626	731	844	971	1,110	1,262	1,429	1,611	1,809	2,026	2,264	2,264	2,264
Loss reduction achieved (%)			0.4%	0.6%	0.7%	0.9%	1.1%	1.3%	1.5%	1.7%	1.9%	2.0%	2.2%	2.4%	2.6%	2.8%	3.0%	3.1%	3.3%	3.5%	3.5%	3.5%
Distribution loss (%)		12.8%	12.6%	12.4%	12.3%	12.1%	11.9%	11.7%	11.5%	11.3%	11.1%	11.0%	10.8%	10.6%	10.4%	10.2%	10.0%	9.9%	9.7%	9.5%	9.5%	9.5%
IV. Total			101	101	101	101	101	101	101	101	101	101	102	102	102	102	102	102	102	102	102	102
E. Net benefits																						
IV−I−II−III		−27	−6	9	9	9	10	10	10	10	11	11	11	11	12	12	12	12	13	13	13	28
Discount rate	12%																					
Net present value	37	−27	−6	7	7	6	6	5	5	4	4	4	3	3	3	2	2	2	2	2	2	3
Internal rate of return	24%	−27	−5	6	5	4	3	3	2	2	2	1	1	1	1	1	0	0	0	0	0	0

1/ US$1 = JD0.708

2/ CGS: Cost of goods sold

Investment in 2017

(Unit: millions of 2015 USD)

Years		2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Item	Initial amount																					
A. Investment schedule																						
Construction of distribution facilities	32	32																				
I. Total	32	32																				
B. Working capital	2/12 of the annual cost		18																			
II. Working capital			18																			-18
C. Annual costs	Annual amount																					
Incremental power purchase			97	96	96	96	96	95	95	95	95	95	95	94	94	94	94	94	93	93	93	93
Incremental power purchase (GWh)			1,168	1,165	1,163	1,160	1,158	1,156	1,153	1,151	1,148	1,146	1,144	1,141	1,139	1,137	1,134	1,132	1,130	1,130	1,130	1,130
Shadow price (2015 US¢/kWh)	JD0.047 as of 2010		8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3
O&M (% of the construction cost)	2%		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Overhead	10% of the CGS		10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
III. Total			107	107	107	106	106	106	106	105	105	105	105	105	104	104	104	104	104	104	104	104
D. Benefits	Annual amount																					
Incremental energy sales			113	113	113	113	113	113	113	113	113	113	113	113	113	113	113	113	113	113	113	113
Energy sales of the project (GWh)			1,022	1,022	1,022	1,022	1,022	1,022	1,022	1,022	1,022	1,022	1,022	1,022	1,022	1,022	1,022	1,022	1,022	1,022	1,022	1,022
Energy sales of the whole system (GWh)		20,506	21,529	22,606	23,735	24,924	26,206	27,533	28,967	30,500	32,096	33,919	35,868	37,949	40,176	42,541	45,073	47,771	50,667	50,667	50,667	50,667
Shadow price (2015 US¢/kWh)	JD0.063 as of 2010		11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
Benefit of loss reduction			5	5	5	5	5	5	5	5	5	5	6	6	6	6	6	6	6	6	6	6
Contribution of the project (GWh)			61	60	61	61	62	63	64	64	65	66	67	68	69	70	71	72	73	73	73	73
Total loss reduction (GWh)			157	219	287	361	442	530	626	731	844	971	1,110	1,262	1,429	1,611	1,809	2,026	2,264	2,264	2,264	2,264
Loss reduction achieved (%)			0.6%	0.7%	0.9%	1.1%	1.3%	1.5%	1.7%	1.9%	2.0%	2.2%	2.4%	2.6%	2.8%	3.0%	3.1%	3.3%	3.5%	3.5%	3.5%	3.5%
Distribution loss (%)		12.6%	12.4%	12.3%	12.1%	11.9%	11.7%	11.5%	11.3%	11.1%	11.0%	10.8%	10.6%	10.4%	10.2%	10.0%	9.9%	9.7%	9.5%	9.5%	9.5%	9.5%
IV. Total			118	118	118	118	118	118	118	118	118	118	118	118	118	118	118	118	119	119	119	119
E. Net benefits																						
IV-I-II-III		-32	-7	11	11	11	12	12	12	12	13	13	13	14	14	14	14	15	15	15	15	33
Discount rate	12%																					
Net present value	45	-32	-6	9	8	7	7	6	5	5	5	4	4	3	3	3	3	2	2	2	2	3
Internal rate of return	25%	-32	-6	7	6	5	4	3	3	2	2	2	1	1	1	1	1	0	0	0	0	0

1/ US$1 = JD0.708

2/ CGS: Cost of goods sold

Investment in 2018

(Unit: millions of 2015 USD)

