Teasimed

TOWARDS AN EFFICIENT, ADEQUATE, SUSTAINABLE AND INTERCONNECTED MEDITERRANEAN POWER SYSTEM

Executing short-term demonstration project in the Eastern Region

med-TSO
MEDITERRANEAN TRANSMISSION SYSTEM OPERATORS

Co-funded by the European Union

TASK 3 Identification and put into operation of the selected Interconnected Electricity Exchange Zones (IEEZ), with a view to increasing electricity exchanges

Activity 3.2 Executing short-term demonstration project in the Eastern Region (Mashreq TF)

Deliverables

- Del. 3.2.A Study of potential candidates and proposal of Pilot Project(s): Zone/Rules;
- Del. 3.2.B Proposal of tentative Road Map for a practical implementation of harmonized rules in the eastern zone.
- Del 3.2. C Definition of Requirements and Operational Agreements

Table of content

List of Figures

List of Tables

LIST OF ABBREVIATIONS AND ACRONYMS

AMCE	Arab Ministerial Council for Electricity
COMELEC	Comité Maghrébin de l'Electricité -
DC	Direct Current
EEA	Egyptian Electricity Authority
EEHC	Egyptian Electricity Holding Company
EETC	Egyptian Electricity Transmission Company
EDL	ELectricité du Liban
EGYPTERA	Egyptian Electric Utility and Consumer Protection Regulatory Agency
EIJLLPST	"Eight Country Interconnection Project" (Egypt, Iraq, Jordan, Lebanon, Libya, Palestine, Syria and Turkey)
EMRC	Energy and Mineral Regulatory Commission (Jordan)
ENTSO-E	European Network of Transmission System Operators for Electricity
EU	European Union
GCC	Gulf Cooperation Council
GDP	Gross Domestic Product
GWh	Giga Watt Hour
IEC	Israel Electricity Company

IPP	Independent Electric Producer
IRENA	International Renewable Energy Agency
ISP	Internet Service Providers
kWh	Kilowatt Hour
LAS	League of Arab State
MEDREG	Mediterranean Energy Regulators
Med-TSO	Mediterranean Transmission System Operators
MoU	Memorandum of Understanding
MW	Megawatt
MWh	Megawatt Hour
NEPCO	National Electric Power Company of Jordan
NRA's	National Regulatory Agencies
NTC	Net Transfer capacity
OS	System Operator of Electricity
PMU	Project Management Unit
PPA	Power Purchase Agreement
PAEM	Pan-Arab Electricity Market
PA-RETP	Pan-Arab Regional Energy Trade Platform

PENRA	Palestinian Energy and Natural Resources Authority
PETL	Palestinian Electricity Transmission Company
RES	Renewable Energy System
SAPP	South Africa Power Pool
TEASIMED	Towards an efficient, adequate, sustainable and interconnected Mediterranean electricity system
Socio	socio – economic development
TSO	Transmission system operator
TWh	Terawatt Hour
WD	World Bank

Introduction

Med-TSO (Mediterranean Transmission System Operators) is a recognized association established in Rome, on the 19th of April 2012, involving the Mediterranean companies performing the activity of transmission system operators (TSO). As part of the Med-TSO activities for the interconnection of Mediterranean Power Systems, an in-depth analysis of the state of the infrastructures, interconnections between countries and regulatory frameworks have been carried out. One of the conclusions of this analysis showed that for the Eastern Mediterranean region, given the current way of using interconnections and cross-border electricity transactions, it is **necessary first of all to establish a roadmap** which makes it possible to harmonize all the aspects necessary to promote the development of electricity exchanges with better use of interconnections.

The possibility of developing an integrated regional energy market in the Eastern Mediterranean region is a key factor for security and socio-economic development in the region, given on the one hand the complementarities between the different electricity systems, and on the other hand the need for some countries to strengthen the security and reliability of their electricity supply (e.g.: Lebanon, Syria, Palestine). **The Eight Country Interconnection Project (EIJLLPST)**, that involves the electrical grids of Egypt, Iraq, Jordan, Libya, Lebanon, Palestine, Syria, and Turkey, set up by the countries of the region, constitutes the focal point for the integration of the local systems, the strengthening of the exchanges, while constituting a **backbone for the future connection of the South-East Mediterranean market to the EU market** and the Council of Gulf Countries.

The **TEASIMED** project (ENI/2020/417-547) "Towards an efficient, adequate, sustainable and interconnected Mediterranean electricity system" is the third project developed by Med-TSO with the financial support of the European Commission, after MP1(2015-2018) and MP2 (2018-2020). Activity 3 of the TEASIMED project concerns the Identification ***and put into operation of some selected Interconnected Electricity Exchange Zones (IEEZ), with a view to increasing electricity exchanges in the region*** and encompass two subtasks:

Activity 3.1 Executing short-term demonstration project in the Maghreb Region

Activity 3.2 Elaboration of zonal target regulatory framework in the Eastern Region

This activity 3.2 will use the previous experience developed in the Mediterranean Project 2 (MP2). This report is elaborated in the context of the **TEASIMED** framework project, contain the main sub activities as follows:

1- Study of potential candidates and proposal of Pilot Project.

2- Road Map to define the actions and steps necessary in order to set up the conditions and set of rules for a Regional Electricity Market.

3- Definition of Minimum Requirements, Models and Set of Rules necessary to realize and operate safely and efficiently the Interconnections between the Mashreq Electricity Systems

4- Definition of the Principles of Cooperation and the Operational Agreements in view of an Electricity Exchange Platform.

Taking into account the role of the Med-TSO as a promoter, facilitator and coordination centre of TSOs in the Mediterranean region, the main objective of the TEASIMED sub-task 3.2. is **to identify the building blocks that are necessary to organize a sub-regional integrated market** and develop some critical analyses and/or activities in order to be able to present and submit a well-founded and reasoned proposal to the main stakeholders for their decision-making on the subject.

The activity also contributes to the drafting of a roadmap and the definition of prerequisites for implementing a platform for electricity exchange and trading in the Mediterranean Eastern Region. This report concerns the first part (First Milestone) of the study related to the elaboration of a zonal regulatory framework to enhance Power Trading in the Eastern Mediterranean Zone. The objective is to propose, together with the concerned TSOs, a ***roadmap*** for implementing a project creating a zone in the Eastern Mediterranean Area where the electricity trading would be developed through the implementation of harmonized rules and an organized market. The project takes into account that the same objective is already included in the projections made by the League of Arab States for the establishment of a **Pan-Arab Electricity Market (PAEM)** and for which high-level decisions have already been taken through the signing of a Memorandum of Understanding (MoU) in 2017. Med-TSO aims to contribute/support PAEM initiative, building on best practises implemented in the wide Mediterranean region.

The purpose of the Roadmap is to identify and prioritize the actions/building blocks necessary to create an area with harmonized rules such as to allow the increase of electricity exchanges and a better use of existing grids/interconnections. In more general terms, the roadmap will define the necessary steps and actions to be implemented by the concerned countries in order to set up the conditions and rules allowing to build a zonal project as a pilot for a Regional Electricity Market and a regional platform for electricity exchanges.

1. Study of potential candidates and proposal of Pilot Project

The identification of pilot zones is based on two dimensions: a geographical aspect, (limited zone in the Mediterranean region where an ample set of issues are selected and developed for tentative roadmap for practical implementation) and regulatory (considering the current legislative framework in each region).

In this context the real existence of interconnections between counties is necessary for the proposal zone in the short-term.

The methodology adopted for this activity is a participative approach between members of TC Regulation

After the discussion, Mashreq area was selected as the first pilot zone as next. A summarized explanation of those 2 zones and the potential regulatory aspects to deal with is presented next:

i. Zone 2A.- Current “Eastern Zone” (Libya, Egypt, Lebanon and Jordan) with focus in operation issues and interconnection management. Or (Eastern interconnected system (Libya, Lebanon, Egypt and Jordan) within the eastern Zone 2A)
ii. Zone 2B.- Future “Eastern Zone” (Libya, Lebanon, Egypt, Jordan, Israel, Palestine, Cyprus, Turkey and Greece) with focus on HVDC interconnections

1.1 Joint Proposal

A mini survey was distributed with the members of TSO concerned by this activity (PETL, EETC and NEPCO) in order to explain the TSO point of view related to the different aspect and technical issues that could be implemented, as shown in the following table.

ISSUES	DESCRIPTION	TSOs		
		NEPCO	EETC	PETL
DEFENCE PLAN	Adjustment thresholds for South-East-Med interconnections	**1**	**1**	**1**
RESERVE MANAGEMENT	The participation in different kinds of reserves	**2**	**2**	**2**
LOAD CONTROL	The participation in the LFC	**2**	**1**	**2**
SYSTEM STATES	Participation and Assistance with mutual security	**2**	**2**	**2**
DISPATCHING & BALANCING	The compensation for voluntary exchanges	**2**	**1**	**1**
TRANSPARENCY	Transparency with mutual exchanges information	**1**	**1**	**1**
REGULATORY / INSTITUTIONAL	Platform Trade	**1**	**1**	**N**
REGULATORY	Grid Services Market	**N**	**N**	**N**
CAPACITY ALLOCATION & CALCULATION	Capacity Calculation	**N**	**N**	**N**
PROFITABILITY & EFFICIENCY	CBA Study	**N**	**N**	**N**
N	Issues not disclosed by TSOs			

Number (1,2)	Issues disclosed with desired priority by TSOs

Table 1 Joint Proposal

Taking into consideration these positions, a road map as been proposed in chapter 2 with the support of a consultant. In this proposal also the position of Electricité du Liban, the Lebanese TSO, has been taken into account.

2. Road map to define the actions and steps necessary in order to set up the conditions and set of rules for a regional electricity market

2.1 General/Strategic Context and Background

In recent years, various initiatives and studies have been carried out, particularly by the League of Arab States, and have focused on the theme of electrical systems integration and the development of electricity markets in the region.

Among them, **numerous studies and analyses carried out by the World Bank, the Arab League, MEDREG and Med-TSO have already highlighted a certain number of barriers**, mainly of a technical, jurisdictional, regulatory and commercial nature which must be removed in order to strengthen exchanges and set up an Arab regional electricity market with the objective of its future extension to the markets of the EU and the Gulf countries.

In terms of the EU policy for the Mediterranean basin, an integration path started with the Barcelona Process launched in November 1995, by the Ministers of Foreign Affairs of the Member States and 14 Mediterranean Partners, as the joint framework within which to manage both bilateral and regional relations. The process envisaged a strong and wide-ranging partnership, founded on three pillars formed by a dialogue on politics and security and two substantial partnerships in economics and finance, and social and cultural affairs. A challenging ambition of the energy and financial partnership was the commitment to work towards a free trade area by 2010 which would be based on the rules in force in the European Community, supporting initiatives aimed at strengthening regional and sub-regional integration and for the development of interconnections and infrastructures in the field of energy between the Euro-Mediterranean countries (cf. declaration of the Euro-Mediterranean Conference, held in Barcelona on 27 and 28 November 1995 and in Naples on 2 and December 3, 2003). Energy was included within this framework and the economic and financial chapter of the Barcelona Declaration assigned to energy a “pivotal role….in the implementation of the partnership” through a strengthened cooperation” and the intensification of the “dialogue in the field of the energy policies, as well as the encouragement of appropriate framework conditions for investments and the activities of the energy companies”.

The importance of cooperation in the energy sector was reaffirmed on many occasions in subsequent Euro-Mediterranean conferences of ministers. In May 2003, the European Commission also issued a Communication on the development of energy policy for the enlarged EU, its neighbours, and partners[1] . This was an important shift in policy towards the countries around the EU that originated from the perception that the enlargement to new EU member states also created an opportunity, and perhaps a need, to restructure its relationships with neighbouring countries. This initiative in the energy sector was part of a general trend to a new Neighbourhood Policy[2] characterised by a more differentiated approach towards EU neighbouring countries depending on the circumstances of the country and the extent to which its government was prepared to engage with economic and political reforms. In the energy sector, the declaration of the European Commission (meeting in Naples on the 2nd and 3rd of December 2003) did not limit the development of a European Internal Energy Market to the members of the EU but conceived that other countries and regions could be included where they could provide a level playing field, in terms of market opening, fair competition, environmental protection and safety. Also, the Commission did not propose that neighbouring countries necessarily adopt existing EU rules, but that they must achieve "substantially similar levels of market access and the adoption of equivalent standards", supporting the initiatives aimed at strengthening regional and sub-regional integration and the development of interconnections and infrastructures in the field of energy between Euro-Mediterranean countries.

On the other hand, **the idea of electricity trade benefits has inspired the vision of a Pan-Arab Electricity Market (PAEM).** With the leadership of the League of Arab States (LAS), the **Memorandum of Understanding (MoU) to establish the PAEM was signed in 2017 by 16 Arab countries**. For its side, the World Bank was accompanying this effort through the Pan-Arab Regional Energy Trade Platform (PA-RETP) Initiative, which has now entered in its second phase of development.

The PAEM project is a pragmatic effort to create closer cooperation among the countries by unifying them around a common vision of shared economic benefits. Trade among countries, as well as joint investment projects, supports economic and political stability as ties become stronger, reducing fragility and conflict in the region. At the same time, it may support some regional projects more than

[1] Communication from the Commission to the Council and the European Parliament on the development of energy policy for the enlarged European Union, its Neighbours and Partner Countries, Brussels, 26.5.2003,COM(2003) 262 final

[2] Communication from the Commission to the Council and the European Parliament on Wider Europe – Neighbourhood: A New Framework for Relations with our Eastern and Southern Neighbours, Brussels, 11.3.2003, COM(2003)104. http://europa.eu.int/comm/world/enp/pdf/com03_104_en.pdf.

others depending on the respective consistency of the solutions adopted by each party. The PAEM is envisioned as a shared vision to increase power trade in the region and potentially export power to the European Electricity Market. **The proposed integration plan under the PAEM seeks to achieve progressive regional integration of electricity production**.

Despite having signed a MoU committing to the establishment of the PAEM, several national and regional actions and steps are required to ensure a successful implementation and optimization of the integration program. The relevant activities are in progress and **to date the PAEM initiative reached a certain level of maturity and political consensus and constitutes a reference framework for any integration project in the area**. Finally, in all the Arab countries several sub-regional initiatives have been on-going for a long time (COMELEC in the Maghreb, EIJLLPST Region, GCC Region) producing some results and establishing some organizations that would be wasted not to consider. Within the framework of the Pan-Arab Electricity Market, the Eastern Mediterranean region, consisting mainly of Egypt, Jordan, Lebanon, Palestine and Syria, constitutes a focal point for the integration of systems, the strengthening of electricity exchanges and the backbone for the extension of electrical interconnections to the European systems and the Gulf countries through the eight countries interconnection project (EIJLLPST) as well as the Egypt-Greece, Israel-Cyprus and Egypt-Cyprus interconnections projects.

The discovery of new gas reserves in the Middle East basin associated with significant renewable energy resources in the region, particularly in Egypt and Jordan, will undoubtedly allow a significant development of energy trade in the region and may fit into a Euro-Mediterranean market scheme. **Jordan, Lebanon and Syria could form the heart of an international electricity trading hub, linking the two major energy systems in the region (Egypt and Turkey) and later expanding trade with Europe and the Gulf region** through the development of energy infrastructures, intended for a larger market than just national markets. The three countries (Jordan, Lebanon and Syria), considered individually, are small markets, both from the energy point of view (small size of the electricity markets, low domestic electricity production and low loads) and economic (financial dimension investments in internal infrastructure compared to international trade flows), with the consequent limited attractiveness for private investment, the cooperation of which is vital for the large investments required by the electricity infrastructure supporting cross-border transactions.

