Project #14 – JORDAN – PALESTINE

Description

In the present situation the Palestinian territories (West Bank and Gaza) depend mainly on Israel for electricity supply. The West Bank is also supplied through a 2x33 kV interconnection with Jordan to Jericho on an isolated-grid basis.

Jordan and Palestine are part of the 8 countries interconnection, including also Egypt, Turkey, Lebanon, Iraq, Syria and Libya.

The project consists of one new interconnection between Jordan and Palestine to be realized through an AC 132kV overhead line. It is expected to increase the transfer capacity between the two systems of about 100MW, aiming to feed power demand in Palestine on an isolated-grid basis.

The project is promoted by NEPCO and PETL (under the umbrella of the studies carried out by Med-TSO within the Mediterranean Project II).

Project Description Table							
Description	***Substation (from)***	***Substation (to)***	***GTC contribution (MW)***	***Total Route length (km)***	***Present status***	***Expected commissioning date***	***Evolution***
New interconnection between Jordan-Palestine (AC)	Jordan (JO) Amman West	Palestine (PS) Jericho	100	40	Long-term project	-	

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Project Merits

The major merits of the project relevant to the Mediterranean electricity system are listed below:

	PROJECT MERITS	ASSOCIATED SYSTEM NEEDS	PROJECT 14
Market	Reduce high price differentials between different market nodes and/or countries	Power studies with a 2030 time horizon can highlight significant differences in average marginal prices between countries, groups of countries or bidding zones. These differences are generally the consequence of structural differences in the composition of production fleets. The increase in the exchange capacity between these zones allows an economic optimization of the use of the generation plants and will be accompanied by electricity flow massively oriented in one direction, from the lower price country to the higher prices country, thus reducing the price differential.	
Dispatch, Adequacy and Security of Supply	Positively contribute to the integration of renewables	Infrastructure to mitigate RES curtailment and to improve accommodation of flows resulting from RES geographic spreading.	
	Contribute to solving issues related to adequacy and security of supply	Infrastructure that presents a benefit for the security of supply or system adequacy, in general by allowing additional importation at peak hours, in countries and areas presenting current of future risk of deficiencies	X
Operation	Fully or partially contribute to resolving the isolation of countries in terms of power system connectivity or to meeting specific interconnection targets	Infrastructure to connect island systems, or to improve exchange capacity of countries showing low level of connectivity, or to contribute to meeting specific interconnection capacity targets	X
	Introduce additional System Restoration mechanisms	Infrastructure that could provide capability for Black Start & Islanding Operation thus decreasing the need for generation units with such capabilities	
	Improve system flexibility and stability	Infrastructure to improve system flexibility and stability, by increasing sharing possibilities, namely in countries were expected changes in the generation fleet may raise concerns in those specific issues. Decreasing levels of dispatchable generation can be compensated by infrastructure and/or market design to provide balancing flexibility at cross-border level (international pooling/sharing of reserves, coordinated development of reserve capacity). The large increase in the penetration of asynchronous renewable generation is leading to Higher Rate of Change of Frequency (RoCoF) on the system, creating transient stability issues and causing voltage dips. This can be compensated through infrastructure designed to contain frequency during system events.	
	Increase system voltage stability	Reactive power controllability of converters can be used to increase system voltage stability	
	Enable cross-border flows to overcome internal grid congestions	Infrastructure to facilitate future scenarios and enable cross border flows, accommodating new power flow patterns, overcoming internal grid congestions	
	Mitigate loop flows in bordering systems	Infrastructure to mitigate the loop flows occurrence in the borders between Mediterranean countries, contributing to the improvement of exchange capacity.	
	Contribute to the flexibility of the power systems through the control of power flows	Contribution to flexibility of power system operation by controlling power flows and optimizing usage of existing infrastructure	
Physical infrastructure	Refurbishment of obsolete infrastructure	Infrastructure to contribute to the refurbishment of obsolete part of grid initially designed in different context	