Years		2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Item	Initial amount																					
A. Investment schedule																						
Construction of distribution facilities	33	33																				
I. Total	33	33																				
B. Working capital	2/12 of the annual cost		19																			
II. Working capital			19																			-19
C. Annual costs	Annual amount																					
Incremental power purchase			101	101	101	101	101	100	100	100	100	100	99	99	99	99	99	98	98	98	98	98
Incremental power purchase (GWh)			1,227	1,225	1,222	1,220	1,217	1,215	1,212	1,209	1,207	1,204	1,202	1,199	1,197	1,195	1,192	1,190	1,190	1,190	1,190	1,190
Shadow price (2015 US¢/kWh)	JD0.047 as of 2010		8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3
O&M (% of the construction cost)	2%		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Overhead	10% of the CGS		10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
III. Total			112	112	112	112	111	111	111	111	111	110	110	110	110	109	109	109	109	109	109	109
D. Benefits	Annual amount																					
Incremental energy sales			119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119
Energy sales of the project (GWh)			1,077	1,077	1,077	1,077	1,077	1,077	1,077	1,077	1,077	1,077	1,077	1,077	1,077	1,077	1,077	1,077	1,077	1,077	1,077	1,077
Energy sales of the whole system (GWh)		21,529	22,606	23,735	24,924	26,206	27,533	28,967	30,500	32,096	33,919	35,868	37,949	40,176	42,541	45,073	47,771	50,667	50,667	50,667	50,667	50,667
Shadow price (2015 US¢/kWh)	JD0.063 as of 2010		11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
Benefit of loss reduction			5	5	5	5	5	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Contribution of the project (GWh)			64	64	64	65	66	67	68	69	70	70	71	72	73	74	76	77	77	77	77	77
Total loss reduction (GWh)			219	287	361	442	530	626	731	844	971	1,110	1,262	1,429	1,611	1,809	2,026	2,264	2,264	2,264	2,264	2,264
Loss reduction achieved (%)			0.7%	0.9%	1.1%	1.3%	1.5%	1.7%	1.9%	2.0%	2.2%	2.4%	2.6%	2.8%	3.0%	3.1%	3.3%	3.5%	3.5%	3.5%	3.5%	3.5%
Distribution loss (%)		12.4%	12.3%	12.1%	11.9%	11.7%	11.5%	11.3%	11.1%	11.0%	10.8%	10.6%	10.4%	10.2%	10.0%	9.9%	9.7%	9.5%	9.5%	9.5%	9.5%	9.5%
IV. Total			124	124	124	124	124	124	124	124	124	124	124	125	125	125	125	125	125	125	125	125
E. Net benefits																						
IV-I-II-III		-33	-7	12	12	12	12	13	13	13	14	14	14	15	15	15	16	16	16	16	16	35
Discount rate	12%																					
Net present value	50	-33	-7	9	8	8	7	6	6	5	5	5	4	4	3	3	3	3	2	2	2	4
Internal rate of return	26%	-33	-6	8	6	5	4	4	3	2	2	2	1	1	1	1	1	1	0	0	0	0

1/ US$1 = JD0.708

2/ CGS: Cost of goods sold

Investment in 2019

(Unit: millions of 2015 USD)

Years		2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Item	Initial amount																					
A. Investment schedule																						
Construction of distribution facilities	35	35																				
I. Total	35	35																				
B. Working capital	2/12 of the annual cost		20																			
II. Working capital			20																			-20
C. Annual costs	Annual amount																					
Incremental power purchase			106	106	106	106	105	105	105	105	104	104	104	104	104	103	103	103	103	103	103	103
Incremental power purchase (GWh)			1,285	1,282	1,280	1,277	1,274	1,272	1,269	1,266	1,264	1,261	1,259	1,256	1,253	1,251	1,248	1,248	1,248	1,248	1,248	1,248
Shadow price (2015 US¢/kWh)	JD0.047 as of 2010		8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3
O&M (% of the construction cost)	2%		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Overhead	10% of the CGS		11	11	11	11	11	11	11	11	11	11	11	11	11	11	10	10	10	10	10	10
III. Total			118	117	117	117	117	116	116	116	116	116	115	115	115	115	114	114	114	114	114	114
D. Benefits	Annual amount																					
Incremental energy sales			124	124	124	124	124	124	124	124	124	124	124	124	124	124	124	124	124	124	124	124
Energy sales of the project (GWh)			1,130	1,130	1,130	1,130	1,130	1,130	1,130	1,130	1,130	1,130	1,130	1,130	1,130	1,130	1,130	1,130	1,130	1,130	1,130	1,130
Energy sales of the whole system (GWh)		22,606	23,735	24,924	26,206	27,533	28,967	30,500	32,096	33,919	35,868	37,949	40,176	42,541	45,073	47,771	50,667	50,667	50,667	50,667	50,667	50,667
Shadow price (2015 US¢/kWh)	JD0.063 as of 2010		11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
Benefit of loss reduction			6	6	6	6	6	6	6	6	6	6	6	6	6	7	7	7	7	7	7	7
Contribution of the project (GWh)			67	68	68	69	70	71	72	73	74	75	76	77	78	79	81	81	81	81	81	81
Total loss reduction (GWh)			287	361	442	530	626	731	844	971	1,110	1,262	1,429	1,611	1,809	2,026	2,264	2,264	2,264	2,264	2,264	2,264
Loss reduction achieved (%)			0.9%	1.1%	1.3%	1.5%	1.7%	1.9%	2.0%	2.2%	2.4%	2.6%	2.8%	3.0%	3.1%	3.3%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%
Distribution loss (%)		12.3%	12.1%	11.9%	11.7%	11.5%	11.3%	11.1%	11.0%	10.8%	10.6%	10.4%	10.2%	10.0%	9.9%	9.7%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%
IV. Total			130	130	130	130	130	130	130	130	130	131	131	131	131	131	131	131	131	131	131	131
E. Net benefits																						
IV-I-II-III		-35	-7	13	13	13	13	14	14	14	15	15	15	16	16	16	17	17	17	17	17	36
Discount rate	12%																					
Net present value	54	-35	-7	10	9	8	8	7	6	6	5	5	4	4	4	3	3	3	2	2	2	4
Internal rate of return	26%	-35	-6	8	7	6	5	4	3	3	2	2	1	1	1	1	1	1	0	0	0	0

1/ US$1 = JD0.708

2/ CGS: Cost of goods sold

Investment in 2020

(Unit: millions of 2015 USD)