Interfacing the national energy needs of Lebanon, Jordan and Syria to a regional trading system will improve security and efficiency (technical and economic) with an optimization of investments at the level of the three electricity systems. Also, the development of the important resource of renewable

energies in the region depends on a reliable and solid electricity network, a high degree of interconnection with neighbouring networks and a market, in order to make it possible to optimize investments and ensure a better integration of these energies. In addition, the Egypt-Saudi Arabia electrical interconnection (transmission capacity of 3.000 MW, Direct Current) and the strengthening of the existing interconnection between Egypt and Jordan, can play a role as a vector for the development of trade and launch of the market, taking into account the existing complementarities between the different systems (non-synchronous daily and seasonal load peaks, etc.). Given its strategic location, the Eastern Region is a real hub for power trade with countries of the southern Mediterranean, Middle East and Europe, particularly with regard to the region's energy resources, particularly renewable.

2.2 Overview Of Countries Electricity Systems in the South-East Mediterranean Zone

2.2.1 The Egyptian Energy System

In terms of energy sector, in 2016 the entire population of Egypt was successfully reached by the electric service, meeting the target of 100% electricity access in the country. **The total installed capacity in the year 2020/2021**, as Figure 1 illustrates, accounted for **58.8 GW**, 33 % higher than 2016. The total installed capacity in 2020/2021 was 58,818 MW and the corresponding peak demand was 32,408 MW (Annual electricity sector report 2020/2021).

DESCRIPTION	2016 / 2017	2017 / 2018	2018 / 2019	2019 / 2020	2020 / 2021
GAS	13.345	5.745	4.055	4.055	3.343
STEAM	15.449	15.449	16.749	17.179	17.179
COMBINED CYCLE	12.630	30.030	32.470	32.448	32.448
HYDRO	2.800	2.832	2.832	2.832	2.832
RENEWABLES	887	1.157	2.247	3.016	3.016

TOTAL (MW)	45.111	55.213	58 353	59 530	58.818

Table 2 Installed Generation Capacities by generation type (MW/GW)- Source: EEHC annual report , 2020/2021

The entire sector is regulated by Egypt ERA, the designed authority, responsible for implementing the laws, guaranteeing the transparency, preventing market monopoly and managing in details tariffs and licenses. In compliance with Law N°87 of 2015, Egypt ERA monitors the whole energy sector (production, transmission and distribution), implements policies, sets tariffs and administrates licenses. **The entire grid, in particular the generation, transmission and distribution of the electric service is managed by EEHC, the Egyptian Electricity Holding Company.** Historically, the electricity market was a monopoly under the state-owned Egyptian Electricity Authority, EEA now known as EEHC. With the New Electricity Law N°87 of 2015 Egypt has started the process of market liberalization, allowing the entry of private companies in the generation and distribution, where the transmission is the responsibility of the **EETC (Egyptian Electricity Transmission Company),** and redefining the role of EEHC as a supervisor and coordinator of all the players along the electricity service value chain (from producers to consumers). Nevertheless, to date, EEHC controls the 90% of the generation capacity (6 companies), the monopoly of transmission and all the utilities responsible for the distribution (9 companies).

The following figure resumes the current organization of the Egyptian Power Sector.

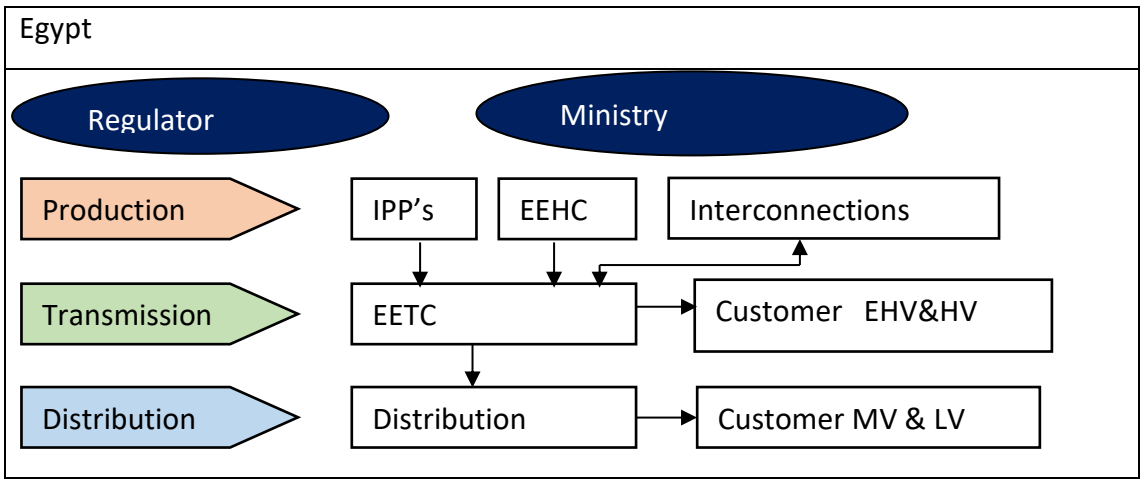


Figure 1 – Egyptian Power Sector

2.2.2 The Jordanian Energy System

The Jordanian Energy System is marked by an almost total dependence on imported fuels (gas and oil products), the lack of hydroelectric resources, with consequent difficulties to a large penetration of RES, one of the available endogenous resources. A second national resource will come from the exploitation of shale oil which will burn in Attarat power plant to generate 470 MW. The total installed capacity available connected with the transmission network, distributed from conventional, is 4000 MW and 1424 MW from renewables; where the renewables come 900 MW from solar and 518 MW from wind (Table 2). Moreover in 2020 the morning peak load had reached to 3,530 MW, while the evening peak load reach to 3630 MW (Table 3).

Installed generation capacity

YEAR	STEAM	GAS TURBINES		COMBINED CYCLE	DIESEL	RENEWABLE ENERGY			TOTAL	
		DIESEL	N.GAS			HYDRO	WIND	SOLAR	RENEWABLE	TRADITIONAL
2016	605	---	307	2.044	814	6	198	194	398	3.770
2017	605	---	228	2.044	814	6	198	204	408	3.691
2018	605	---	83	2.740	814	6	280	449	735	4.242
2019	605	---	83	2.740	814	6	369	637	1.012	4.242
2020	**363**	**---**	**83**	**2.740**	**814**	**6**	**518**	**900**	**1.424**	**4.000**

Table 3: Jordan available capacity of generation plans on transmission network (MW)- Source IRENA May 2022

Jordan electrical power system is interconnected with Egypt (Submarine cable single circuit with 550 MW maximum capacity) **and with the Syrian Power system** (400 kV single circuit overhead line, with 800 MVA capacity from Amman North S/S in Jordan to Der Ali S/S/ in Syria). And feeding islanding load in Palestine and Border offices in Iraq.

The country energy strategy for the future, considered the lack of endogenous resources, is oriented towards the integration of the local energy system in the regional market, and planned to install pump-

hydro and batteries to storage energy and to absorb more renewable energy, leveraging on the country strategic position, together with Lebanon and Syria in the Middle East. **With the New Electricity Law, Temporary Law N°64 for the Year 2003, General Electricity Law, Jordan has started the process of market liberalization**, allowing the entry of private companies in the generation and distribution and **redefining the role of EMRC as a supervisor and coordinator of all the players along the electricity service value chain** (from producers to consumers). Nevertheless, to date, EMRC controls the 100% of the generation capacity (7 companies), and all the utilities responsible for transmissions (NEPCO) and the distribution (3 companies).

The following figure resumes the current organization of the Jordanian Power Sector.

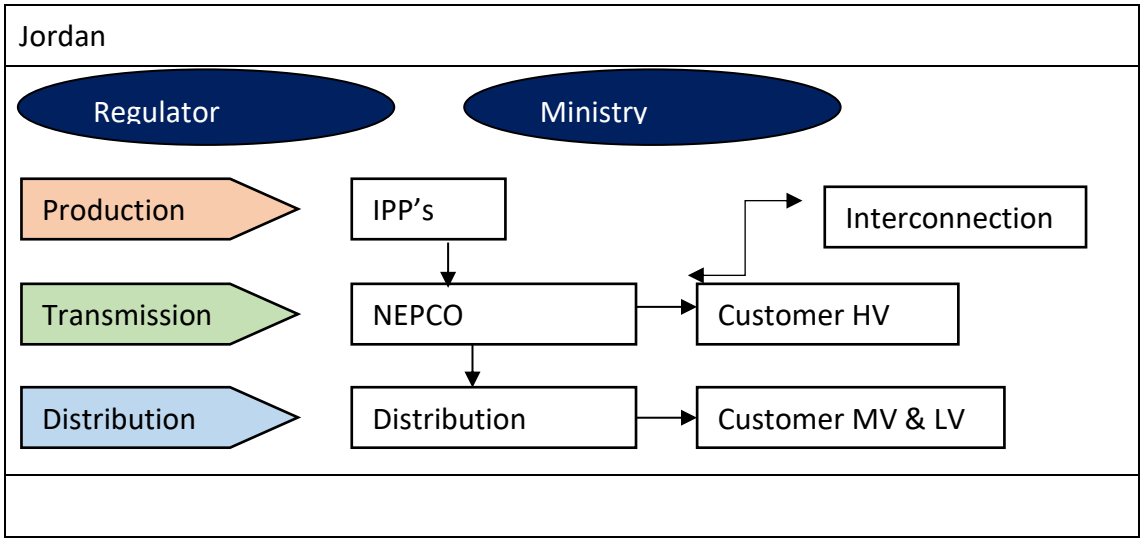


Figure 2 Jordanian Power Sector

2.2.3 The Lebanese energy system

The Lebanese electricity sector is plagued by a severe mismatch between supply and demand, resulting from long-standing capacity deficit and exacerbated by fuel shortages, leading to extending rolling blackouts and power outage. Lebanon depends exclusively on imported fuel to generate electricity, apart from a small and variable hydropower supply (100 MW).

The Lebanese electrical grid is connected only to Syria through three interconnections. The first one is a single circuit 400 kV line Ksara (Lebanon)–Dimas (Syria). The line is double circuit in the Lebanese territories and single circuit in the Syrian territories. This line was used (before the Syrian crises) to import power mainly from Egypt but not in a synchronization regime (a part of the Lebanese grid was set to operate as an electrical island with Egypt). Currently, this line is used to import power only from Syria without synchronization. The second is a single circuit 220 kV tie line Deir Nbouh (Lebanon)–

Samarian (Syria) which is not frequently used to import power due to technical restrictions from the Syrian side (after the Syrian crises). Finally, there are two 66 kV overhead tie lines Ksara–Dimas which are used from time to time.

As for the Syrian electricity system, after 10 years of political unrest, many electricity infrastructures (power stations, transmission lines, etc.) are out of service and are also impacting the supply of electricity to the Lebanese network, which cannot import energy only through the Syrian grid. Given the embargo imposed by the US since 2011, Jordan, Lebanon and Syria have concluded a multilateral agreement for the supply of electricity by Jordan to Lebanon via Syria, with the approval of the United States and funding from the World Bank. NEPCO is awaiting acceptance from the World Bank to finance energy exports to Lebanon. Electricity imports from Jordan could increase supply in the short-term. The connection between the Lebanese and Jordanian grids (though the connection through Syria was damaged during Syria's civil war but was recently repaired), also is another existing channel that can be tapped. Jordan has a surplus electricity that Lebanon can buy to increase its power supply. In the medium to long-term.

Lebanon is only connected to the Arab Gas Pipeline (AGP) through Egypt, Jordan and Syria. This pipeline can supply gas to the Deir Amar power plant. The ongoing rehabilitation of the pipeline section within Lebanon is expected to be completed by April 2022. Switching other power plants to natural gas requires installation of a Floating Storage and Regasification Unit(s) (FSRU) and supply of liquified natural gas (LNG), unless a dedicated extension of AGP linking Deir Amar in the north with Zahrani in the south is built in the future. Securing fuel supply would double electricity supply from existing efficient generation assets and triple electricity supply if existing old Zouk and old Jieh power plants are also included in the mix.

For this, the government of Egypt recently took the decision to export natural gas to Lebanon via Syria after the signing of an agreement on the 21st of June 2022 (ref. Al Monitor Review ''Independent, trusted coverage of the Middle East'' of June 30, 2002), at a rate of 650 million m3 per year via the Arab gas pipeline, in accordance with World Bank conditions and awaiting United States approval to exclude Egypt from sanctions against the Syrian government, because of the embargo imposed by the USA on Syria since 2011. This quantity of natural gas will supply the Lebanese power plant of Deir Ammar with a production of 450 MW and will thus reduce the constraints of satisfying electricity demand in Lebanon.

2.2.4 The Palestinian Energy System

The Palestinian electricity system is limited on the one hand to the network of the territory of the West Bank supplied by a 33 kV line with a capacity of 80 MW from the Jordanian network and on the other hand to the network supplying the Gaza Strip. The consumption is very low for both system of Palestinian territory:

- West Bank (2020) : Consumption/Year: 4490 GWh “1250 KWh /per capita”, for 3,04 Million
- Gaza Strip (2020) : Consumption/Year: 1517 GWh “798 KWh /per capita”, for 2 million

The limited production capacities of the Palestinian electricity system, associated on the one hand with the low capacity of the connection with the Jordanian network and on the other hand with the high price of electricity imported from the Israeli network, mean that significant constraints of demand coverage are observed at the level of the Palestinian network.

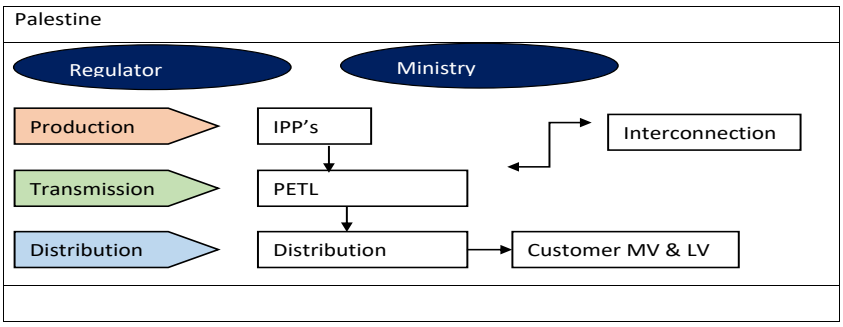


Figure 3 – Palestinian Power Sector

2.2.5 The Syrian Energy System

Before the 2011 conflict, Syria’s electricity infrastructure was barely functional. There was high production and transmission losses with frequent load shedding, especially in the summer. Syria had poor structural and performance indicators: power losses stood at nearly 26% and there were 43 days of power outage per year. Tariffs were low due to heavy government subsidies. However, ten years of war has worsened matters considerably. Per capita consumption of state electricity is 15% of what it was in 2010. For instance, in the first half of 2021, Aleppo had ten-hours of rationing for every hour or half an hour of power; Damascus had, instead, five “dead” hours for one hour of electricity. The damage to the grid and substations can be fixed at reasonable rates with local expertise. This is not the case, though, with power generation plants. The conflict saw four of the 14 plants suffer serious damage, representing nearly 18% of the pre-war installed capacity nationwide.

Two other plants near Hama and Damascus have also been damaged but have since been partially repaired.

Up until the outbreak of war in 2011, the country had enough fuel resources to cover most of its oil and gas needs for electricity generation. However, the infrastructure needed to be modernised, with high production and transmission losses. Additionally, demand was outstripping generation capacity. This was due to a lack of investment and resulted in frequent load shedding, especially in the summer. Neglect, robbery, vandalism, and shelling damaged electricity infrastructure during the conflict. Since 2012, failures in electricity supply have become a chronic problem affecting vital services and, with them, people's livelihoods. The lack of electricity impeded economic activity as the economy continued to contract, especially during the period 2011-2016.8 According to the 2018 World Bank Enterprise Report, "the intermittent supply of electricity and fuel constitutes the greatest challenges for Syrian firms, with 67.5% of firms citing electricity interruptions as a major or severe problem"9 Electricity interruptions were, in fact, the most serious reported problem across all categories. In 2021, the situation became still worse, with rationing paralysing most economic activity for hours and hours.