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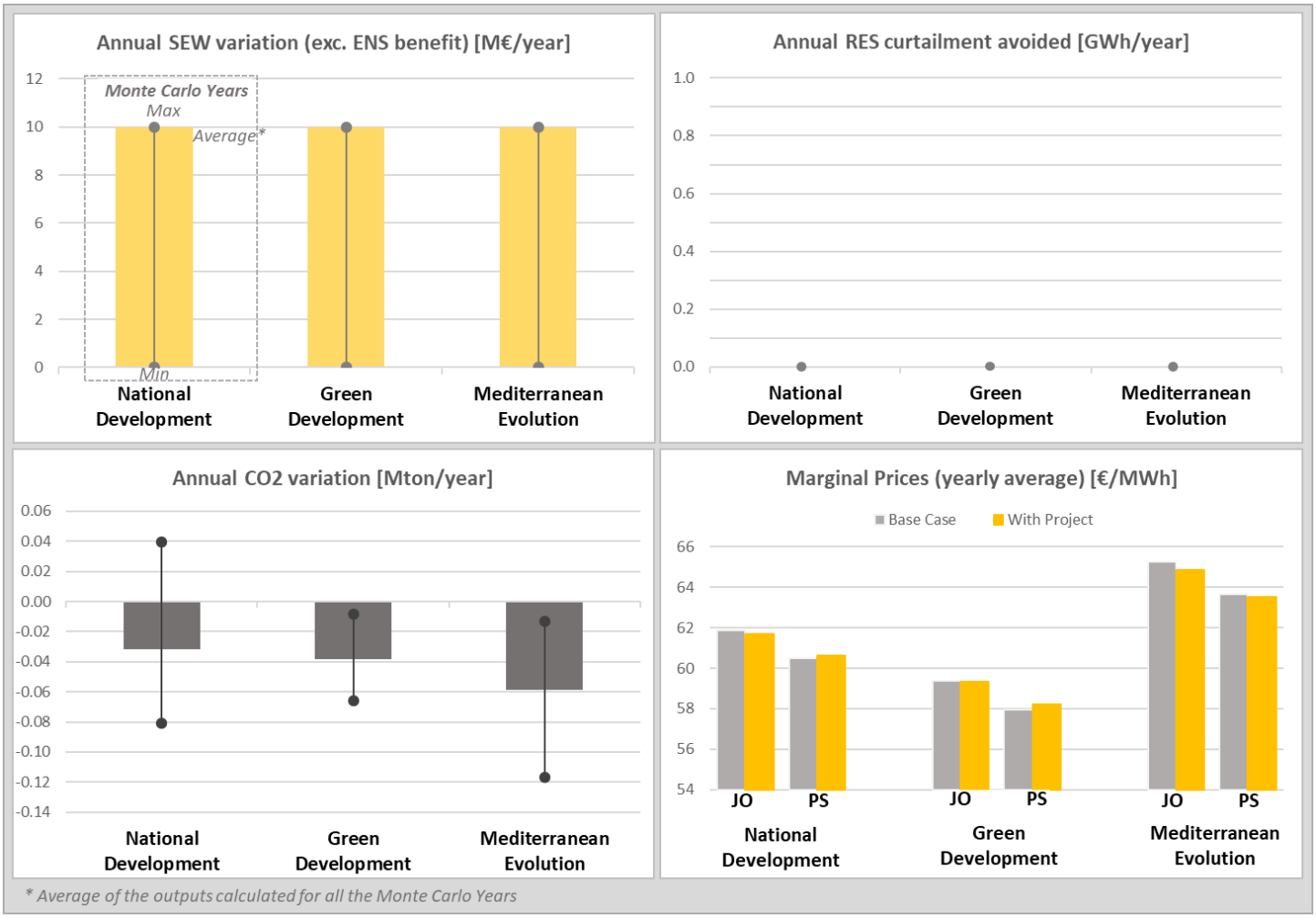
Project assessment analysis

CBA Indicators

Project 14 yields a small positive impact in the expected values of the SEW across the 3 simulated scenarios. In what concerns the impact of the project on RES curtailment and on CO_2 emissions, the study does not show noticeable effect.