Years		2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Item	Initial amount																					
A. Investment schedule																						
Construction of distribution facilities	37	37																				
I. Total	37	37																				
B. Working capital	2/12 of the annual cost		21																			
II. Working capital			21																			-21
C. Annual costs	Annual amount																					
Incremental power purchase			111	111	111	111	111	110	110	110	110	109	109	109	109	108	108	108	108	108	108	108
Incremental power purchase (GWh)			1,349	1,346	1,343	1,340	1,338	1,335	1,332	1,329	1,327	1,324	1,321	1,318	1,316	1,313	1,313	1,313	1,313	1,313	1,313	1,313
Shadow price (2015 US¢/kWh)	JD0.047 as of 2010		8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3
O&M (% of the construction cost)	2%		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Overhead	10% of the CGS		11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
III. Total			124	123	123	123	123	122	122	122	121	121	121	121	121	120	120	120	120	120	120	120
D. Benefits	Annual amount																					
Incremental energy sales			131	131	131	131	131	131	131	131	131	131	131	131	131	131	131	131	131	131	131	131
Energy sales of the project (GWh)			1,188	1,188	1,188	1,188	1,188	1,188	1,188	1,188	1,188	1,188	1,188	1,188	1,188	1,188	1,188	1,188	1,188	1,188	1,188	1,188
Energy sales of the whole system (GWh)		23,735	24,924	26,206	27,533	28,967	30,500	32,096	33,919	35,868	37,949	40,176	42,541	45,073	47,771	50,667	50,667	50,667	50,667	50,667	50,667	50,667
Shadow price (2015 US¢/kWh)	JD0.063 as of 2010		11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
Benefit of loss reduction			6	6	6	6	6	6	6	6	7	7	7	7	7	7	7	7	7	7	7	7
Contribution of the project (GWh)			71	72	73	74	75	76	77	78	79	80	81	82	83	85	85	85	85	85	85	85
Total loss reduction (GWh)			361	442	530	626	731	844	971	1,110	1,262	1,429	1,611	1,809	2,026	2,264	2,264	2,264	2,264	2,264	2,264	2,264
Loss reduction achieved (%)			1.1%	1.3%	1.5%	1.7%	1.9%	2.0%	2.2%	2.4%	2.6%	2.8%	3.0%	3.1%	3.3%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%
Distribution loss (%)		12.1%	11.9%	11.7%	11.5%	11.3%	11.1%	11.0%	10.8%	10.6%	10.4%	10.2%	10.0%	9.9%	9.7%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%
IV. Total			137	137	137	137	137	137	137	137	137	137	138	138	138	138	138	138	138	138	138	138
E. Net benefits																						
IV-I-II-III		-37	-7	13	14	14	14	15	15	15	16	16	16	17	17	18	18	18	18	18	18	38
Discount rate	12%																					
Net present value	60	-37	-7	11	10	9	8	8	7	6	6	5	5	4	4	4	3	3	3	2	2	4
Internal rate of return	27%	-37	-6	9	7	6	5	4	3	3	2	2	2	1	1	1	1	1	0	0	0	1

1/ US$1 = JD0.708

2/ CGS: Cost of goods sold

Investment in 2021

(Unit: millions of 2015 USD)

Years		2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Item	Initial amount																					
A. Investment schedule																						
Construction of distribution facilities	40	40																				
I. Total	40	40																				
B. Working capital	2/12 of the annual cost		22																			
II. Working capital			22																			-22
C. Annual costs	Annual amount																					
Incremental power purchase			120	120	120	119	119	119	119	118	118	118	118	117	117	117	117	117	117	117	117	117
Incremental power purchase (GWh)			1,452	1,449	1,446	1,443	1,440	1,437	1,434	1,431	1,428	1,425	1,422	1,419	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417
Shadow price (2015 US¢/kWh)	JD0.047 as of 2010		8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3
O&M (% of the construction cost)	2%		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Overhead	10% of the CGS		12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
III. Total			133	133	132	132	132	132	131	131	131	131	130	130	130	130	130	130	130	130	130	130
D. Benefits	Annual amount																					
Incremental energy sales			141	141	141	141	141	141	141	141	141	141	141	141	141	141	141	141	141	141	141	141
Energy sales of the project (GWh)			1,282	1,282	1,282	1,282	1,282	1,282	1,282	1,282	1,282	1,282	1,282	1,282	1,282	1,282	1,282	1,282	1,282	1,282	1,282	1,282
Energy sales of the whole system (GWh)		24,924	26,206	27,533	28,967	30,500	32,096	33,919	35,868	37,949	40,176	42,541	45,073	47,771	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667
Shadow price (2015 US¢/kWh)	JD0.063 as of 2010		11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
Benefit of loss reduction			6	6	7	7	7	7	7	7	7	7	7	7	8	8	8	8	8	8	8	8
Contribution of the project (GWh)			78	79	80	81	82	83	84	85	86	87	89	90	91	91	91	91	91	91	91	91
Total loss reduction (GWh)			442	530	626	731	844	971	1,110	1,262	1,429	1,611	1,809	2,026	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264
Loss reduction achieved (%)			1.3%	1.5%	1.7%	1.9%	2.0%	2.2%	2.4%	2.6%	2.8%	3.0%	3.1%	3.3%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%
Distribution loss (%)		11.9%	11.7%	11.5%	11.3%	11.1%	11.0%	10.8%	10.6%	10.4%	10.2%	10.0%	9.9%	9.7%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%
IV. Total			148	148	148	148	148	148	148	148	148	148	148	149	149	149	149	149	149	149	149	149
E. Net benefits																						
IV-I-II-III		-40	-8	15	15	16	16	16	17	17	17	18	18	19	19	19	19	19	19	19	19	41
Discount rate	12%																					
Net present value	67	-40	-7	12	11	10	9	8	8	7	6	6	5	5	4	4	3	3	3	2	2	4
Internal rate of return	28%	-40	-6	10	8	7	5	4	4	3	2	2	2	1	1	1	1	1	0	0	0	1

1/ US$1 = JD0.708

2/ CGS: Cost of goods sold

Investment in 2022

(Unit: millions of 2015 USD)