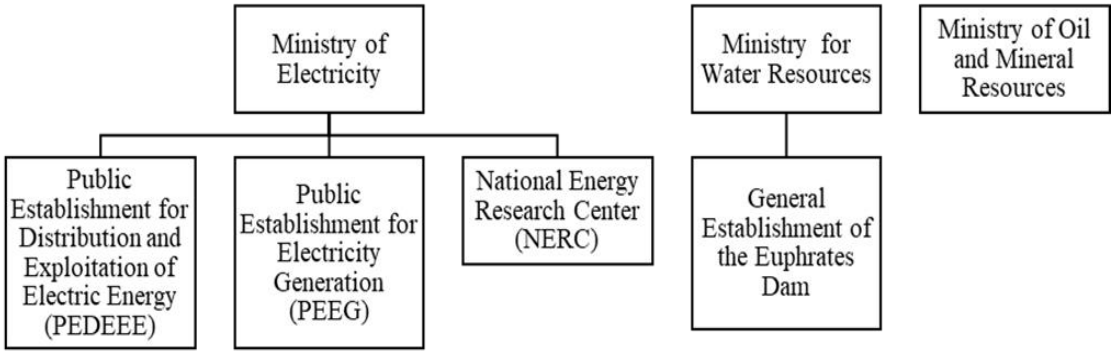


Figure 4 - Syrian Electricity Sector Structure

2.2.6 Main Figures of Electricity Sector in South-East-Med Zone. Regional Electricity System data (2020)

COUNTRY	COUNTRY CODE	ENERGY DEMAND (TWh 2020)	INSTALLED CAPACITY (GW in 2020)	PEAK LOAD (GW in 2020)
Jordan	JO	19.19	4.000	3.630
Egypt	EG	199.843	58.353	31.4
Palestine	PS	6.4	0.14	1.3

Table 4 South-East-Med Electricity Systems Data

2.2.7 Legal, Regulatory, Institutional and Policy Framework in the South-East-Med region

COUNTRY	ELECTRICITY LAW	REGULATOR	TRANSMISSION GRID CODE	DISTRIBUTION GRID CODE	SECTOR STRUCTURE/REFORM	REGIONAL ELECTRICITY FORUM
EGYPT	YES (Ren)	EgyptERA	YES	YES	VER	AUE, AERF, Steering Planning Operation
JORDAN	YES (EE&Ren)	EMRC	YES	YES	SB/UNB	Idem
PALESTINE	YES	PERC	NO	YES	SB/UNB	Idem
LEBANON	YES (IPP)	NO	NO	NO	VER	idem
SYRIA	YES	NO	NO	NO	VER	Idem

Table 5- Regulatory, institutional and Policy framework in South-East-Med region

In the South-East-Med region, wholesale and retail power trade markets have not opened yet.

2.3 Analysis Of The Current Status Of Electricity Trading In The Eastern Mediterranean Zone and Utilization Of Interconnections

2.3.1 The Existing Electricity South-East-Med System

For the Eastern Mediterranean region, the project of interconnections between the 8 countries (EIJLLPST) constitutes the most extensive network pool of the Arab South-East-Med. The Project was launched in 1988 linking Egypt, Iraq, Jordan, Syria and Turkey with its subsequent extension to Libya, Lebanon and Palestine. The expected objective was to initiate real cooperation through the sharing of reserves in the event of an emergency and the exchange of surplus electricity between the different countries, taking into account the opportunities linked to the difference in consumption profiles (daily, seasonal). However, commercial-type trade among these countries has been marginal, given the limited generation capacities (ex. Jordan) and relatively low interconnection capacities. Also, **the bulk of the exchanges has taken place between Egypt and Jordan through supply contracts from Egypt to Jordan** through the Egypt-Jordan interconnection with a maximum capacity of 550 MW.

With regard to the development of interconnections between Jordan, Iraq, Saudi Arabia and Palestine, Jordan should export 150 MW of electricity to Iraq at the beginning of 2022 (through the process of a call for tenders from the Jordanian side); for the West Bank, the **Jordanian and Palestinian TSOs coordinated to increase the amount of electricity exported from 26 MW to 80 MW in 2022**. In addition, **there are plans to increase the capacity of the electricity interconnection line between Jordan and Egypt from 550 MW to 1,100 MW by 2023**. Also, Jordan and Saudi Arabia have signed a memorandum agreement for the export and import of electricity via a 127 km interconnection line linking East Amman and Qurayyat in Saudi Arabia.

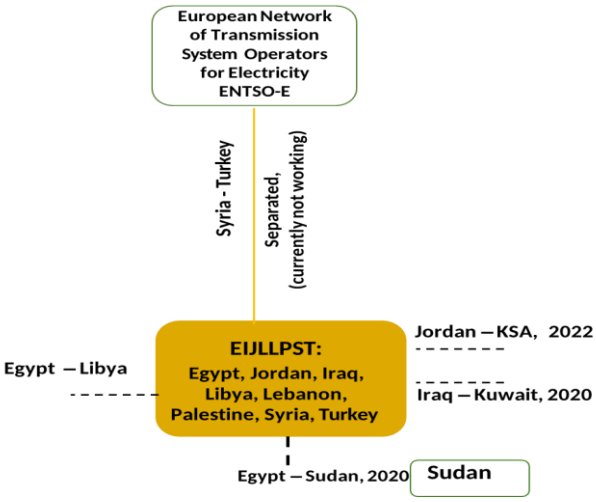


Figure 5 - Current situation of Interconnections in South-East-Med regions. Source: World Bank

2.3.2 Current situation in the Electricity exchanges in the South-East-Med region

THE YEAR	EXPORT GWH		EXPORT GWH		
	EGY_JOD	JOR-SYR	SYR-JOR	JOR- JDECO*	JOR_EGP
2008	534	245	13.0	64.0	8.6
2009	363	68	20	56	9
2010	446	0	224	48.4	3.8
2011	1458	0	280	75.5	4.2
2012	784	0	0	83.0	14.5
2013	381	0	0	41.5	10.8
2014	435	0	0	34.4	64
2015	603	0	0	41.4	3.0

2016	384	0	0	42	0
2017	51	0	0	54	0
2018	188	0	0	88	0
2019	239	0	0	92	0
2020	380	0	0	184	0

Table 6 Electricity exchange in the South-East-Med Region with Existing interconnections

(*) JDECo Jerusalem District Electricity Company (Palestine)

- **The opportunity for electrical energy exchange for Palestine**

Table N°6 shows the opportunity for electrical energy exchange among the South-East-Med countries. It is clear that **Egypt and Jordan have a surplus in generation, while Palestine has a shortage in local generation** with an energy consumption of 6.5 TWh/year and an installed capacity of only 140 MW. Palestine covers its needs through IEC (Israel Electricity Company) but at very high cost. In fact, the challenge for Palestine is to increase the imported energy from Egypt and Jordan while receiving the political approval from the Government of Israel. This would allow the Palestinians to build their own HV transmission network that would connect to the transmission networks of Jordan and Egypt, instead of importing limited amount of electricity through the MV networks.

- **The technical obstacles to overcome to increase the energy exchanges**

There are some restrictions on opening the amount of electricity exchanged among Egypt, Jordan, Syria and Lebanon:

- The line between Egypt and Jordan is one circuit
- The thermal limit of the submarine cable between Egypt and Jordan is 550 MW
- Single transformer connection to Taba 500/400/220 kV.
- Voltage drops because the connection point is far from the load centres in Egypt and Jordan
- Some internal stability problems must be solved
- One transformer 250 MVA connected to a network of 400 KV in Lebanon
- One circuit 400 kV between Jordan and Syria

The energy systems of Jordan, Lebanon and Syria present complementarities conducive to the development of electricity transactions, due to their **location among the main energy systems of the region (Egypt, Saudi Arabia, Turkey)**, which would later connect the South-East-Med region to the energy systems of Europe (via Turkey and future interconnections linking the networks of the Middle East to the ENTSOE system) and the Gulf countries.

The Egypt-Saudi Arabia electrical interconnection project (transmission capacity of 3,000 MW, DC) and the strengthening of the existing interconnection between Egypt and Jordan, can play a role as a vector for the development of trade and launch of the market, taking into account the existing complementarities between the different systems (non-synchronous daily and seasonal load peaks, etc.). The Region, in general, is marked by the presence of the large system of Egypt, together with other smaller countries often presenting stability problems impeding a rapid development of their electrical systems.

Interconnection issues include a structural problem of supply in Lebanon and the challenge of connecting the Palestinian distribution networks to an integrated network. In both cases, the integration of renewable energies is becoming increasingly important jointly with the role of cross-border integration for reinforcing the stability of the networks, ensure good management of intermittence. The whole South-East-Med is subject to great heterogeneity in the organization of the systems and with regard to the issues concerning the security of supply. In Egypt, the existing electricity cross-border infrastructures connect Egypt with Libya on its western border, with Jordan and Palestine on its eastern border and with Sudan in its south border. Two more interconnections are in development phase, construction/negotiation, with the Kingdom of Saudi Arabia, Cyprus and a reinforcement of the interconnection with Jordan is also under development. Existing Egyptian east-west cross-border interconnections are part of the so-called “Eight Country Interconnection Project.”

Interconnectors from Egypt to Libya and Jordan have not been completely exploited. In 2016, no electricity exchange took place through the Egyptian–Libyan electrical interconnection due to the current prevailing conditions in the region and the Egyptian Jordanian electrical interconnection also witnessed a certain decline in electricity trade for a period of time. In 2020, 492 GWh were exported from the Egyptian network to the Jordanian one. Concerning the interconnection with Palestine, the power trade is relevant mainly due to the significant deficit of the Palestinian network and the high price of electricity sold by the Israeli network. The bulk of the exchanges has been taking place between Egypt and Jordan through supply contracts from Egypt to Jordan through the Egypt-Jordan interconnection with a capacity of 450 MW. As a precaution against transmitting capacity exceeding

the nominal capacity of the submarine cable or Taba transformer 500/400/220 kV in emergency situations.

In Jordan, existing electricity cross-border infrastructures connect the country with Egypt, Palestine and Syria, but operations with Syria ended in 2011. The other two interconnections are supposed to run at 100% of their theoretical capacity, which is around 430 MW. However, not all of these infrastructures are always used at their full potential. For instance, in 2016, no energy was exported from Jordan to Egypt. In contrast, the interconnection that links Jordan to Palestine usually provides a satisfactory level of electricity trade. The West Bank started importing 20 MW of power from the Jordanian grid through a 33 kV feeder to Jericho in 2008. However, a decline was registered in 2016, reducing Jordanian exports compared to the level of the previous years.

Since the Palestinian power demand is not integrated into the expansion plans of the Jordanian power sector, Palestine will only be able to rely on the residual Jordanian power surplus for its growing demands. In Palestine, the power system is interconnected with Israel, Jordan and Egypt and the imported electricity from the cross-border interconnections are unique sources of supply, making them vital to satisfy the electricity supply since there are no other power sources. The Palestinian communities are connected with the Israel Electricity Company (IEC) as customers, in most areas, by medium and low voltage with a total import of 1100 MVA. Furthermore, as mentioned in the Jordanian case, Palestine is connected to Jordan with a capacity of 80 MW and an existing line with Egypt which is not in operation.

The Palestinian territories relied on the IEC for 90% of their electricity supply in 2015, ranging from 64% in Gaza to 99% in the West Bank. The only slight exception to this is the transmission lines from Jordan and Egypt to the West Bank and Gaza respectively. In 2008, the West Bank started importing 20 MW of power from the Jordanian grid through a 33 kV feeder to Jericho. In 2008, Gaza also started to import 20–30 MW of power from Egypt during a limited number of hours per day which provides 14% of Gaza's energy supply through three feeder lines. This restricted service is frequently interrupted due to the lack of line maintenance and security in the Sinai Peninsula.

It is worth noting the importance of the interconnection between Jordan and Syria for the extension of exchanges between Egypt and Jordan towards the electrical systems of Lebanon and Syria. Between Jordan and Syria coordination is taking place in both the energy and trade sectors to export the electricity to Lebanon through Syria, because due to the geographical and political reasons Lebanon will only be able to import electricity through Syria. Jordan and Egypt will export energy to Lebanon through Syria, since the US will be involved in discussions with the World Bank regarding

financing the energy bill. The agreement allows Jordan to export 150 megawatts from the middle of the night until 6:00 in the morning and export 250 megawatts during the remaining hours of the day. On one hand, this encourages the development of the power market among the South-East-Med countries, and, on the other hand, it is a further step in the implementation of the EIJLLPST project and its future interconnection with the ENTSO-E system.

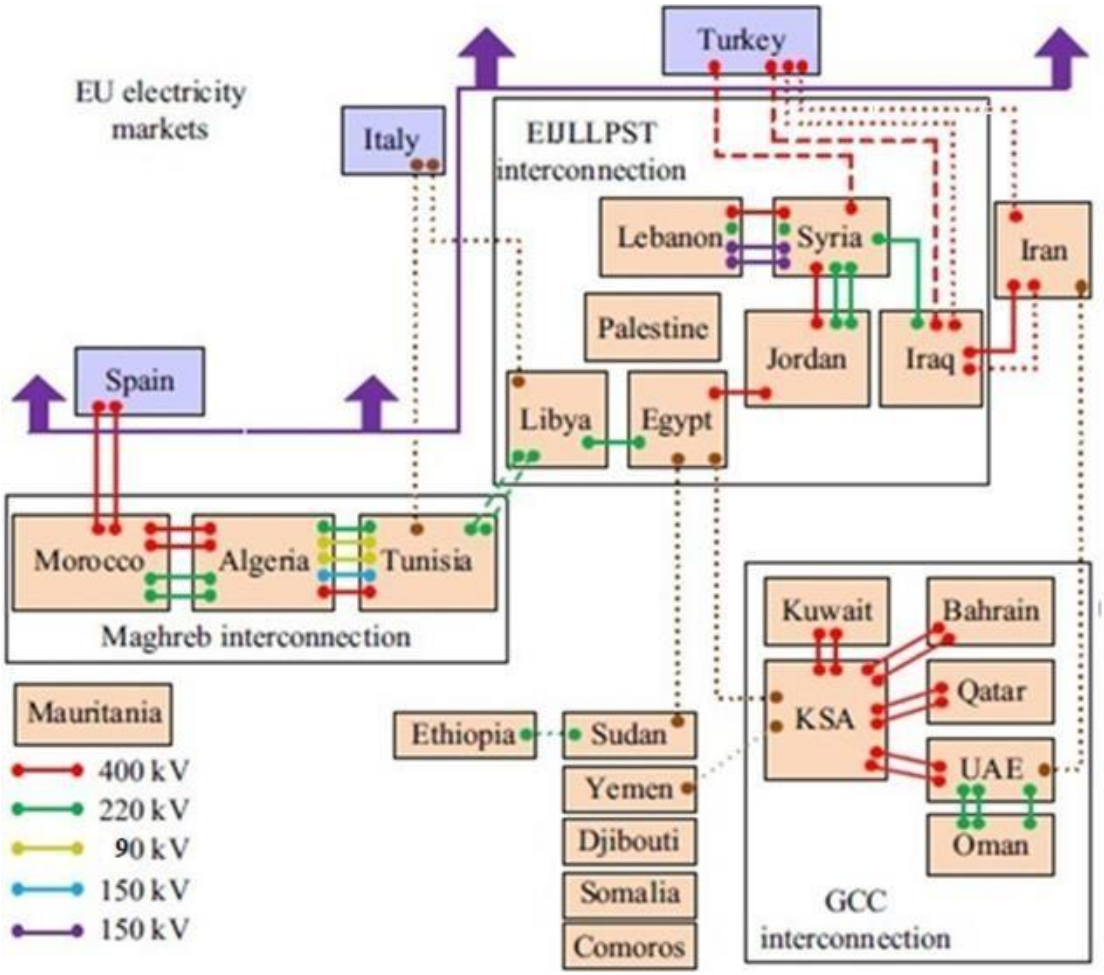


Figure 6 - Existing and planned interconnections between Europe, Africa and Middle East. Source: World Bank