** Average of the outputs calculated for all the Monte Carlo Years*

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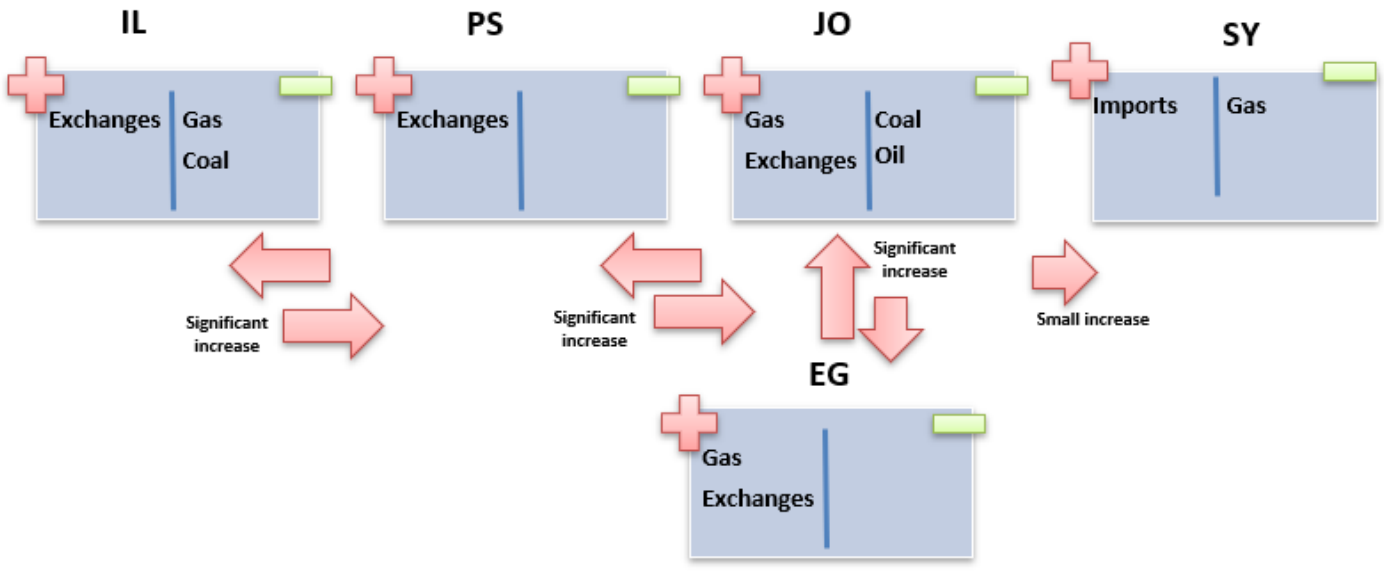
Project assessment analysis

Market Studies

Although this project is planned for Jordan to contribute in feeding the demand in Palestine, the market study is performed following the general rules adopted for the Mediterranean Master Plan, in particular assuming the electricity exchanges driven by market mechanism may be in the two directions, in the limits offered by the interconnection (the additional capacity is 100 MW in the two directions). Consequently, exchanges between Jordan and Palestine may indirectly affect exchange between Israel and Palestine, and between Jordan and its neighboring countries. Then, Project 14 drives an increase in the exchanges between Israel and Egypt through Jordan and Palestine, resulting in the substitution of coal and gas based generation in Israel and gas based generation in Syria by gas based generation in Egypt and Jordan in scenarios National Development and Green Development. In Mediterranean Evolution scenario a different situation is reported, with gas based generation in Israel and Jordan substituting coal and oil based generation in Jordan and gas based generation in Syria, while the Egyptian generation mix is not affected. More specifically:

- **Generation mix:**
  - **JO:** increase in local gas generation in all scenarios, decrease in local coal in scenario Mediterranean Evolution
  - **IL:** decrease in local coal and gas generation in scenarios National Development and Green Development, increase in local gas generation in scenario Mediterranean Evolution
  - **EG:** increase in local gas generation in scenarios National Development and Green Development
  - **SY:** small decrease in local gas generation in all scenarios

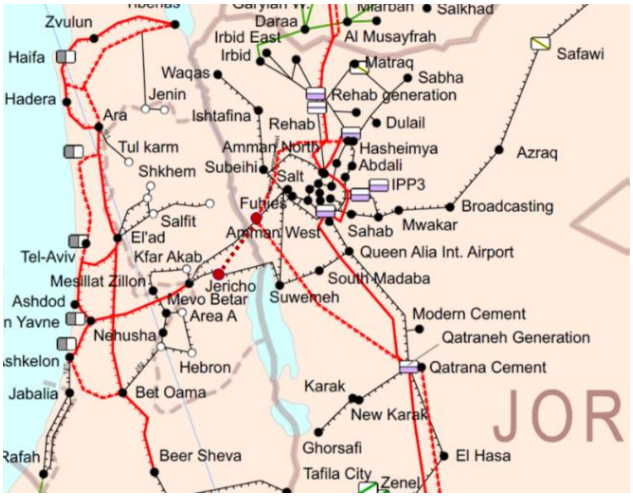
Country balance and cross-country power flows: due to the increase in the NTCs between Jordan and Palestine with the new interconnection, there is an increase in the exchanges between Israel and Egypt through Jordan and Palestine, with the direction of the flow dependent on the scenario. More specifically, in scenarios National Development and Green Development Egypt is exporting through Palestine to Israel and through Jordan to Syria, while in scenario Mediterranean evolution Israel is exporting through Palestine to Jordan, Syria and Egypt.