Years		2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Item	Initial amount																					
A. Investment schedule																						
Construction of distribution facilities	41	41																				
I. Total	41	41																				
B. Working capital	2/12 of the annual cost		23																			
II. Working capital			23																			-23
C. Annual costs	Annual amount																					
Incremental power purchase			124	124	123	123	123	123	122	122	122	122	121	121	121	121	121	121	121	121	121	121
Incremental power purchase (GWh)			1,500	1,497	1,494	1,491	1,487	1,484	1,481	1,478	1,475	1,472	1,469	1,466	1,466	1,466	1,466	1,466	1,466	1,466	1,466	1,466
Shadow price (2015 US¢/kWh)	JD0.047 as of 2010		8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3
O&M (% of the construction cost)	2%		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Overhead	10% of the CGS		13	13	13	13	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
III. Total			137	137	137	137	136	136	136	135	135	135	135	134	134	134	134	134	134	134	134	134
D. Benefits	Annual amount																					
Incremental energy sales			146	146	146	146	146	146	146	146	146	146	146	146	146	146	146	146	146	146	146	146
Energy sales of the project (GWh)			1,327	1,327	1,327	1,327	1,327	1,327	1,327	1,327	1,327	1,327	1,327	1,327	1,327	1,327	1,327	1,327	1,327	1,327	1,327	1,327
Energy sales of the whole system (GWh)		26,206	27,533	28,967	30,500	32,096	33,919	35,868	37,949	40,176	42,541	45,073	47,771	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667
Shadow price (2015 US¢/kWh)	JD0.063 as of 2010		11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
Benefit of loss reduction			7	7	7	7	7	7	7	7	7	8	8	8	8	8	8	8	8	8	8	8
Contribution of the project (GWh)			81	82	84	85	86	87	88	89	90	92	93	95	95	95	95	95	95	95	95	95
Total loss reduction (GWh)			530	626	731	844	971	1,110	1,262	1,429	1,611	1,809	2,026	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264
Loss reduction achieved (%)			1.5%	1.7%	1.9%	2.0%	2.2%	2.4%	2.6%	2.8%	3.0%	3.1%	3.3%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%
Distribution loss (%)		11.7%	11.5%	11.3%	11.1%	11.0%	10.8%	10.6%	10.4%	10.2%	10.0%	9.9%	9.7%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%
IV. Total			153	153	153	153	153	153	153	153	154	154	154	154	154	154	154	154	154	154	154	154
E. Net benefits																						
IV-I-II-III		-41	-7	16	16	17	17	17	18	18	18	19	19	20	20	20	20	20	20	20	20	42
Discount rate	12%																					
Net present value	71	-41	-7	13	12	11	10	9	8	7	7	6	6	5	4	4	4	3	3	3	2	4
Internal rate of return	28%	-41	-6	10	8	7	6	5	4	3	3	2	2	1	1	1	1	1	0	0	0	1

1/ US$1 = JD0.708

2/ CGS: Cost of goods sold

Investment in 2023

(Unit: millions of 2015 USD)

Years		2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Item	Initial amount																					
A. Investment schedule																						
Construction of distribution facilities	44	44																				
I. Total	44	44																				
B. Working capital	2/12 of the annual cost		25																			
II. Working capital			25																			-25
C. Annual costs	Annual amount																					
Incremental power purchase			134	133	133	133	133	132	132	132	131	131	131	131	131	131	131	131	131	131	131	131
Incremental power purchase (GWh)			1,617	1,614	1,611	1,607	1,604	1,601	1,597	1,594	1,591	1,587	1,584	1,584	1,584	1,584	1,584	1,584	1,584	1,584	1,584	1,584
Shadow price (2015 US¢/kWh)	JD0.047 as of 2010		8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3
O&M (% of the construction cost)	2%		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Overhead	10% of the CGS		14	14	14	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
III. Total			148	148	147	147	147	147	146	146	146	145	145	145	145	145	145	145	145	145	145	145
D. Benefits	Annual amount																					
Incremental energy sales			158	158	158	158	158	158	158	158	158	158	158	158	158	158	158	158	158	158	158	158
Energy sales of the project (GWh)			1,434	1,434	1,434	1,434	1,434	1,434	1,434	1,434	1,434	1,434	1,434	1,434	1,434	1,434	1,434	1,434	1,434	1,434	1,434	1,434
Energy sales of the whole system (GWh)		27,533	28,967	30,500	32,096	33,919	35,868	37,949	40,176	42,541	45,073	47,771	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667
Shadow price (2015 US¢/kWh)	JD0.063 as of 2010		11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
Benefit of loss reduction			7	7	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Contribution of the project (GWh)			89	90	92	93	94	95	96	98	99	101	102	102	102	102	102	102	102	102	102	102
Total loss reduction (GWh)			626	731	844	971	1,110	1,262	1,429	1,611	1,809	2,026	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264
Loss reduction achieved (%)			1.7%	1.9%	2.0%	2.2%	2.4%	2.6%	2.8%	3.0%	3.1%	3.3%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%
Distribution loss (%)		11.5%	11.3%	11.1%	11.0%	10.8%	10.6%	10.4%	10.2%	10.0%	9.9%	9.7%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%
IV. Total			165	165	165	165	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166
E. Net benefits																						
IV-I-II-III		-44	-8	18	18	18	19	19	20	20	20	21	21	21	21	21	21	21	21	21	21	46
Discount rate	12%																					
Net present value	80	-44	-7	14	13	12	11	10	9	8	7	7	6	5	5	4	4	3	3	3	2	5
Internal rate of return	29%	-44	-6	11	9	8	6	5	4	4	3	2	2	2	1	1	1	1	1	0	0	1

1/ US$1 = JD0.708

2/ CGS: Cost of goods sold

Investment in 2024

(Unit: millions of 2015 USD)