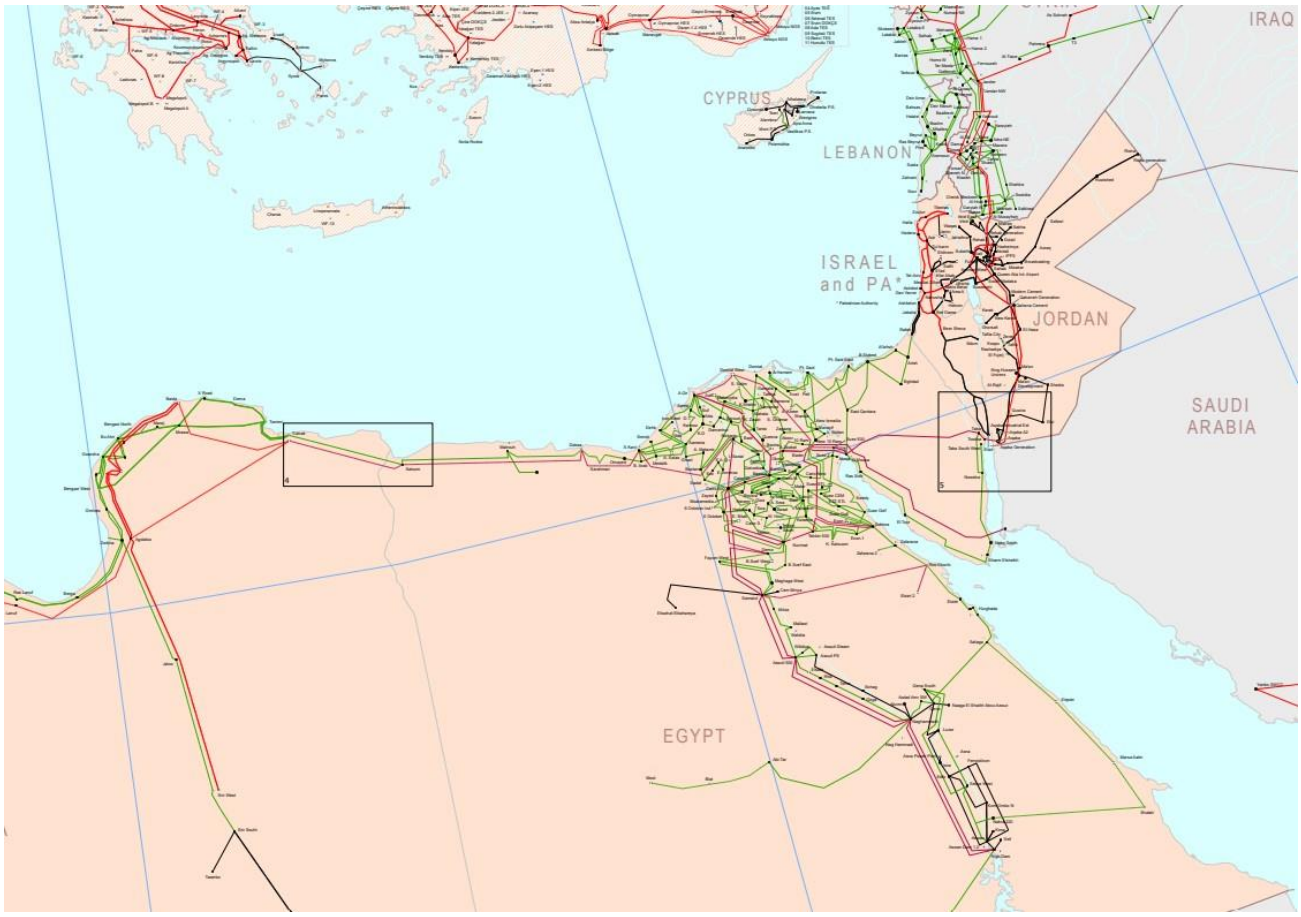


Figure 7 - Electricity interconnection infrastructure in the East-Med region

2.4 Overview And Analysis of Existing Eastern Mediterranean Sub-Regional Integration Initiatives

2.4.1 The EIJLLPST

The original five countries in the regional interconnection project, Egypt, Iraq, Jordan, Syria, and Turkey signed a general trading agreement in 1992. This established their commitment to develop interconnections, as well as share objectives of providing mutual assistance and sharing benefits as parts of the network, to improve the reliability of supply, and to improve the region's economies through the exchange of power surplus.

In 1996, the **General Trading Agreement (Interconnection Agreement)** was amended to become a comprehensive agreement that outlines the terms and conditions for use of the interconnection.

The terms and conditions cover:

- reserve sharing during emergencies;
- capacity transactions;
- interchange of surplus power and energy;
- regulation of energy flows to maintain schedules;
- regulation of reactive power flows;
- transmission services—making each country's transmission facilities available for the purpose of transmitting power and energy to other parties;
- operating reserves, including maintaining minimum levels of reserves and their sharing between countries;
- the coordination of maintenance schedules; and (ix) coordination of planning to increase reliability and maximize the value of the interconnection.

The **Interconnection Agreement** also established the scope and duties for some permanent committees, which however are not fully functioning. These permanent committees are the :

- **Steering committee**. This committee is responsible for promoting reliable and efficient operation of the interconnection and the interconnected power systems by coordinating design, planning, and operating activities.
- **Planning committee.** This committee aims to foster greater coordination among the members as well as determine if the plans conform to Steering Committee rules and guidelines. It plays an analytical and planning role.
- **Operating committee.** Each pair of neighbouring countries is required to maintain a bilateral operating committee. The operating committees are required to take all actions necessary to ensure delivery and payment for power in accordance with the interconnection agreement and any agreement between the countries.

The National Electric Power Company of Jordan (NEPCO) was nominated by the other parties as the coordinating body of the EIJLLPST. The interconnection program planned to produce great economical and technical benefits for interconnected countries, reducing investments in constructing new power stations and exchanging energy among the networks in normal and emergency cases, thereby improving their financial standing, exchanging knowledge and experience in power system planning and operation. **Despite the interconnection agreement, there has been limited trade of electricity over the network**.

The expected objective was to initiate real cooperation through the sharing of reserves to face the event of an emergency and the exchange of surplus electricity between the different countries, taking into account the opportunities linked to the difference in consumption profiles (daily, seasonal, etc.). However, commercial-type exchanges between these countries are marginal, due to limited production capacities in some countries (e.g., Jordan), the absence of a harmonized regulatory framework for electricity transactions and the relatively low capacities of certain interconnections (e.g., Jordan-Palestine, Jordan-Syria and Syria-Lebanon). Tight generation supply in some countries, lack of a harmonized regulatory framework, limited access to national transmission networks, and the fact that trade is, generally, restricted to a single government-owned entity in each country constrained electricity exchanges within the region. In addition to these issues, the interconnected systems are often not completely synchronized and therefore part of a national grid system must be isolated from the main grid to accept imports from another country.

Overall, the national transmission systems in the South-East-Med region are constrained by the lack of a regional coordination centre and the lack of a formal regional market. These institutions would facilitate market transactions, promote regional trade, and compensate entities for providing transport services, or determine the technical feasibility of transactions. A regional coordination centre would bring significant savings through more optimal generation capacity planning, reduced settlement costs (due to having only one central settlement system rather than five or more separate national ones) and reducing the cost of load interruptions (WBG 2010).

Even at the present time, in the Eastern Mediterranean region, the **South-East-Med Electrical Systems do not have significant experience in terms of power exchanges, operation and management of cross-border interconnections, except only for the case Egypt-Jordan**.

EIJLLPST has not been exploited according to its possibilities due also to the continuous political issues between the countries in the region. As a consequence, interconnections utilization is quite low in the Eastern Mediterranean, even if the recent gas fields discovered by Israel and Egypt might open up a very strong development potential for the sub-region. Better interconnections with neighbouring countries and with the rest of the Mediterranean could indeed be helpful to fully exploit these resources.

In this context, assuming no technical constraints, power import in Lebanon, Jordan and Egypt is very low (around or less than 1%) and very high in Palestine (99.36%). As already described, Palestine cannot provide for its electricity needs and depends on imports from Israel. It is to be noted that the

importing of energy from Israel is still not regulated by the PPA; this means that there are 300 connection points supplied to the Palestinian market with individual contracts.

Exports are also rare and marginal, which highlights the potential development of exchanges and interconnection capacities. These exchanges are very low in Egypt and Jordan (less than 1.5%). Egypt imported 0.081 TWh of its electricity for 0.425 TWh of export. While Jordan imported 1.07% and exported 0.47% of its electricity in 2018. Lebanon imported 0.078% of its electricity from Syria in 2018 (compared to 3.61% in 2017 and 0.59% in 2016).

Palestine did not export any energy to neighbouring countries. Working as an isolated network, there are neither power import nor export figures available for Israel.

2.4.2 Achievements and open issues

In general terms the South-East-Med Region present a story of integration with some achievements and open issues that are worth considering in order to develop a further path towards increased cross-border exchanges and an integrated electricity market. The Region actually presents reasonably strong international connections potential and is open to considering further cross-border connections and upgrades to national transmission networks to enable synchronization within EIJLLPST and ultimately with Turkey and the EU. Some reserves and energy sharing at regional level have been realized but mostly limited to Egypt and Jordan, and only to a lesser extent, Syria and Lebanon. **There is still no third-party access or published tariffs for using transmission.**

Some limited progress on market reforms such as unbundling have been implemented but limited primarily to Jordan. Independent regulation remains an issue. Retail tariffs remain heavily subsidized in all countries except Jordan. Some regional planning has been performed and Jordan relies on its interconnections for reserves, but no planning is done from the perspective of EIJLLPST in part because of national transmission networks limitations. Regional documentation governing trade exists in the form of the Interconnection Agreement with regional steering, operating, and planning committees. Although regular meetings are held, regional institutions appear to have limited functionality. Some success in attracting private capitals for the power sector has been achieved. Private sector involvement is limited primarily to independent Power Producers (IPPs) with some private sector involvement in distribution in Jordan.

For the South-East-Med region's progress towards an increased level of cross border exchanges and a more integrated market **the solution is to build on what exists leveraging on the positive**

achievements already reached by the countries and giving priority to the introduction of commercial mechanisms producing clear Commercial Agreements that should be able to move local TSOs from a Pre-determined Dispatching Rules situation to a Market Conditions scheme.

2.5 Analysis Of The PAEM

2.5.1 Rationale and objectives

The benefits of electricity trade among countries are commonly recognized and encompass operational, (flexibility and security of supply), economic and environmental benefits. Recognizing these benefits, the **Arab Ministerial Councils for Electricity (AMCE)**, under the **League of Arab States (LAS)** umbrella, has made a priority the establishment of a **Pan-Arab Electricity Market (PAEM)**. Working with the World Bank, the LAS and Arab countries have made strong efforts for developing **PAEM as the tool for a greater integration among the power systems in the region**. **The agreements of the PAEM are designed to become legally binding to any Arab country that signs them in order to facilitate electricity trade transactions**.

The AMCE approved the ratification process of the PAEM legal and market agreements in the summer of 2020, which sets the path for Arab countries to finalize their internal procedures in preparation for signing the agreements in 2021/2022. While this marks an important milestone in the process of establishing the PAEM, its effective operationalization will be a long and complex process that requires greater commitment and support from participating governments. The PAEM enables countries to integrate their national grids and therefore commit to commercial cross-border electricity trade.

The region is already highly interconnected with the Gulf Cooperation Council (GCC), with the South-East-Med ’s eight-country interconnection and Maghreb subregions. Nevertheless, only 2 percent of electricity produced in the whole region is traded in a year. The PAEM would improve these existing cooperation efforts and increase the utilization of the existing cross-border transmission infrastructures by introducing new pricing mechanisms to unlock commercial bilateral electricity trade and pave the way for a greater number of market participants.

The PAEM aims at increasing cross-border electricity trade from the current 2 percent to between 37 and 41 percent by 2035. This change would endow the region with one of the largest multicounty integrated systems in the world—producing a total generation capacity of **over 600 gigawatts by 2035**. Additionally, the size and geographical reach of the PAEM unlock opportunities for trade with

electricity grids in the European Union, sub-Saharan Africa, and Asia. Finally, establishing the PAEM deepens the commitment of the participating countries to cooperate in building trust and resolving shared concerns about security and national sovereignty.

By introducing new pricing mechanisms for cross-border electricity trade, the establishment of the PAEM will further solicit participating countries to reform their respective domestic electricity sectors, phase out subsidies, enable greater private sector investment, and enhance the competitiveness of their respective economies.

2.5.2 The scope of Pan Arab Electricity Market – Integration Plan

The following Figs shows the development Road Map of the PAEM, the framework of Governance Docs and the Governance Structure.