Project #14 – JORDAN – PALESTINE

Project assessment analysis

This project consists in a new interconnection between Jordan and Palestine to be realized through 400kV AC OHL with a capacity of 200MW and a length of 40km. The system of Palestine was represented as an external bus with load/generator to simulate energy interchange, since the full system model was not available. However, the system of Jordan was represented by its full model. For this project 6 different Points in time were selected (2 Pit per scenario)



The security analysis applied to the transmission level did not identify any necessary additional internal reinforcements for the system of Jordan. Also for the third countries that are included in this project no internal reinforcements were suggested.

The overall investment cost is expected to be around 15M€. The more detailed breakdown of the cost is presented below.

Investment cost-Interconnection	
Lines	***Cost [M€]****
AC line Jordan	2
AC line Palestine	10
Line bay Jordan	1
Line bay Palestine	2
TOTAL	15

*Rounded values

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Project cost benefit analysis results

Assessment results for the Project #14: Jordan-Palestine												
GTC increase direction 1 (MW)			100									
GTC increase direction 2 (MW)			100									
Scenario Specific			MedTSO Scenario									
			1 - National Development (ND)			2 - Green Development (GD)			3 - Mediterranean Evolution (ME)			
			Reference Scenario	With new project	Delta	Reference Scenario	With new project	Delta	Reference Scenario	With new project	Delta	
GTC/NTC - Import		JO	2350	2450	100	2350	2450	100	2350	2450	100	
		PS	0	100	100	0	100	100	0	100	100	
GTC/NTC - Export		JO	2550	2650	100	2550	2650	100	2550	2650	100	
		PS	0	100	100	0	100	100	0	100	100	
Interconnection Rate - Import/Export (%) [1]		JO	29.0% / 31.5%	30.2% / 32.7%	1.2%	25.1% / 27.2%	26.2% / 28.3%	1.1%	22.7% / 24.6%	23.7% / 25.6%	1.0%	
		PS	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
Scenario Specific			MedTSO Scenario									
			1 - National Development (ND)			2 - Green Development (GD)			3 - Mediterranean Evolution (ME)			
Based on Monte Carlo Years			Average	Min	Max	Average	Min	Max	Average	Min	Max	
Benefit Indicators	B1 - SEW[2]	(M€/y)	10	0	10	10	0	10	10	0	10	
	B2 - RES Integration[3]	(GWh/y)	0	0	0	0	0	0	0	0	0	
	B3 - CO_2	(Mton/y)	0.0	-0.1	0.0	0.0	-0.1	0.0	-0.1	-0.1	0.0	
	B4 - Losses[2]	(M€/y)	0			0			0			
		(GWh/y)	0			0			0			
	B5a - SoS Adequacy[4]	(GWh/y)	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.7	0.0	
		(M€/y)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	B5b - SoS System Stability											
Residual Impact Indicators	S1 - Environmental Impact											
	S2 - Social Impact											
	S3 - Other Impact											
Costs	C1 - Estimated Cost[5]	(M€)	15									

[1] considering the GTC/NTC for 2030 and the Installed generation for 2030

[2] considering adequate rounding of values (to the tens)

[3] ignoring low values and negative values of RES integration (average values below 50GWh lead to setting average, min and max equal to zero) and considering adequate rounding of values (to the tens)

[4] ignoring low values (average values below 0.1 GWh/y lead to setting average, min and max equal to zero)

[5] based on the average value of the different technology options considered in the analysis (if applicable)

Rules for sign of Benefit Indicators

B1- Sew [M€/year] =	Positive when a project reduces the annual generation cost of the whole Power System
B2-RES integration [GWh/Year] =	Positive when a project reduces the amount of RES curtailment
B3-CO_2 [Mton/Year] =	Negative when a project reduces the whole quantity of CO_2 emitted in one year
B4-Losses - [M€/Year] and [GWh/Year] =	Negative when a project reduces the annual energy lost in the Transmission Network
B5a-SoS [GWh/Year] and [M€/y]=	Positive when a project reduces the risk of lack of supply

Assessment	Color code
negative impact	
neutral impact	
positive impact	
Not Available/Not Applicable	
monetized	