Years		2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Item	Initial amount																					
A. Investment schedule																						
Construction of distribution facilities	47	47																				
I. Total	47	47																				
B. Working capital	2/12 of the annual cost		26																			
II. Working capital			26																			-26
C. Annual costs	Annual amount																					
Incremental power purchase			143	142	142	142	141	141	141	140	140	140	140	140	140	140	140	140	140	140	140	140
Incremental power purchase (GWh)			1,725	1,721	1,718	1,714	1,711	1,707	1,703	1,700	1,696	1,693	1,693	1,693	1,693	1,693	1,693	1,693	1,693	1,693	1,693	1,693
Shadow price (2015 US¢/kWh)	JD0.047 as of 2010		8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3
O&M (% of the construction cost)	2%		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Overhead	10% of the CGS		14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14
III. Total			158	158	157	157	157	156	156	156	155	155	155	155	155	155	155	155	155	155	155	155
D. Benefits	Annual amount																					
Incremental energy sales			169	169	169	169	169	169	169	169	169	169	169	169	169	169	169	169	169	169	169	169
Energy sales of the project (GWh)			1,532	1,532	1,532	1,532	1,532	1,532	1,532	1,532	1,532	1,532	1,532	1,532	1,532	1,532	1,532	1,532	1,532	1,532	1,532	1,532
Energy sales of the whole system (GWh)		28,967	30,500	32,096	33,919	35,868	37,949	40,176	42,541	45,073	47,771	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667
Shadow price (2015 US¢/kWh)	JD0.063 as of 2010		11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
Benefit of loss reduction			8	8	8	8	8	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
Contribution of the project (GWh)			96	98	99	100	102	103	104	106	108	109	109	109	109	109	109	109	109	109	109	109
Total loss reduction (GWh)			731	844	971	1,110	1,262	1,429	1,611	1,809	2,026	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264
Loss reduction achieved (%)			1.9%	2.0%	2.2%	2.4%	2.6%	2.8%	3.0%	3.1%	3.3%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%
Distribution loss (%)		11.3%	11.1%	11.0%	10.8%	10.6%	10.4%	10.2%	10.0%	9.9%	9.7%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%
IV. Total			177	177	177	177	177	177	177	177	178	178	178	178	178	178	178	178	178	178	178	178
E. Net benefits																						
IV-I-II-III		-47	-8	19	20	20	20	21	21	22	22	23	23	23	23	23	23	23	23	23	23	49
Discount rate	12%																					
Net present value	88	-47	-7	15	14	13	12	11	10	9	8	7	7	6	5	5	4	4	3	3	3	5
Internal rate of return	30%	-47	-6	12	10	8	7	6	5	4	3	3	2	2	1	1	1	1	1	0	0	1

1/ US$1 = JD0.708

2/ CGS: Cost of goods sold

Investment in 2025

(Unit: millions of 2015 USD)

Years		2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Item	Initial amount																					
A. Investment schedule																						
Construction of distribution facilities	49	49																				
I. Total	49	49																				
B. Working capital	2/12 of the annual cost		27																			
II. Working capital			27																			-27
C. Annual costs	Annual amount																					
Incremental power purchase			148	148	148	147	147	147	146	146	146	146	146	146	146	146	146	146	146	146	146	146
Incremental power purchase (GWh)			1,793	1,790	1,786	1,782	1,778	1,775	1,771	1,768	1,764	1,764	1,764	1,764	1,764	1,764	1,764	1,764	1,764	1,764	1,764	1,764
Shadow price (2015 US¢/kWh)	JD0.047 as of 2010		8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3
O&M (% of the construction cost)	2%		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Overhead	10% of the CGS		15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
III. Total			164	164	164	163	163	163	162	162	162	162	162	162	162	162	162	162	162	162	162	162
D. Benefits	Annual amount																					
Incremental energy sales			176	176	176	176	176	176	176	176	176	176	176	176	176	176	176	176	176	176	176	176
Energy sales of the project (GWh)			1,597	1,597	1,597	1,597	1,597	1,597	1,597	1,597	1,597	1,597	1,597	1,597	1,597	1,597	1,597	1,597	1,597	1,597	1,597	1,597
Energy sales of the whole system (GWh)		30,500	32,096	33,919	35,868	37,949	40,176	42,541	45,073	47,771	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667
Shadow price (2015 US¢/kWh)	JD0.063 as of 2010		11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
Benefit of loss reduction			8	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
Contribution of the project (GWh)			102	103	104	106	107	109	110	112	114	114	114	114	114	114	114	114	114	114	114	114
Total loss reduction (GWh)			844	971	1,110	1,262	1,429	1,611	1,809	2,026	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264
Loss reduction achieved (%)			2.0%	2.2%	2.4%	2.6%	2.8%	3.0%	3.1%	3.3%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%
Distribution loss (%)		11.1%	11.0%	10.8%	10.6%	10.4%	10.2%	10.0%	9.9%	9.7%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%
IV. Total			184	184	184	184	185	185	185	185	185	185	185	185	185	185	185	185	185	185	185	185
E. Net benefits																						
IV-I-II-III		-49	-7	20	21	21	22	22	23	23	24	24	24	24	24	24	24	24	24	24	24	51
Discount rate	12%																					
Net present value	94	-49	-7	16	15	14	12	11	10	9	9	8	7	6	5	5	4	4	3	3	3	5
Internal rate of return	30%	-49	-6	13	11	9	7	6	5	4	3	3	2	2	1	1	1	1	1	0	0	1

1/ US$1 = JD0.708

2/ CGS: Cost of goods sold

Investment in 2026

(Unit: millions of 2015 USD)

Years		2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Item	Initial amount																					
A. Investment schedule																						
Construction of distribution facilities	56	56																				
I. Total	56	56																				
B. Working capital	2/12 of the annual cost		31																			
II. Working capital			31																			-31
C. Annual costs	Annual amount																					
Incremental power purchase			169	168	168	168	167	167	167	166	166	166	166	166	166	166	166	166	166	166	166	166
Incremental power purchase (GWh)			2,043	2,039	2,035	2,030	2,026	2,022	2,018	2,014	2,014	2,014	2,014	2,014	2,014	2,014	2,014	2,014	2,014	2,014	2,014	2,014
Shadow price (2015 US¢/kWh)	JD0.047 as of 2010		8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3
O&M (% of the construction cost)	2%		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Overhead	10% of the CGS		17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
III. Total			187	187	186	186	186	185	185	184	184	184	184	184	184	184	184	184	184	184	184	184
D. Benefits	Annual amount																					
Incremental energy sales			201	201	201	201	201	201	201	201	201	201	201	201	201	201	201	201	201	201	201	201
Energy sales of the project (GWh)			1,823	1,823	1,823	1,823	1,823	1,823	1,823	1,823	1,823	1,823	1,823	1,823	1,823	1,823	1,823	1,823	1,823	1,823	1,823	1,823
Energy sales of the whole system (GWh)		32,096	33,919	35,868	37,949	40,176	42,541	45,073	47,771	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667
Shadow price (2015 US¢/kWh)	JD0.063 as of 2010		11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
Benefit of loss reduction			10	10	10	10	10	10	11	11	11	11	11	11	11	11	11	11	11	11	11	11
Contribution of the project (GWh)			118	119	121	122	124	126	128	130	130	130	130	130	130	130	130	130	130	130	130	130
Total loss reduction (GWh)			971	1,110	1,262	1,429	1,611	1,809	2,026	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264
Loss reduction achieved (%)			2.2%	2.4%	2.6%	2.8%	3.0%	3.1%	3.3%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%
Distribution loss (%)		11.0%	10.8%	10.6%	10.4%	10.2%	10.0%	9.9%	9.7%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%
IV. Total			210	210	211	211	211	211	211	211	211	211	211	211	211	211	211	211	211	211	211	211
E. Net benefits																						
IV-I-II-III		-56	-8	24	24	25	25	26	26	27	27	27	27	27	27	27	27	27	27	27	27	58
Discount rate	12%																					
Net present value	110	-56	-7	19	17	16	14	13	12	11	10	9	8	7	6	6	5	4	4	4	3	6
Internal rate of return	31%	-56	-6	15	13	10	9	7	6	5	4	3	3	2	2	1	1	1	1	1	0	1