2.5.3 Market Integration Plan

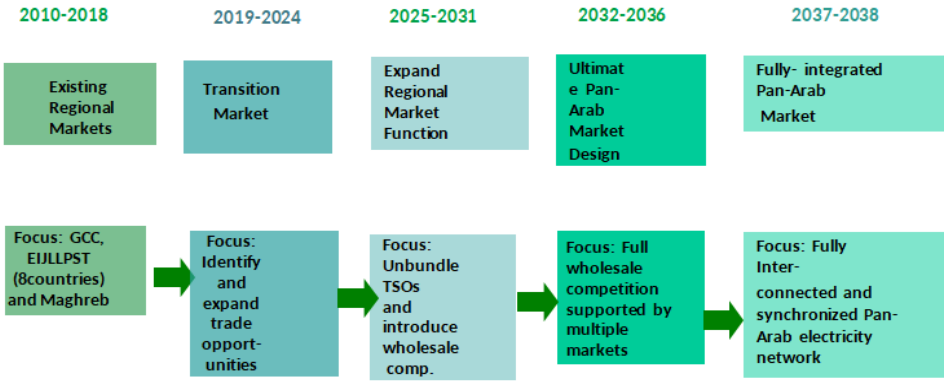


Figure 8 - PAEM integration plan

2.5.4 Governance Proposed for the PAEM

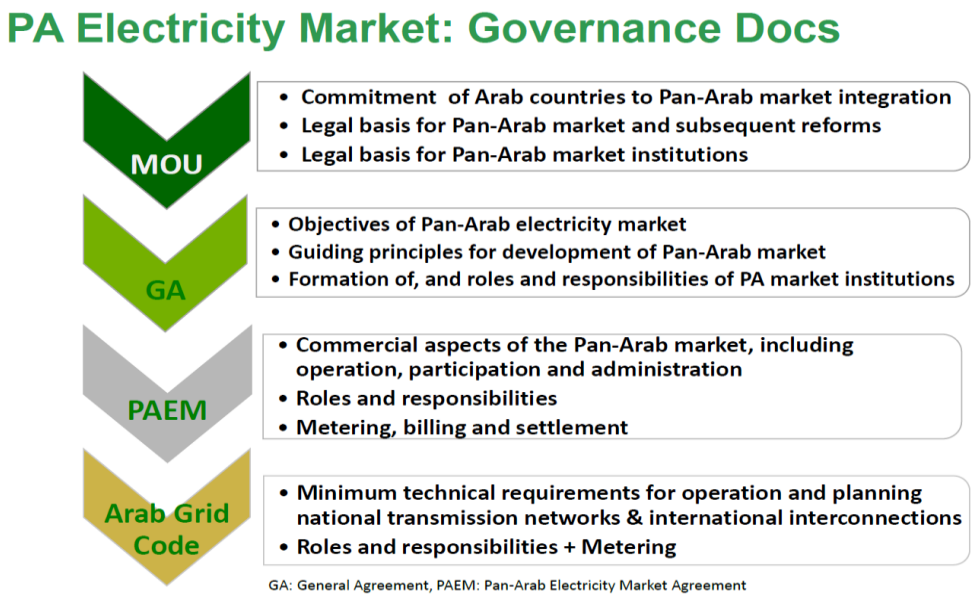


Figure 9 PAEM Market Governance

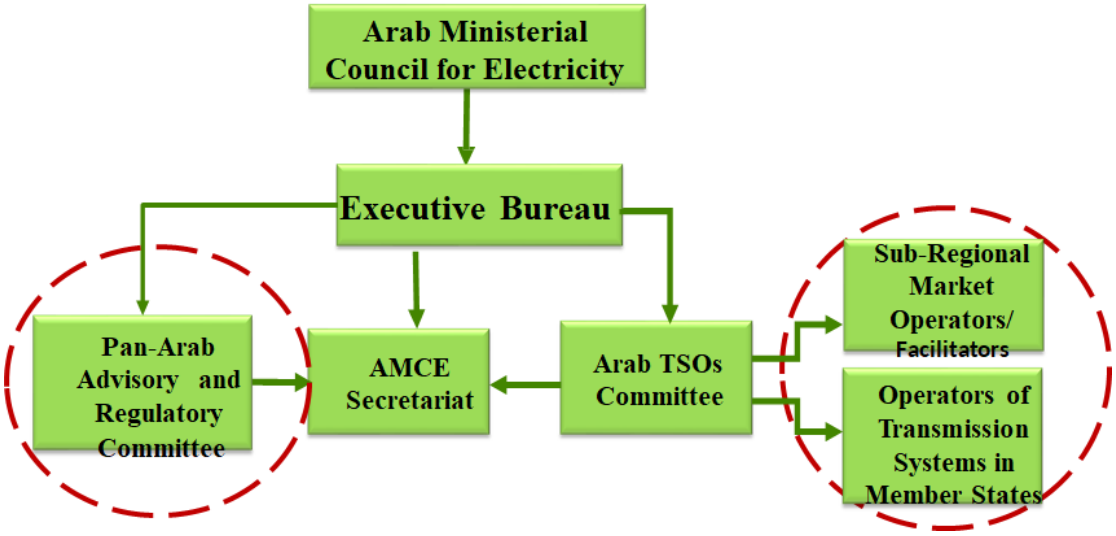


Figure 10 PAEM Structure

2.6 Med-TSO Project For The Pilot Zone: Identification Of Main Issues Relevant For The Establishment And Development Of A Regional Market.

The objective of the Med-TSO project is to set up the conditions to improve and develop the electricity trade in the region.

The analysis conducted in previous paragraphs shows that electricity trade among the South-East-Med countries has historically been very low, compared to the capacity of cross-border interconnection and the complementarities that exist between the different systems. Still, barriers such as an uneconomical pricing framework constrain trade volumes and leave market participants to prefer exchanges “in-kind” and on emergency operations (Egypt, Jordan, Syria, EIJLLPST countries).

At present, in the Southern and Eastern shore of the Mediterranean region, interconnections are used mainly for security of supply between the networks and not for market purpose. Still, they can be used as a springboard to move to a competitive market; this will be possible when the financial agreements are in place, and within the existing available capacities.

With the existing networks and those under development, a large part of the capacity is available to continue the development of the market, mainly with regard to the development of renewable energies.

Given the existing availabilities in the region in terms of resources (Jordan, Egypt) and needs (Lebanon, Palestine, Syria), greater exchanges could be developed thanks to better use of interconnection capacities, even without resorting to a global market integration but through a significant increase in bilateral trade. This should be considered as a step towards possible target interconnections to other systems (Europe, Gulf countries)

A further improvement would require specific interventions on regulatory and commercial framework.

Given this, **it does not seem necessary to wait for the liberalization of domestic markets to initiate market integration at the regional level**. This will allow a stronger incentive to develop the networks, in particular the interconnections towards the Lebanese and Syrian networks, which will constitute a first stage for the interconnection with the European system via Turkey, Cyprus and Greece.

For this, based on the current model of exchanges (relief, exchange in kind, etc.) and a shared roadmap, the establishment of a transitional economic model with successive evolutions towards market

mechanisms integrated can be envisaged starting from the reference single buyer model by **gradually introducing market mechanisms (e.g. IPP capable of selling electricity on an organized market, even a limited one , e.g. IPP obliged to sell the energy to TSOs and TSOs capable to sell the energy internally and externally)**.

Achieving higher volumes of electricity trade in the region requires addressing the following core challenges, mainly:

- Establishing the terms under which electricity will be traded, including the conditions for access to interconnections, the basis for determination and allocation of available interconnection capacity, and the basis for pricing of access and use of available interconnection capacity.
- Establishing common rules for the use of networks within a framework of integrated regional market and regulations which guarantees third party access to the network
- Reinforce the capacity of interconnections between the countries, mainly where the capacities of the interconnections are weak and do not allow market-oriented transactions (Jordan – Palestine and Jordan – Syria – Lebanon)
- Establish rules and conditions for the development of exchanges: Exchange of information, interconnection management fee, transaction settlement rules, compensation for involuntary exchanges, etc

For significantly improving the energy zonal exchanges, in addition to simply identifying the trading opportunities, is required to establish the enabling environment through which trade can take place addressing five key dimensions.

1. **Infrastructural:** is the availability of assets allowing for trades (power plants, transmission lines and dispatch centres).
2. **Institutional:** actually, in addition to physical infrastructure, an effective, transparent institutional governance framework is a key precondition for the regional trade to reach any substantial volumes and attract new private and public traders. It includes setting up market rules and regulations supporting fair competition. In turn, achieving a level playing field requires that certain electricity trade must be based on international fuel prices, thus supporting domestic policy reforms to phase out subsidized generation fuels and end-user tariffs. This dimension relates to the necessity to ensuring that the institutions at regional level and those at national level are functioning and empowered and that coordination between them and other stakeholders is clear and functional. At the regional level, PAEM could take a

great role in providing political guidance and oversight. Regional institutions for power trade need to be established and empowered within a common framework that ensures efficient coordination. The development of regional institutions can build on current experience in the region. Governments would benefit by establishing designated and authorized national entities to institutionalize electricity trade in close coordination with the regional institutions envisaged under the PAEM governance framework. Governance documents, including the PAEM General Agreement and the Market Agreement, will form the legal basis for the institutions and the market they will support.

3. **Regulatory:** relates to the definition and enforcement of the relevant rules and legal documents required to facilitate trade such as Third-Party access to the network, standard PPAs and transmission tariffs. Countries need to develop and agree on a transparent methodology of pricing approach suitable for cross-border trade and transmission "wheeling" on a commercial basis. Removing domestic fuel subsidies for power generation in every country engaged in cross-border trade would be the key long-term solution. Applying international fuel prices specifically to cross-border transactions without eliminating subsidies at home is a possible interim solution in the early phases of the regional market.
4. **Operational:** relate to the ability in handling power flows in a stable and reliable manner across the new integrated regional system. The critical issues in this respect are the availability of detailed grid code and procedures setting out standards to coordinate the approach to issues such as operational planning, handling outages and providing frequency and voltage stabilization.
5. Harmonization of regulations for cross-border trade with market rules and PAEM network code and adaptation of necessary reforms by member states on their territory at their own pace. Indeed, harmonized regulations will play a vital role in realizing the PAEM vision of a coordinated and competitive regional market. Establishment of technical committees for the development of rules and procedures for the management of interconnections, their updating, harmonization and upgrading with the rules established within the framework of the PAEM by the League of Arab States.
6. **5-Commercial**: relates to the availability of an appropriate contractual architecture allowing market members and regional utilities to engage in commercial energy transactions economically and efficiently.

In order to define a pilot project for an integrated electricity market in the South-East-Med region Med TSO has already developed a preliminary analysis examining the priorities of the TSO's of the South-

East-Med, in terms of the various aspects to be harmonized in the region to achieve the objective of systems integration. After analysing different priorities, listed in the first chapter, the South-East-Med TSOs choose to develop as common priority project that of establishing a zonal platform for power trading, building on the activities already performed in the zone and using the Med-TSO support for accessing the international experience on this subject.

Based on the priorities identified by the TSOs, the project committee at Med-TSO level will examine the existing technical, institutional, regulatory and commercial framework in the area and assess its adequacy with the options envisaged by the PAEM and EU standards and possible adaptations to achieve the objective of the project (Step 2 of the roadmap). In particular, the main constraints and barriers to the integration of systems will be examined, such as the compatibility of network codes, access to the network and to the market, the procedures for exchanging information between the various stakeholders around of the market, etc....

The priorities identified by the TSOs specially focus on the technical aspects concerning the importance of setting up, before addressing the aspects of the market, the common defence plan and the procedures shared between the different TSO's in terms of plan compensation for exchanges and exchanges of information between the various dispatching centres.

In terms of regulation, the essential aspects to be strengthened to support the establishment of an integrated market have been identified as a less priority and include the harmonization of the procedures related to the allocation of exchange capacities (capacity allocation, CBA, ancillary services).

The commercial aspects are referred as priority 1 under the item Platform Trade: the way to reach this target includes many items that the Consultant propose to clearly detail and identify including the Market Model (or the Market Model Phase) to consider, the different format of Contracts needed to regulate the different transactions, the Regional Tariff methodology etc.

Issues like Market Participants, Transacted Contracts, Nomination of Transaction, Metering, Scheduling of Transactions, Invoicing Payment and Fees and in general the different processes supporting the establishment and operation of a Regional Market should also identified and prioritized through an even simplified Market Code.

The relevant action plan that the TSOs concerned by the development of exchanges should gradually put in place in the short, medium and long term, in order to remove the various barriers and ensure coordinated management of the interconnections between the various TSOs, should include:

In the short-term, removal of constraints relating to interconnection management procedures, the establishment of a common defence plan, harmonization of the regulatory and institutional framework relating to the management of interconnections, information exchange and exchange programming, will contribute to activating the strengthening of exchanges electricity and to prepare the ground for a future integrated electricity market in the region. Mainly in terms of regulations.

In the medium term and with a view to setting up an integrated market, the actions would focus on establishing and harmonizing procedures for reserve management, load control and mutual assistance in emergency situations.

In the long term and with a view to setting up a more open and integrated market, the action plan would focus on setting up and harmonizing procedures for allocating capacity, sharing ancillary services, compensation and liquidation inter TSO's and other stakeholders, the consistency and harmonization of regulatory and institutional frameworks.

The related activities could be classified under 2 categories:

- **Internal regulation**: Agreements or contracts adopted between TSOs or between TSOs and other stakeholders.
- **External regulation**: Regulations proposed by TSO's and approved by competent authorities at national or regional level (Common Grid Codes, , exchange rules on cross-border interconnections, Liquidations rules,).

2.7 Proposed Tentative Road Map Towards A Zonal Power Trading

Taking into account the role of the Med-TSO as a promoter, facilitator and coordination centre of TSOs in the Mediterranean region, the main objective of the TEASIMED sub-task 3.2. is **to identify the building blocks that are necessary to organize a sub-regional integrated market** and develop some critical analyses and/or activities in order to be able to present and submit a well-founded and reasoned proposal to the main stakeholders for their decision-making on the subject.

The activity 3.2 Elaboration of zonal target regulatory framework and tentative roadmap of the TEASIMED Project refers to the implementation of a sub-regional project (zonal) concerning a practical application of harmonization for the subset of rules necessary to implement a priority project in the selected zone for advancing in regional integration.

The development of such a Project involves the contribution and participation of many different stakeholders (Consultant, TSOs, PAEM, Regulators, Ministries etc) and requires to be framed and phased through a definite road map and strongly coordinated. The development of a zonal pilot project for the integration of the Energy Markets and the proper functioning of the interconnections involves the participation of many different organizations, entities and levels of political power.

The engagement of all relevant stakeholders is of paramount importance.

The success of the project will depend on a careful review and a quality dialogue with all the Stakeholders involved.

As a conclusion of this chapter a roadmap is proposed allowing the integration of power systems, the strengthening of exchanges and the implementation of a market, according to the PAEM scheme, approved by all the Arab countries and for which a MOU has already been signed and a timetable fixed.

Steps of a **tentative road map** to implement the project and reach the desired target:

ACTIONS	FRAMEWORK	HORIZON	Stakeholders/Institution Engaged*
STEP 1 - Creation of a Dedicated Governance Structure: Dedicated Steering Committee and Project Management Unit within Med-TSO and Roles			
Creation of structure of governance capable of making the Road Map, supported and validated implemented, by all the Stakeholders who have the responsibility and power to subsequently implement the phases outlined as necessary.	**Next to the TEASIMED Project**	Short Term	*MED-TSO / TSO's / EIJLLSPT / PAEM / NRA's / MINISTRIES*

ACTIONS	FRAMEWORK	HORIZON	Stakeholders/Institution Engaged*
Creation of Project Management Unit composed of resources skilled in operation, regulation, markets formed by the Task force of Med-TSO in charge of South-East-Med integration market and the TSO's. The Project Management Unit (PMU) will be made by high-level experts coming from Electrical system management departments (Dispatching/Operation).	**Next to the TEASIMED Project**	Short Term	*MED-TSO/TSO's /NRA's*
Step 2 - Project Scoping Review and Objective Consolidation			
Review by the PMU the Technical, Institutional, Regulatory and Commercial framework existing in the zone assessing its compatibility with the PAEM options/rules and EU standards and its possible adaptation to achieve the project	**Next to the TEASIMED Project**	Short Term	*MED-TSO/TSO's/ NRA's/PAEM / EIJLLSPT*
Analysis of the current situation in terms of the trading capacities and development in terms of interconnections and review of existing procedures and their updating for harmonization if necessary. Development prospects of the South-East-Med Markets on the basis of a supply-demand analysis by country to define the trade opportunities and interconnection capacities to be set up	**Next to the TEASIMED Project**	Short Term	*MED-TSO/TSO's / EIJLLSPT / NRA's*
Step 3 - Road Map consolidation			
Review and consolidation (the project team) of the final road map for the project implementation (activities, resources, responsibilities and timing)	**Next to the TEASIMED Project**	Short Term	MED-TSO/TSO's/NRA's / *EIJLLSPT*
Step 4 – Definition and Selection of Market Integration Model to be advocated			
For the selection of the Model, the Governance Structure, the Stakeholders and the Project Management Unit will use as a basis the analysis and results of Activity 3.2 TEASIMED Elaboration of zonal target regulatory framework in the Eastern Region. Especially with regard to: Minimum Requirements for the proper functioning of the regional market at its first stage, Definition of Cooperation Principles	**Elements for this step have been developed in TEASIMED**	Short Term	*MED-TSO/TSO's/PAEM /NRA's / EIJLLSPT*

ACTIONS	FRAMEWORK	HORIZON	Stakeholders/Institution Engaged*
and Operational Arrangements, needs of Regional Stakeholders Engagement			
Step 5 - Development of specific Market Code			
Coordination (Project Team), in liaison with the stakeholders for the development of the relevant market Code fitting with the selected model	**Next to the TEASIMED Project**	Middle Term	*MED-TSO/TSO's/NRAs/ PAEM / EIJLLSPT / MINISTRIES*
Step 6 - Development of Tariffication methodology and Pricing			
Define the processes and procedures of the exchange platform consolidating the relevant rules and organization in a Trading Agreement in accordance with the international best practice	**Next to the TEASIMED Project**	Middle Term	*MED-TSO/TSO's/NRAs / EIJLLSPT / PAEM /*
Step 7 - Development and establishment of the Trading Agreement			
Definition (Project Team) of the processes and procedures of the exchange platform consolidating the relevant rules and organization in a Trading Agreement in accordance with the international best practice. Select a software for the practical implementation of these processes and define the deployment plan for a fast track first application.	**Next to the TEASIMED Project**	Middle Term	*MED-TSO/TSO's/NRAs / EIJLLSPT / PAEM / MINISTRIES*
Step 8 – Launch of the first application			
Launch of the first application and management by the regulatory authorities of the design phase for the regulatory framework and by the TSOs for the system implementation phase	**Next to the TEASIMED Project**	Middle Term / Long Term	*MED-TSO/TSO's/NRAs/ PAEM / EIJLLSPT / MINISTRIES*
*** Preliminary proposal**			

Table 7 - tentative road map to implement the project

3. Definition of minimum requirements, models and set of rules necessary to realize and operate safely and efficiently the interconnections between the Mashreq electricity systems

The Minimum Requirements, Models and Set of Rules are necessary to realize and operate safely and efficiently the Interconnections between the Electricity Systems of the countries of the South-East Mediterranean Region. This report makes therefore a benchmark analysis of different cross-border electricity markets around the world that are related to the situation of the South-East Mediterranean countries. The analysis identifies key lessons and best practices from these international experiences and use cases, that can be applied to the development of the power trade in the South-East Mediterranean region. At the same time, obstacles and flaws that are encountered in the benchmarked cases have been taken into account to be avoided.