1/ US$1 = JD0.708

2/ CGS: Cost of goods sold

Investment in 2027

(Unit: millions of 2015 USD)

Years		2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Item	Initial amount																					
A. Investment schedule																						
Construction of distribution facilities	60	60																				
I. Total	60	60																				
B. Working capital	2/12 of the annual cost		33																			
II. Working capital			33																			-33
C. Annual costs	Annual amount																					
Incremental power purchase			180	180	179	179	179	178	178	178	178	178	178	178	178	178	178	178	178	178	178	178
Incremental power purchase (GWh)			2,180	2,175	2,171	2,166	2,162	2,158	2,153	2,153	2,153	2,153	2,153	2,153	2,153	2,153	2,153	2,153	2,153	2,153	2,153	2,153
Shadow price (2015 US¢/kWh)	JD0.047 as of 2010		8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3
O&M (% of the construction cost)	2%		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Overhead	10% of the CGS		18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18
III. Total			200	199	199	198	198	198	197	197	197	197	197	197	197	197	197	197	197	197	197	197
D. Benefits	Annual amount																					
Incremental energy sales			215	215	215	215	215	215	215	215	215	215	215	215	215	215	215	215	215	215	215	215
Energy sales of the project (GWh)			1,949	1,949	1,949	1,949	1,949	1,949	1,949	1,949	1,949	1,949	1,949	1,949	1,949	1,949	1,949	1,949	1,949	1,949	1,949	1,949
Energy sales of the whole system (GWh)		33,919	35,868	37,949	40,176	42,541	45,073	47,771	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667
Shadow price (2015 US¢/kWh)	JD0.063 as of 2010		11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
Benefit of loss reduction			11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
Contribution of the project (GWh)			127	129	131	133	135	137	139	139	139	139	139	139	139	139	139	139	139	139	139	139
Total loss reduction (GWh)			1,110	1,262	1,429	1,611	1,809	2,026	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264
Loss reduction achieved (%)			2.4%	2.6%	2.8%	3.0%	3.1%	3.3%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%
Distribution loss (%)		10.8%	10.6%	10.4%	10.2%	10.0%	9.9%	9.7%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%
IV. Total			225	225	225	225	226	226	226	226	226	226	226	226	226	226	226	226	226	226	226	226
E. Net benefits																						
IV-I-II-III		-60	-8	26	27	27	28	28	29	29	29	29	29	29	29	29	29	29	29	29	29	62
Discount rate	12%																					
Net present value	120	-60	-7	21	19	17	16	14	13	12	10	9	8	7	7	6	5	5	4	4	3	6
Internal rate of return	31%	-60	-6	17	14	11	9	8	6	5	4	3	3	2	2	1	1	1	1	1	0	1

1/ US$1 = JD0.708

2/ CGS: Cost of goods sold

Investment in 2028

(Unit: millions of 2015 USD)

Years		2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Item	Initial amount																					
A. Investment schedule																						
Construction of distribution facilities	64	64																				
I. Total	64	64																				
B. Working capital	2/12 of the annual cost		35																			
II. Working capital			35																			-35
C. Annual costs	Annual amount																					
Incremental power purchase			192	192	191	191	190	190	190	190	190	190	190	190	190	190	190	190	190	190	190	190
Incremental power purchase (GWh)			2,323	2,318	2,313	2,308	2,304	2,299	2,299	2,299	2,299	2,299	2,299	2,299	2,299	2,299	2,299	2,299	2,299	2,299	2,299	2,299
Shadow price (2015 US¢/kWh)	JD0.047 as of 2010		8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3
O&M (% of the construction cost)	2%		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Overhead	10% of the CGS		19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19
III. Total			213	212	212	211	211	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
D. Benefits	Annual amount																					
Incremental energy sales			229	229	229	229	229	229	229	229	229	229	229	229	229	229	229	229	229	229	229	229
Energy sales of the project (GWh)			2,081	2,081	2,081	2,081	2,081	2,081	2,081	2,081	2,081	2,081	2,081	2,081	2,081	2,081	2,081	2,081	2,081	2,081	2,081	2,081
Energy sales of the whole system (GWh)		35,868	37,949	40,176	42,541	45,073	47,771	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667
Shadow price (2015 US¢/kWh)	JD0.063 as of 2010		11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
Benefit of loss reduction			11	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Contribution of the project (GWh)			138	140	142	144	146	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148
Total loss reduction (GWh)			1,262	1,429	1,611	1,809	2,026	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264
Loss reduction achieved (%)			2.6%	2.8%	3.0%	3.1%	3.3%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%
Distribution loss (%)		10.6%	10.4%	10.2%	10.0%	9.9%	9.7%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%
IV. Total			240	241	241	241	241	241	241	241	241	241	241	241	241	241	241	241	241	241	241	241
E. Net benefits																						
IV-I-II-III		-64	-8	28	29	30	30	31	31	31	31	31	31	31	31	31	31	31	31	31	31	66
Discount rate	12%																					
Net present value	131	-64	-7	23	21	19	17	16	14	12	11	10	9	8	7	6	6	5	4	4	4	7
Internal rate of return	32%	-64	-6	18	15	12	10	8	7	5	4	4	3	2	2	1	1	1	1	1	1	1

1/ US$1 = JD0.708

2/ CGS: Cost of goods sold

Investment in 2029

(Unit: millions of 2015 USD)

Years		2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Item	Initial amount																					
A. Investment schedule																						
Construction of distribution facilities	69	69																				
I. Total	69	69																				
B. Working capital	2/12 of the annual cost		38																			
II. Working capital			38																			-38
C. Annual costs	Annual amount																					
Incremental power purchase			205	204	204	204	203	203	203	203	203	203	203	203	203	203	203	203	203	203	203	203
Incremental power purchase (GWh)			2,480	2,475	2,470	2,465	2,459	2,459	2,459	2,459	2,459	2,459	2,459	2,459	2,459	2,459	2,459	2,459	2,459	2,459	2,459	2,459
Shadow price (2015 US¢/kWh)	JD0.047 as of 2010		8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3
O&M (% of the construction cost)	2%		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Overhead	10% of the CGS		21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21
III. Total			227	227	226	226	225	225	225	225	225	225	225	225	225	225	225	225	225	225	225	225
D. Benefits	Annual amount																					
Incremental energy sales			245	245	245	245	245	245	245	245	245	245	245	245	245	245	245	245	245	245	245	245
Energy sales of the project (GWh)			2,226	2,226	2,226	2,226	2,226	2,226	2,226	2,226	2,226	2,226	2,226	2,226	2,226	2,226	2,226	2,226	2,226	2,226	2,226	2,226
Energy sales of the whole system (GWh)		37,949	40,176	42,541	45,073	47,771	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667
Shadow price (2015 US¢/kWh)	JD0.063 as of 2010		11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
Benefit of loss reduction			12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
Contribution of the project (GWh)			149	152	154	156	159	159	159	159	159	159	159	159	159	159	159	159	159	159	159	159
Total loss reduction (GWh)			1,429	1,611	1,809	2,026	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264
Loss reduction achieved (%)			2.8%	3.0%	3.1%	3.3%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%
Distribution loss (%)		10.4%	10.2%	10.0%	9.9%	9.7%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%
IV. Total			257	258	258	258	258	258	258	258	258	258	258	258	258	258	258	258	258	258	258	258
E. Net benefits																						
IV-I-II-III		-69	-7	31	32	32	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	71
Discount rate	12%																					
Net present value	142	-69	-7	25	23	21	19	17	15	13	12	11	9	8	8	7	6	5	5	4	4	7
Internal rate of return	33%	-69	-6	20	17	14	11	9	7	6	5	4	3	2	2	2	1	1	1	1	1	1

1/ US$1 = JD0.708

2/ CGS: Cost of goods sold

Investment in 2030

(Unit: millions of 2015 USD)

Years		2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Item	Initial amount																					
A. Investment schedule																						
Construction of distribution facilities	73	73																				
I. Total	73	73																				
B. Working capital	2/12 of the annual cost		40																			
II. Working capital			40																			-40
C. Annual costs	Annual amount																					
Incremental power purchase			217	217	216	216	216	216	216	216	216	216	216	216	216	216	216	216	216	216	216	216
Incremental power purchase (GWh)			2,629	2,624	2,619	2,613	2,613	2,613	2,613	2,613	2,613	2,613	2,613	2,613	2,613	2,613	2,613	2,613	2,613	2,613	2,613	2,613
Shadow price (2015 US¢/kWh)	JD0.047 as of 2010		8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3
O&M (% of the construction cost)	2%		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Overhead	10% of the CGS		22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22
III. Total			241	240	240	239	239	239	239	239	239	239	239	239	239	239	239	239	239	239	239	239
D. Benefits	Annual amount																					
Incremental energy sales			260	260	260	260	260	260	260	260	260	260	260	260	260	260	260	260	260	260	260	260
Energy sales of the project (GWh)			2,365	2,365	2,365	2,365	2,365	2,365	2,365	2,365	2,365	2,365	2,365	2,365	2,365	2,365	2,365	2,365	2,365	2,365	2,365	2,365
Energy sales of the whole system (GWh)		40,176	42,541	45,073	47,771	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667
Shadow price (2015 US¢/kWh)	JD0.063 as of 2010		11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
Benefit of loss reduction			13	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14
Contribution of the project (GWh)			161	163	166	169	169	169	169	169	169	169	169	169	169	169	169	169	169	169	169	169
Total loss reduction (GWh)			1,611	1,809	2,026	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264
Loss reduction achieved (%)			3.0%	3.1%	3.3%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%
Distribution loss (%)		10.2%	10.0%	9.9%	9.7%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%
IV. Total			274	274	274	274	274	274	274	274	274	274	274	274	274	274	274	274	274	274	274	274
E. Net benefits																						
IV-I-II-III		-73	-7	34	34	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	75
Discount rate	12%																					
Net present value	154	-73	-6	27	24	22	20	18	16	14	13	11	10	9	8	7	6	6	5	5	4	8
Internal rate of return	33%	-73	-6	22	18	15	12	10	8	6	5	4	3	3	2	2	1	1	1	1	1	1

1/ US$1 = JD0.708

2/ CGS: Cost of goods sold

Investment in 2031

(Unit: millions of 2015 USD)