3.1 Electricity Cross Border Integration Models

An overview of the international examples shows the many available options for establishing interconnectivity and develop bi-directional and multilateral electricity trading among different countries and allows to define general categories of integration and their organisational requirements.

The depth and comprehensiveness of regional power system integration can be categorised in integration models according to:

- the characteristics of the power trade between the participants in the integration scheme. The relevant transaction models can differ significantly in their commercial and political characteristics
- the infrastructure development and interconnections between systems
- the characteristics of the supporting transmission infrastructure. The models vary with respect to transmission, exchanges capacities and operational coordination between the involved countries. Improvements to dispatch and ancillary service procurement can also differ.
- the level of harmonization of regulation. Important factors that can differ include ownership of generation, coordination with power system operations on either side of the border, instructions for the operational safety of electrical systems, risk management, the ability of the generator to recover costs, and impacts on domestic customer electricity bills.
- the existence of common institutions

- and the level of authority the participating countries have vested in them.

The different forms of cross border integration can be categorized under three points of view that can be adopted.

1. One refers to the **level of integration (simple -direct link) between two countries,** going progressively **from limited integration to complete integration**.
2. The second refers to the timeframe: **from long-term to short-term coordination**. Cross-border integration can involve collaboration that occurs over long-time horizons, such as long-term system planning or short-term horizons, such as ancillary services and real-time dispatch.
3. The third one considers the terms of how the integration fits into national system operations. **"Primary" models** of trade are ones where regional, multilateral power trading is the default mode. **"Secondary" models** are ones where regional trading takes place as an additional option on top of domestic market or system operation arrangements

Under the first point of view, the following categories and examples can be found.

The first category, the simplest integration stage, is '**Interconnection**', representing a direct link between two countries.

The second category being a next integration stage is that called **'Shallow Integration'**, where a group of countries (or, more specifically, TSOs, utility companies, generating companies, and large consumers in these countries) start trading with each other through one or more interconnections between their systems.

The qualifier **'Shallow'** reflects the lack of overarching, harmonised rules governing trading in electricity between the interconnected countries. The participating governments and authorities or vertically integrated utilities must, however, allow power plants, large consumers and transmission line owners to operate in their markets and to have open access (known as 'third-party access') to the national power grids within the limits of available transmission capacity.

The commercial agreements between parties are based on case-by-case considerations, rather than on harmonised and binding rules. Trading with electricity takes place bilaterally on the basis of PPAs, which may cover various time horizons. As investments in power generation are capital intensive and characterised by long payback periods, PPAs tend to be long term commitments.

A step deeper in integration, the shallow integration model can encompass a wide spectrum of institutional integration and regulation. This category includes Bilateral and Multilateral models.

***In the Bilateral model*,** the exchange of power takes place only between two systems (and therefore between two different jurisdictions). For this model, the flow of exchanges can be bidirectional or unidirectional. In most cases in the world, the bilateral model tends to be bidirectional (eg. there is a bilateral bidirectional power trade between California (USA) and Baja California (Mexico), between the United States and Canada and between the Maghreb countries Algeria-Morocco and Algeria-Tunisia). In some cases, the bilateral model needs to involve an intermediary third country to allow transit from country A to country B or vice versa.

The ***Multilateral Models*** involve three or more countries, with all participants exchanging with each other. In these cases, the integration process is also supported through regional institutions, which do not replace local institutions but help in coordination and management of the power exchanges.

In multilateral models, power trade can occur both between jurisdictions and systems that are completely different in terms of market structure, and also between jurisdictions and systems with market structures and regulations that are harmonized (eg. In the West African Power Pool (WAPP) and in the Central American Electrical Interconnection System (SIEPAC), power exchanges occur between jurisdictions that differ in terms of market structure).

3.1.1 The Bilateral Model and its variants

As mentioned above, under bilateral integration, trades occur between only two jurisdictions.

In some cases, these trades may be unidirectional (Ex: Thailand imports electricity from hydroelectric plants in the Lao People's Democratic Republic (Lao PDR) but does not export its own power to Lao PDR) or bidirectional (Ex: there is a bilateral bidirectional power trade between California (United States) and Baja California (Mexico) and between the United States and Canada) and between the Maghreb countries Algeria-Morocco and Algeria-Tunisia.

In other cases, they may involve intermediary transit (or wheeling) jurisdictions that transfer flows of power. In this case the integration takes place between three countries, with two countries trading with each other on the basis of a PPA while a third-party country's grid provides a transmission channel between the two on the basis of a transmission services agreement (TSA) (Ex: Lao PDR, for example, sells electricity to Malaysia, with Thailand involved only as a transit country and Algeria sells electricity to Spanish electricity market with Morocco involved as a transit country).

Bilateral cross border transactions involve electricity that is scheduled and wheeled across an interconnection between two countries' power systems. The generator is connected to the grid of the

exporting country, while the entity purchasing the power is connected to the grid of the importing country.

Bilateral cross border transactions involve a moderate level of operational coordination between the two countries. Balancing that, it is the continuous task of keeping total generation equal to the sum of load and net transfers to neighbouring grids is one example. Each country's grid operator must ensure that actual generation matches actual metered electricity demand at every moment throughout the day. Imports and exports are part of the balancing equation, as Figure below illustrates. The importing country and the exporting country need to have the same information about the volume and timing of electricity flows between their two systems for each to maintain balance. After accounting for net imports and exports, each country maintains its system balance with incremental increases or decreases to its active generation and with load management (demand response, interruptible load, and, in extreme cases, load shedding).

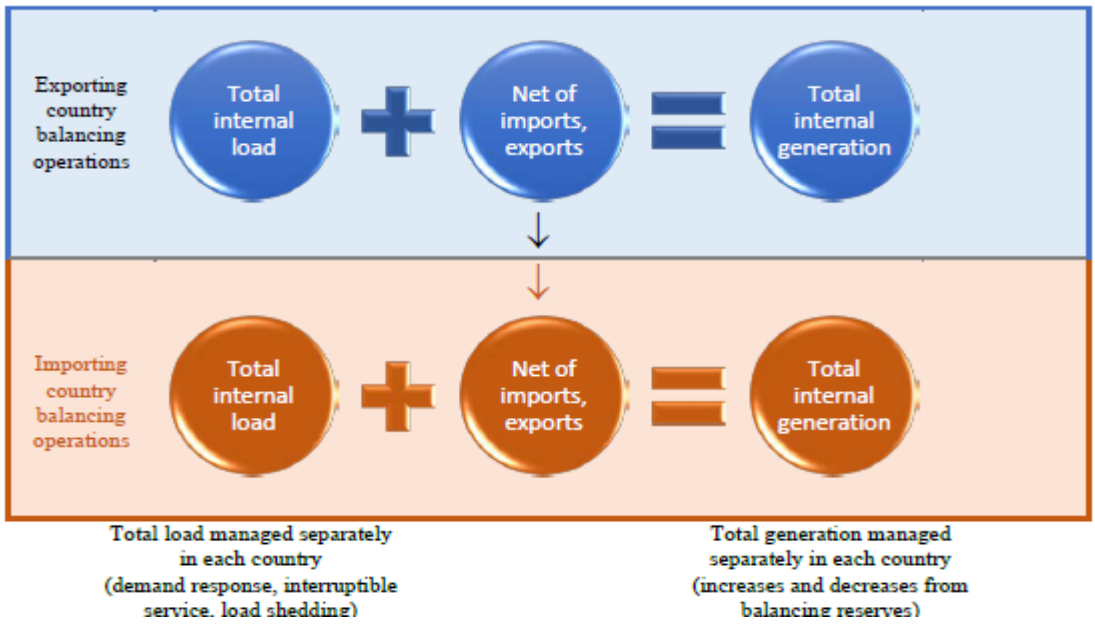


Figure 11 - Bilateral CBET with separate balancing in each country NREL illustration

Bilateral exchanges are commercially independent of one another. The agreement between one buyer and one seller does not directly affect the price, quantity, or timing of another agreement between two other counterparties. Only when transmission congestion restricts the total flow of power on the system does the grid operator have a role in changing the amount of electricity moving under a bilateral agreement.

Government policies, such as network access, import tariffs, taxes, and regulations, can create additional costs that counterparties account for when they enter into a bilateral agreement. Such policies tend to be non-discriminatory, in that they are universally applicable to any deal between two eligible counterparties. Policies can be favourable or unfavourable, but it is nevertheless up to the counterparties to decide whether the agreement ultimately benefits both sides.

Barriers to bilateral cross border trading can include ownership requirements, import tariffs, government requirements for generation or a lack of harmonization in regulations governing grid operations.

The **'harmonised bilateral trading model'** is a case of a deeper integration within the category of shallow integration with significantly developed centralised co-ordination. While trading remains bilateral, standard templates for PPAs and TSAs are developed and enforced, possible spare capacities of transmission connections are managed and overseen by a single entity, and minimum technical requirements are set for the market participants for example, in terms of how they should maintain system reserves (IEA, 2019).

In this harmonised bilateral trading model, it is particularly important to have a standardised methodology for establishing transmission fees (known as 'wheeling charges'). Such shared methodology helps market participants plan their energy options and investments in generation and transmission, as one important cost element is not completely subject to case-by-case commercial judgement.

For such harmonisation to happen, a regional organisation, established by the region's governments or major utilities, is typically needed to plan and propose, enforce and oversee rules and regulations to guide regional electricity trading.

A harmonised bilateral trading model with a secondary trading system has been proposed by the IEA for the Association of South-east Asian Nations (ASEAN) (IEA, 2019).

Secondary trading model is applied by the Central American **SIEPAC** system described later as one the case studies of this report. The secondary trading system allows countries to maintain their traditional market structures but builds a competitive regional electricity market that works in parallel as a superstructure on top of them. Depending on the market design, participants of national markets may join the regional market with their spare capacities of ad hoc demands, but there can also be power generators, traders, and large consumers who rely fully on the regional market.

A secondary market requires significant oversight from regional-level institutions. Transmission services need to be regulated and to be transparent, non-discriminatory and equal to all market participants. The trading itself also necessitates the creation of a market operator, as well as a central clearing entity.

3.1.2 The Multilateral Model

Finally **Multilateral modes of integration** involve three or more jurisdictions that can trade among one another. Underlying market structures within the jurisdictions can vary.

In all cases, however, integration is supported through the development of some regional institutions that help co-ordinate or manage, but do not replace, local institutions.

The individual jurisdictions may still organise their own local markets and retain full control over system operations. This model may involve differentiated (i.e., mixed) market structures, or might only include jurisdictions with harmonised market structures. In multilateral models, power trade can occur both between jurisdictions and systems that are completely different in terms of market structure, and also between jurisdictions and systems with market structures and regulations that are harmonized

In the Southern African Power Pool (SAPP) and in the Central American Electrical Interconnection System (SIEPAC), power exchanges occur between jurisdictions that differ in terms of market structure.

In the Europe's Internal Energy Market, market structure and relevant regulations are harmonized.

3.1.3 Deep Integration

The third integration category, 'Deep Integration', includes regional trading and, consequently, a regionally set power plant merit order and dispatch. This requires a central marketplace, which receives both supply side and demand side bids. This marketplace then establishes the market equilibrium points between the bidding sides and the costs of generation at those points for every hour, half hour, or 15 minutes, as the case may be on a day-ahead basis.

A truly regional marketplace brings efficiency to the generation sector, contributes to the placement of sales in ascending order of costs and promotes competitiveness and reduces the cost of electricity, allows, among other things, the remote exploitation of renewable energy resources, helps lower the

electricity cost, and creates diversity in the energy mix. It also reduces the volumes and thus total costs of balancing and reserve capacities, as they can be shared across the region.

The operation of such a regional primary market does not necessitate a ban on other kinds of trading, provided the primary market has enough participants to prevent manipulative and speculative bidding. In the Nord Pool, for example, direct sales through PPAs are possible, but are generally not practical for the market participants. Most trade flows therefore still go through the central marketplace.

The mechanisms of trading largely determine what kind of potential benefits can be achieved through electricity integration. As the IEA (2019) has stated, "The greater the degree of integration, the greater the potential benefits but also the greater the complexity of organisation". Deep integration would therefore seem to be the most attractive option, but the long-term nature of regional interconnectivity investments creates significant issues.

The benefits of greater interconnectivity are realised in the long-term once the infrastructure and institutions have sufficiently evolved. Each step towards that goal, however, needs to be financially feasible and desirable on its own so that the sector operators will take the necessary steps.

This model includes the integrated market exchange where cross-border trades and all other power flows are optimized simultaneously over multiple networks.

An integrated market optimizes unit dispatch and pricing across the region, so that load is met by the least-cost resources all the time. Energy offers from generators, updated load forecasts, and information on the current state of the grid feed into software that computes market outcomes many times throughout the day.

Bilateral CBET deals are independent of one another and can be as numerous as the market will bear; an integrated market is the opposite. Unit dispatch and pricing are determined simultaneously for all load and all generation within the market footprint. A generator can submit an offer to provide a certain quantity of power at a certain price, but neither the dispatch quantity nor the price will be known to the generator until the market actually clears (i.e., until all offers are processed by the market software to produce a least-cost solution) operations.

Many integrated markets use security-constrained economic dispatch (SCED) to clear the market every hour or, in some cases, every 5 minutes. SCED is a computerized generator selection process that exactly matches the least-cost portfolio of generators to the amount of load expected for an operating interval without violating the thermal limits of any transmission line in the network. In many markets,

SCED run for every hour of the next operating day to determine which generators are started and what their set points (operating levels) will be each hour. SCED can also run-in real time to resolve imbalances between actual generation and actual load.

An international border trading, running through an integrated market area, has virtually no impact on how the market clears. What distinguishes one generator from another is the marginal cost of generation, the quantity of power available, transmission limits from the generator to the grid, and operational qualities such as ramp rate. Figure below illustrates how balancing is more efficient in an integrated market.

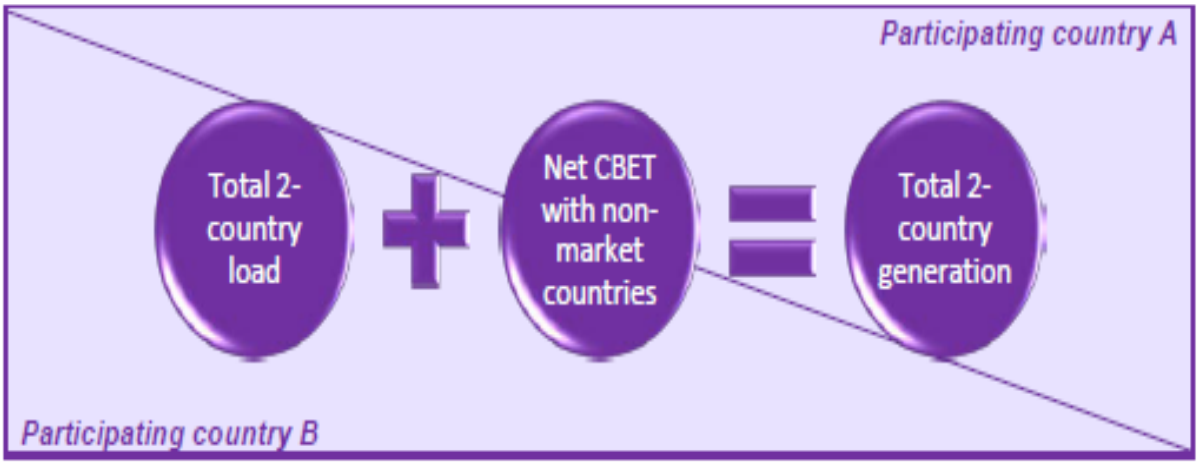


Figure 12 - Integrated market combining CBET and energy balancing NREL illustration

First, combining imbalances across several countries (or control areas within a country) often results in a smaller aggregated imbalance: negative and positive imbalances offset one another when combined. Second, this smaller imbalance can be resolved by drawing on a larger number of generators from which the least-cost option can be selected.

Integrated markets and bilateral trading are both driven by the market fundamentals of supply and demand. In bilateral deals, visibility into these fundamentals is a function of knowledge held by the counterparts. In an integrated market, on the other hand, prices form with fuller information about supply, demand, and value across the region.

No government has a hand in determining the quantity or price of electricity traded. A government may, however, approve participation by utilities, generators, and other entities under their

jurisdictions. In addition, participating governments may discuss market rules to ensure they are non-discriminatory, transparent, and promote economically efficient price formation.

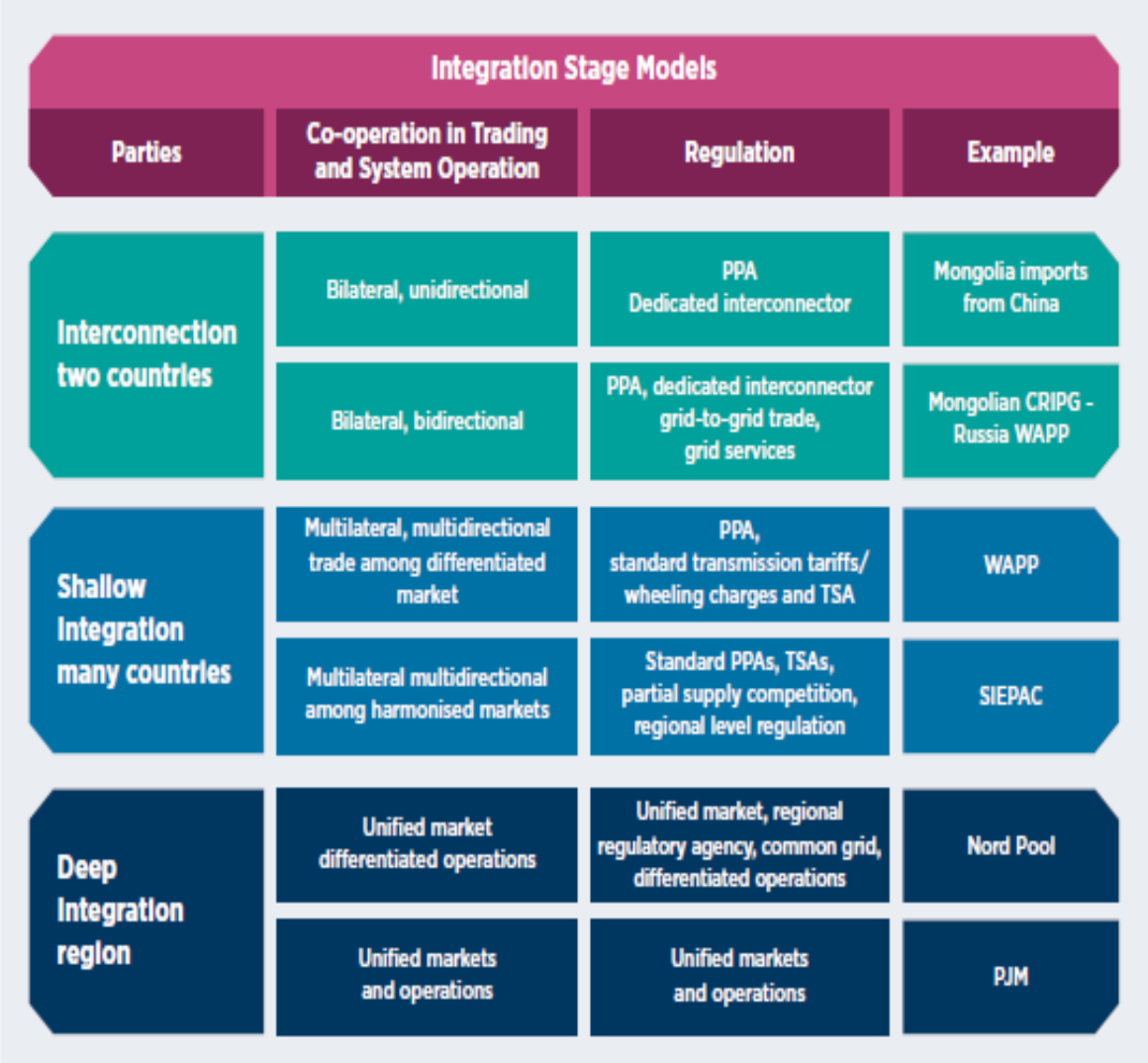
Participating in an integrated market involves more regulatory steps by the government and more coordination between governments. Integration significantly changes many of the assumptions behind regulating the power sector. The public interest is less concerned with setting prices that are just and reasonable; it is more concerned with ensuring that pricing, dispatch, and other decisions are based on processes that are fair, transparent, economically efficient, and consistent.

Under these models of integration, also called as “unified” (IEA), regional institutions take on some or all the responsibilities for managing the power system across multiple jurisdictions, including at least market organisation, and possibly even system operations. Unified models centralise market organisation, and possibly system operations as well, across jurisdictions in a regional institution.

Nord Pool, for example, is a regional power market that functions across multiple countries, each of which maintains full control over system operations

In PJM, the largest regional electricity system in the United States, both market and system operations are responsibility of a single institution

The following figure taken by IRENA Report *Renewable Energy and Electricity Interconnections for a Sustainable Northeast Asia* offers a synoptic picture of the different Integration models



Source: Adjusted from IEA, 2019; ESMAP, 2010

Figure 13 - synoptic picture of the different Integration models

The similar figure below, taken from IEA Report *Integrating Power Systems across Borders (2019)* shows examples of cross-border integration that extend from limited (bilateral, unidirectional power trades) to complete (unified market and operations).

Figure 14 Cross border integration towards unified market and operations

Taken together, they can be considered a kind of hierarchy where three main modes of cross-border integration can be identified (IEA): bilateral, multilateral, and unified.

The greater the degree of integration, the greater the potential benefits but also the greater the complexity of organisation.

A cross-border integration project between power systems involves collaboration and coordination between different jurisdictions. As with integration models, there is a broad spectrum of activities that can be the subject of collaboration between two jurisdictions and these activities have different time horizons. For instance, from long-term to real-time:

- Long-term System Planning
- Power Purchase Agreements
- Day-ahead scheduling
- Intra-day scheduling
- Ancillary Services/Balancing Markets
- Real-time Dispatch

"Between the long-time horizons (long-term system planning or PPAs) and the short-time horizons (ancillary services and real-time dispatch) there are areas of collaboration and coordination that may be governed by market arrangements or operating agreements such as the sharing of short-term forecasts and/or information on day-ahead scheduling"

What has been noted in various international experiences is that usually cross-border integration starts from a collaboration on long-term system planning and this can lead afterwards to collaboration on other areas as well. This is mainly because the level of complexity of collaboration and coordination required increases as integration approaches areas with short-time time horizons. To coordinate, for example, the ancillary services, or exchange information on dispatch in real time, communication must take place constantly and collaboration must be, by definition, in intra-day real-time.

3.2 Cross-Border Power Trading Models

When there is an integration between power systems and therefore electricity exchanges can take place, it is necessary to establish arrangements to clarify in which framework of agreements and trade the power exchange takes place. Also on this aspect, the spectrum of possible trading arrangements is wide and ranges from very simplified agreements to complex regional market structures.

There are some agreements in which the parties simply define what will be the amount of power exchanged, the timings and the complexity can increase up to regional market agreements in which numerous participants buy and sell power between them. In defining the characteristics of these arrangements, the market structure of the jurisdictions involved plays an important role. For example, non-financially driven (non-price-based, e.g., zero balances of import/export over the agreed period) forms of electricity trading are more common to implement when the market structures are very different from each other and a market model based on a single buyer is used.

Ex: "For example, Malaysia and Singapore, which are interconnected by a 450 MW AC transmission line, have very different internal market arrangements. Peninsular Malaysia has a single, vertically integrated and government owned utility, Tenaga Nasional Berhad (TNB). Singapore, on the other hand, is fully restructured, with liberalised wholesale and retail markets. While this is not a fundamental obstacle to the two countries engaging in financial (i.e., price-based) trade, in practice the interconnector is used only in emergency circumstances, in particular to help meet peak demand needs or to ensure the stability of the power grid".

According to the IEA there are three primary models for cross-border power trade:

- **Unidirectional** trades based on a bilateral agreement, such as a PPA
- **Bidirectional** or multilateral power trades between utilities
- **Multi-buyer**, multi-seller markets

It should be noted, however, that these primary models in some cases can also coexist simultaneously, when for example in the context of a regional market some bilateral agreements and unidirectional exchanges continue to be into force.

3.2.1 Unidirectional trades

Unidirectional trades involve one jurisdiction importing power from (or exporting power to) a second jurisdiction without a corresponding agreement to export (or import) power in return. In these cases, the arrangement may consist of a Power Purchase Agreement (PPA) which may be:

1) negotiated bilaterally between the purchaser and the seller
2) procured through some kind of open tender process (such as an auction)

The unidirectional trade can also involve sometimes a third jurisdiction when through the grid of the latter must transit the power between the jurisdiction that exports and the one that imports.

This third jurisdiction (the transit or wheeling jurisdiction) is impacted by the power exchange because the electricity flow exchanged between exporter and importer potentially affects its local system operations. To compensate for this impact, wheeling agreements are created with the transit jurisdiction establishing the wheeling charges that must be paid. Also, there are cases where the party importing power invests directly in the generation assets and/or in the necessary transmission infrastructures located in the territory of the exporting jurisdiction (e.g. in transactions between Thailand and Lao PDR, Thailand imports hydropower from plants that it has dispatch control over via transmission lines that it has developed (IEA, 2016)).

3.2.2 Bilateral trade

If we consider that one of the greatest benefits of cross-border power systems integration consists in the optimization of regional diversity, both in terms of supply and demand, it should be noted that the unidirectional trade model is therefore limiting in some cases compared to the potential of regional power trade. For this reason, two or more jurisdictions may decide to establish bilateral and/or multilateral agreements for **bidirectional** and/or **multidirectional** forms of trade.

For example, two or more power systems can have very different peak periods (or seasonality) that can compensate each other. These types of trade arrangements may entail different and separate PPAs, but should be framed within a more general agreement, in which to define some key issues such as:

- the cost of power (which could depend on the time of the transaction)

- agreed methodology for measuring transmission capacity
- some way of sharing dispatch schedules or at least available generating capacity

These general agreements can also involve many different jurisdictions and power systems, however to agree on a common trade methodology it is often necessary to create an ad-hoc regional institution, without which it is difficult to ensure the coordination needed.

When this regional institution is not created, trading arrangements remain bilateral and bidirectional and, in this case, it can become difficult to move from bidirectional models to a harmonized multilateral multidirectional scheme.

This difficulty may result from the lack of compatibility of bilateral agreements with each other. In these cases, the solution adopted was to maintain the existing bilateral agreements in force but creating at the same time an additional, separate, multilateral market arrangement.

3.2.3 Multi - buyer multi-seller

For the **Multi - buyer multi-seller** model in which a regional market is created and in which any participant from any interconnected jurisdiction can enter into a power trade transaction with another participant in another jurisdiction, the spectrum of participants can range from a participation limited only to vertically integrated utilities or Independent Power Producers IPPs, up to a regional market fully open to any authorized participant.

The Multi-buyer multi-seller model can then be divided into two different types of market arrangements: primary and secondary power trade arrangements.

In the **primary multi-buyer multi-seller model** all resources are pooled together in a single market (Pool market), including all transactions and any bilateral trading agreement. For this reason, the power trade mode in these models is described as multilateral by default.

In multi-buyer multi-seller models, in some cases market organization is separated from system operations while in other cases the management is centralized for both market and systems operation *(e.g. Nord Pool and PJM in the United States are examples of primary multi-buyer multi-seller models. However, the PJM model is much more centralized.*

For instance, Nord Pool organizes day-ahead and intraday markets for all participants, but system operations remain the responsibility of the various national TSOs; while by contrast the PJM organizes

a regional power market across multiple US states and is also responsible for system operations in the region).

In the **secondary multi-buyer multi-seller model** the multilateral market is used only as a secondary option (Stock Market). Multilateral power trade takes place therefore in addition to other trading arrangements, to sell the excesses of generation*. E.g. the SIEPAC regional market is an example of a secondary multi-buyer multi-seller model.*

"The process works as follows:

- *First, the various national system operators perform a pre-dispatch optimisation where they determine least-cost dispatch using only domestically located generation. Excess generation (that is, generation that is not needed to meet local demand at least cost) is made available to the regional market, the Mercado Eléctrico Regional (MER, "Regional Electricity Market")".*
- *When the excess generation is dispatched, the plant receives the clearing price of the regional market (MER). In the SIEPAC, there is a regional system operator, the EOR (Ente Operador Regional) that is in charge of elaborating the least-cost regional dispatch plan thanks to the excess generation made available by national system operators. When a generator is dispatched under this regional plan, it receives the regional clearing price. Other generators, dispatched under national plans receive local (national) clearing prices.*

Some secondary multi-buyer multi-seller models can also be created specifically for renewable energy trade and **spot markets for excess renewable generation** have been created.

In August 2017 China has developed a spot regional market for trading excess of renewable generation among the provinces of Gansu, Xinjiang, Ningxia, Qinghai and Sichuan)

The hierarchy of power system integration models, vary from ones that are very limited, e.g., the simplest model being unidirectional power trading, to ones that can be considered complete.

The fully integrated model is represented by the PJM system in the United States, which organises markets, supports transmission planning and manages generator dispatch across a wide geographic area that includes multiple jurisdictions.

Different models require varying levels of cross-border collaboration and resource sharing, from low levels in bilateral trade models to high levels in more unified models. Higher degrees of integration generally allow for more optimal use of common resources such as transmission grids, thereby shortening the payback periods and maximising the economic outcome for the participants.

- Nascent trading arrangements such as bilateral trading arrangements are between two countries. For this model, often each trade is negotiated separately, and hence the volume of trade and the margins need to be sufficient to cover high transaction costs and to justify any required grid investment. Where transmission infrastructure exists, a market arrangement can be developed relatively quickly as it does not require high degrees of harmonisation.
- Secondary trading is a model in which domestic electricity markets are cleared first using respective domestic generation with any surplus or deficit traded and balanced with the trading partners. It requires a higher degree of system harmonisation and political agreement among participants although it does not require the same domestic market structures. Examples of a secondary market are the Southern Africa Power Pool and the Central American Electrical Interconnection System.
- Primary trading is a model in which a multilateral market is the main platform for trade. Primary trading arrangements require participants to restructure and harmonise domestic frameworks, such that all generators and consumers have equal status across boundaries. Examples of primary arrangements are PJM in the United States and the European Union Internal Energy Market. This arrangement requires high levels of co-ordination and political agreement among the various jurisdictions.