Years		2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Item	Initial amount																					
A. Investment schedule																						
Construction of distribution facilities	78	78																				
I. Total	78	78																				
B. Working capital	2/12 of the annual cost		43																			
II. Working capital			43																			-43
C. Annual costs	Annual amount																					
Incremental power purchase			232	232	231	231	231	231	231	231	231	231	231	231	231	231	231	231	231	231	231	231
Incremental power purchase (GWh)			2,809	2,803	2,797	2,797	2,797	2,797	2,797	2,797	2,797	2,797	2,797	2,797	2,797	2,797	2,797	2,797	2,797	2,797	2,797	2,797
Shadow price (2015 US¢/kWh)	JD0.047 as of 2010		8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3
O&M (% of the construction cost)	2%		2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Overhead	10% of the CGS		23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23
III. Total			257	257	256	256	256	256	256	256	256	256	256	256	256	256	256	256	256	256	256	256
D. Benefits	Annual amount																					
Incremental energy sales			279	279	279	279	279	279	279	279	279	279	279	279	279	279	279	279	279	279	279	279
Energy sales of the project (GWh)			2,532	2,532	2,532	2,532	2,532	2,532	2,532	2,532	2,532	2,532	2,532	2,532	2,532	2,532	2,532	2,532	2,532	2,532	2,532	2,532
Energy sales of the whole system (GWh)		42,541	45,073	47,771	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667
Shadow price (2015 US¢/kWh)	JD0.063 as of 2010		11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
Benefit of loss reduction			14	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
Contribution of the project (GWh)			175	178	180	180	180	180	180	180	180	180	180	180	180	180	180	180	180	180	180	180
Total loss reduction (GWh)			1,809	2,026	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264
Loss reduction achieved (%)			3.1%	3.3%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%
Distribution loss (%)		10.0%	9.9%	9.7%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%
IV. Total			293	293	294	294	294	294	294	294	294	294	294	294	294	294	294	294	294	294	294	294
E. Net benefits																						
IV-I-II-III		-78	-7	37	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	80
Discount rate	12%																					
Net present value	166	-78	-6	29	27	24	21	19	17	15	14	12	11	10	9	8	7	6	5	5	4	8
Internal rate of return	33%	-78	-6	24	20	16	13	10	8	7	5	4	3	3	2	2	1	1	1	1	1	1

1/ US$1 = JD0.708

2/ CGS: Cost of goods sold

Investment in 2032

(Unit: millions of 2015 USD)

Years		2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Item	Initial amount																					
A. Investment schedule																						
Construction of distribution facilities	83	83																				
I. Total	83	83																				
B. Working capital	2/12 of the annual cost		46																			
II. Working capital			46																			-46
C. Annual costs	Annual amount																					
Incremental power purchase			247	246	246	246	246	246	246	246	246	246	246	246	246	246	246	246	246	246	246	246
Incremental power purchase (GWh)			2,986	2,980	2,980	2,980	2,980	2,980	2,980	2,980	2,980	2,980	2,980	2,980	2,980	2,980	2,980	2,980	2,980	2,980	2,980	2,980
Shadow price (2015 US¢/kWh)	JD0.047 as of 2010		8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3
O&M (% of the construction cost)	2%		2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Overhead	10% of the CGS		25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
III. Total			273	273	273	273	273	273	273	273	273	273	273	273	273	273	273	273	273	273	273	273
D. Benefits	Annual amount																					
Incremental energy sales			297	297	297	297	297	297	297	297	297	297	297	297	297	297	297	297	297	297	297	297
Energy sales of the project (GWh)			2,697	2,697	2,697	2,697	2,697	2,697	2,697	2,697	2,697	2,697	2,697	2,697	2,697	2,697	2,697	2,697	2,697	2,697	2,697	2,697
Energy sales of the whole system (GWh)		45,073	47,771	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667
Shadow price (2015 US¢/kWh)	JD0.063 as of 2010		11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
Benefit of loss reduction			16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
Contribution of the project (GWh)			189	192	192	192	192	192	192	192	192	192	192	192	192	192	192	192	192	192	192	192
Total loss reduction (GWh)			2,026	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264
Loss reduction achieved (%)			3.3%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%
Distribution loss (%)		9.9%	9.7%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%
IV. Total			313	313	313	313	313	313	313	313	313	313	313	313	313	313	313	313	313	313	313	313
E. Net benefits																						
IV-I-II-III		-83	-6	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	86
Discount rate	12%																					
Net present value	179	-83	-6	32	28	25	23	20	18	16	14	13	11	10	9	8	7	7	6	5	5	9
Internal rate of return	34%	-83	-5	26	21	17	14	11	9	7	6	5	4	3	2	2	2	1	1	1	1	1

1/ US$1 = JD0.708

2/ CGS: Cost of goods sold

Investment in 2033

(Unit: millions of 2015 USD)

Years		2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Item	Initial amount																					
A. Investment schedule																						
Construction of distribution facilities	89	89																				
I. Total	89	89																				
B. Working capital	2/12 of the annual cost		49																			
II. Working capital			49																			-49
C. Annual costs	Annual amount																					
Incremental power purchase			264	264	264	264	264	264	264	264	264	264	264	264	264	264	264	264	264	264	264	264
Incremental power purchase (GWh)			3,200	3,200	3,200	3,200	3,200	3,200	3,200	3,200	3,200	3,200	3,200	3,200	3,200	3,200	3,200	3,200	3,200	3,200	3,200	3,200
Shadow price (2015 US¢/kWh)	JD0.047 as of 2010		8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3
O&M (% of the construction cost)	2%		2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Overhead	10% of the CGS		27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27
III. Total			293	293	293	293	293	293	293	293	293	293	293	293	293	293	293	293	293	293	293	293
D. Benefits	Annual amount																					
Incremental energy sales			319	319	319	319	319	319	319	319	319	319	319	319	319	319	319	319	319	319	319	319
Energy sales of the project (GWh)			2,897	2,897	2,897	2,897	2,897	2,897	2,897	2,897	2,897	2,897	2,897	2,897	2,897	2,897	2,897	2,897	2,897	2,897	2,897	2,897
Energy sales of the whole system (GWh)		47,771	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667	50,667
Shadow price (2015 US¢/kWh)	JD0.063 as of 2010		11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
Benefit of loss reduction			17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
Contribution of the project (GWh)			206	206	206	206	206	206	206	206	206	206	206	206	206	206	206	206	206	206	206	206
Total loss reduction (GWh)			2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264
Loss reduction achieved (%)			3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%
Distribution loss (%)		9.7%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%
IV. Total			336	336	336	336	336	336	336	336	336	336	336	336	336	336	336	336	336	336	336	336
E. Net benefits																						
IV-I-II-III		-89	-6	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	92
Discount rate	12%																					
Net present value	193	-89	-5	34	31	27	24	22	19	17	15	14	12	11	10	9	8	7	6	6	5	10
Internal rate of return	34%	-89	-5	28	22	18	15	12	9	8	6	5	4	3	3	2	2	1	1	1	1	1

1/ US$1 = JD0.708

2/ CGS: Cost of goods sold