Multilateral trades can coexist alongside other differentiated (market or non-market) arrangements such as long-term power purchase agreements (PPAs) or non-financial power exchanges, wherein the participants are not restricted from such choices. A common feature among these models is third-party access to the domestic grid, so that any generator can directly supply a demand in another jurisdiction for a defined trading period. The assessment of a likely degree of integration depends on the common economic and political interest among the countries.

3.3 Study Cases On Cross-Border Electricity Trade

While each type of market offers interesting lessons, five market models are of particular interest for the South-eastern Mediterranean region, given their degree of network integration and market structures, particularly in terms of exchange of capacities and institutional processes. These are the PJM (Pennsylvania-New Jersey-Maryland), SIEPAC (Central American Electricity Interconnection System), the EU Market (European Union), the WAPP (West African Power Pool System and the SAPP (South Africa Power Pool). The main characteristics of these five markets are as follows:

3.3.1 Case 1. PJM: Pennsylvania, New Jersey and Maryland (United State of America)

PJM started as a fully regulated power pool in 1927. For the member utilities in the states of Pennsylvania, New Jersey and Maryland (Maryland joined in 1956) the objective was to share generation resources to improve efficiency and minimize investments in generation and transmission capacity. While the utilities in the three states were the beneficiaries of the power pool, the benefits were ultimately extended to consumers and shareholders. Over time, the power pool was expanded to utilities in other states in the Mid-Atlantic region.

The primary market operated by PJM include:

- A day-ahead market where hourly locational marginal prices (LMPs) are calculated for the next operating day based on generation offers and demand bids in a day-ahead auction. LMPs reflect the marginal cost of production at different nodes when constraints arise on the transmission system.
- A real-time energy market where a spot market during the day determines LMPs separately from day ahead LMPs
- A capacity market for capacity up to three years into the future. It secures capacity commitments from generators through competitive auctions.
- Financial transmission rights (FTRs) market where market participants can participate in an auction to secure payments to hedge their exposure to locational marginal pricing. FTRs pay out differences between the prices at the entry and exit nodes of specific transmission paths.

PJM offers two types of transmission service including network service allowing any market participant full access to the transmission system for a monthly fee charged according to usage, and point-to-point firm and non-firm service for specific bilateral contract routes from generators to loads.

3.3.2 Case 2: SIEPAC

Six Central American countries including Guatemala, El Salvador, Honduras, Costa Rica, Nicaragua and Panama have created the Central American Electrical Interconnection System (SIEPAC), an integrated regional electricity market to expand international trade. SIEPAC would also bring efficiency gains through economic dispatch on the broader regional level and shared reserves.

The legal foundation for SIEPAC is an inter-governmental framework agreement known as the Marco Treaty which was signed in 1996 and came into effect in 1999. The Marco Treaty provides the legal basis for both the regional market and the supporting institutional and physical infrastructure. A regional planning organization represents the six national utilities and includes planning, advisory and steering groups.

The market structures among the six countries vary from fully competitive wholesale markets to monopoly integrated utilities acting as single buyers. Some countries have significant private sector participation in their power sectors while others are limited to IPP investment in generation.

To accommodate the wide range of development and capacity in the national markets, the regional electricity market known as the Mercado Eléctrico Regional (MER) has been designed as a seventh market that operates on top of the national markets, in effect, connecting the six national markets while remaining separate from them. The design is an attempt to allow the individual countries to develop at their own pace while enabling trade at the regional level. Gradualism is explicitly identified in the Marco Treaty.

SIEPAC consists of two components. The first is a regional electricity market referred to as the Mercado Eléctrico Regional (MER) which includes a set of market rules to govern trade at the regional level on top of trade in the national markets. The MER includes a regional regulator and a regional transmission system operator that were specifically identified in the Marco Treaty.

The regional regulator known as the Comisión Regional de Interconexión Eléctrica (CRIE) began its operations in 2000 and the regional system and market operator known as the Ente Operador Regional (EOR) began operations in 2001.

The design of the MER was based on principles enshrined in the Marco Treaty and took two years to develop before being approved by the six governments in 2000. The CRIE and the EOR have supra-national legal status granting them independence from the six national legal systems. The regional market and supporting institutions are now operating and trade in the MER using the existing interconnectors is underway, albeit at very low levels.

The second component of SIEPAC is the construction of a new 1,800 km transmission line from Panama in the south to Guatemala in the north. The new transmission line will increase the transfer capacity from something less than 50 MW currently to 300 MW at all borders in the region.

The transmission line is owned and operated by a company formed for this purpose.

The company is owned in equal shares by:

- Each of the six state-owned national transmission companies;
- The dominant state-owned utilities of Mexico and Colombia; and
- A private-sector partner that is managing the transmission project.

3.3.3 Case 3: The EU Electricity Market

The European Union Electricity Market is a primary trading model. It has evolved with different levels of restructuring at member state levels since the 1990s as part of the European Council's objective of achieving increased market integration to improve security of supply, reduce costs and improve economic competitiveness. Four EU directives (1996, 2003, 2009 and 2019) instituted major changes to achieve common market structures, expand competition and increase interconnections (European Parliament, 2020).

In order to increase the participation of the member states, a number of choices were offered to achieve specific goals. For example, the 1996 directive to increase competition in electricity generation provided that member states could set up a wholesale market where all generation utilities could freely enter or to establish competitive procurement through a single buyer. Third-party access to grids could either be through negotiations with an integrated utility or by regulation (Pollitt, 2019).

Given the difficulties associated with assigning costs in new cross-border transmission developments, the European Union established a "project of common interest" status where project developers can take advantage of accelerated permitting, financial incentives and access to loans. In order to obtain this status, a prospective transmission project developer must first submit a cost-benefit analysis following an agreed methodology from the European Network of Transmission System Operators for Electricity (ENTSO-E) and the Agency for the Co-operation of Energy Regulators (ACER).

In addition, a cross-border cost allocation agreement process has been established where ACER can step in and mediate disagreements about cost allocation among countries to progress a project (Meeus, 2020). These measures have been used successfully to expand cross-border transmission capacity in the European Union.

The European transmission network is highly meshed. Though developed with a national focus, it has interconnections among nations that allow robust system operation across the main synchronized

blocks and for significant exchange of power across national borders. The Association of European Transmission System Operators (ENTSO) focused on facilitation of the emergence and operation of the internal competitive European electricity market, and on the market rules and harmonization needed to accomplish this. Its focus encompassed issues relating to: inter-TSO compensation, congestion management, real time electronic data exchange, tariffs, system security and legal and regulatory aspects. In the European market, the electricity trading can be traded on different types of wholesale markets:

- In a power exchange or multilateral trading platform, market participants submit generation and demand bids. The market is cleared once per predefined time period and a single market price is determined.
- In bilateral over-the-counter (OTC) trading, a generator and consumer agree on a trade contract by directly interacting with each other. OTC trading can take the market price published by the power exchange as reference price.
- In organized over-the-counter (OTC) trading, market participants submit generation and demand bids to a market platform which is cleared continuously; one market player can bilaterally accept the bid of another market player, resulting in different prices for each trade.

The main issues of Energy trading in Europe are:

- The market is divided into bidding zones and is based on the assumption that trading opportunities within those zones are unlimited (i.e., no congestion). Trade between bidding zones is limited by the level of cross-border capacity. That creates constraints on how much trade is technically feasible.
- TSOs need to anticipate uncoordinated flows and take measures to keep the power system secure, by limiting the potential for cross-border trade. TSOs also have to reschedule the output from power generation plants when the market demand cannot be supplied due to grid limitations. Uncertainty about cross-border capacity calculations (ATC) as a result.
- This treatment of cross-zonal trade, versus trade within bidding zones, is now of particular interest to European regulators and policymakers. The zonal market design implicitly prioritizes internal trade over cross-border trade. Review on how cross-border capacity is calculated, setting the limit on trade between zones, could change the way Europe's entire zonal market is organized.

3.3.4 Case 4: West African Power Pool (WAPP)

The Economic Community of West African States (ECOWAS) adopted the West African Power Pool (WAPP) initiative in 1999 to integrate electricity markets and address lack of electricity access in its 15 member countries: Benin, Burkina Faso, Cape Verde, Côte d'Ivoire, Gambia, Ghana, Guinea, Guinea Bissau, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone and Togo. Following the adoption of the WAPP Articles of Agreement in October 2005, the WAPP Organization was established in January 2006.

The WAPP aims to enhance information sharing among ECOWAS member countries, harmonize electricity operating standards, design priority investments, improve electricity system reliability and cost effectiveness and encourage cross-border electricity trade.

The WAPP is governed by a General Assembly (GA) that comprises representatives from all member countries and is the highest decision-making authority within the WAPP. The WAPP Executive Board serves on a part-time basis and is primarily responsible for setting policy, and overseeing the operations of the WAPP as well as the planning for its future development. The Board also analyses the findings of the various technical working groups and makes recommendations to the GA.

While each country will maintain its independent national regulatory body, power trade and exchange carried out through the WAPP will be regulated by a regional regulatory body. In January 2008, ECOWAS adopted a Supplementary Act establishing the ECOWAS Regional Electricity Regulatory Authority (ERERA). The ERERA, once functional, and will play a similar role to that of ACER in Europe.

3.3.5 Case 5: Southern African Power Pool Model (SAPP)

The Southern African Power Pool (SAPP) was created in August 1995 when member governments of the Southern African Development Community (SADC) signed an intergovernmental memorandum of understanding in 1992. The SAPP has twelve member countries represented by their respective electric power utilities. This is Angola, Botswana, Democratic Republic of the Congo, Eswatini, Lesotho, Mozambique, Malawi, Namibia, South Africa, Tanzania, Zambia, Zimbabwe.

The SAPP co-ordinates the planning and operation of the electric power system among member utilities. Its primary aim is to provide reliable and economical electricity supply to consumers in each member country consistent with reasonable use of natural resources and minimal negative impact on the environment.

The highest governing body of SAPP is the executive committee which comprises the chief executives of the various power utilities participating in SAPP. The committee receives and refers matters such as the requests for membership by non-SADC members and the major policy issues to the SADC energy ministers for onward consideration. The management committee which comprises officials from the member utilities oversees the running of the SAPP. Four sub-committees, including planning, operating, market and environmental sub-committees are responsible to the management committee. The SAPP member states and the interconnected grid are shown in Figure 9. SAPP comprises all 12 SADC member countries.

Bilateral contracts dominate the trading arrangements in SAPP and it often accounts for between 90-95% of the energy traded. Bilateral agreements usually cover a period of 1-5 years or more. These agreements guarantee the security of supply but are not flexible enough to accommodate varying demand profiles and prices. In order to ensure a more competitive electricity trading platform, a Day ahead Market (DAM) was introduced in 2009. Between 2012 and 2013, however only about 6% of energy demand in Day ahead Market was traded.

The regional power pool (Figure 15) was established even though the electricity markets at the national level had not necessarily been restructured. National utility companies act as buyers and sellers of electricity. Independent power producers (IPPs) are allowed to trade directly.

In 2001, the short-term energy market was established and in 2004, SAPP started the development of a competitive electricity market for the SADC region. A day ahead market was instituted in 2009 and in 2015 the trading platform was upgraded with forward physical markets and an intra-day market.

An important feature of the SAPP is that only excess generation is traded; hence its classification as a secondary market arrangement. Member utilities first ensure that they can cover domestic demand before offering generation capacity to the regional market. Electricity can also be traded through the pool on an emergency basis to meet unexpected shortfalls.

The Regional Electricity Regulators Association of Southern Africa (RERA) was created in 2002 and consists of the national regulators of the member countries. RERA functions only as a co-operative body to facilitate harmonised electricity sector policy, legislation and regulation and does not wield authority in regulatory matters.

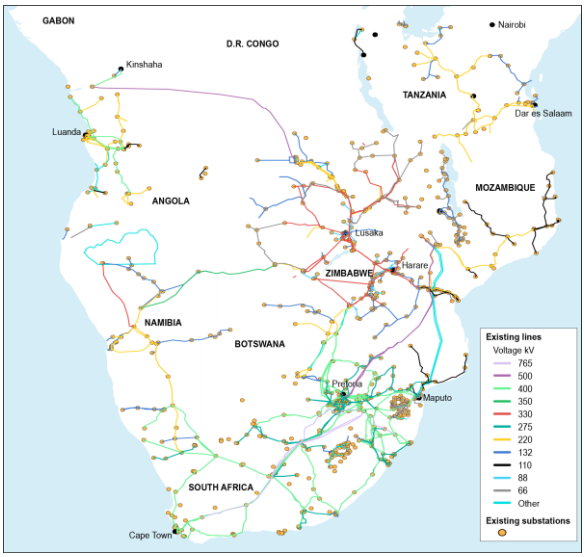


Figure 15 - MAP of SAPP power pool - Source: SAPP (2021), SAPP SADC Grid Map

3.4 Experience with Electricity Market Integration

Based on the analysis of existing regional markets around the world, it appears a wide range of integration models, ranging from simple bilateral transactions between two neighbouring countries to a multilateral trade scheme among a set of countries with fully integrated competition. Also, it emerges:

(a) The existence of different levels of regional electricity systems integration. Many levels and types of regional electricity sector integration exist, ranging from simpler forms that may only include cross-border generation projects to more advanced schemes with a combination of unified multinational companies, technical and regulatory harmonization, high levels of interconnection, regional coordination of investments (e.g., joint ventures, etc.) and cross-border competition.
The complete integration of a set of national electricity systems into a regional electricity market offers the greatest advantages particularly in terms of price difference and consumption profile.

Substantial benefits can be obtained at all levels of regional market integration, simple interconnections between systems and ad hoc cross-border exchanges of electricity can offer significant advantages in terms of complementarity and countries in some cases can also prefer to remain at this basic level of systems integration.

The choice of moving towards deeper integration of electricity markets depends on many factors, including the political commitment and the institutional capacity of participating countries. The time required to move from no integration to full integration can be measured in decades, but

moving from an intermediate level of integration to a higher level of integration can be relatively quick.

(b) An integration approach tailored to each region. The circumstances under which regional markets develop depend on several considerations. Indeed, countries have different motivations, electricity sectors are at different stages of reform and development, interconnections are not strengthened enough, financial capacities differ, and priorities are different from country to country.

The approach to the development of regional markets must be adapted to the circumstances and particularities of each region, and political factors and the historical evolution of regional agreements are generally as important as technical and economic factors. The development of a regional market is almost always a complex and progressive process with temporary reversals as well as periods of consolidation. The design, approach and sequencing of regional integration efforts must be tailored to local realities with considerable room for flexibility and adjustment as conditions and attitudes change.

(c) Integration of systems and markets leads to efficiency gains. Optimizing generation and transmission investments on a regional rather than national basis can offer significant cost reductions. However, these cost reductions are often not achieved when countries follow only national priorities, including security of national energy supply, economic nationalism and sovereignty concerns.

Recognizing integration as legitimate and dealing appropriately with its priorities is essential to achieving the best value for regional investments and reaping the full benefits of regional integration and the development of cross-border trade.

(d) Need for the creation of regional institutions. Regional institutions are vital for regional markets even though there is no one single institutional architecture suitable for all regional electricity integration schemes. The strongest institutions are those that grow organically from local initiatives rather than being imposed from outside. Possibilities of building on existing arrangements should be explored before creating new institutions.

(e) Technical and regulatory harmonization should be addressed earlier. Harmonization of technical standards is necessary to avoid endangering the reliability of neighbouring systems or imposing excessive costs from one country to another. Harmonization of relevant economic regulations among participating countries is not a prerequisite for initial levels of regional integration, but it is necessary as cross-border electricity trade develops.

Deepening regional integration will generally require a gradual move towards uniform approaches by national regulators, creating a common regulatory framework for regional markets, or possibly some form of “regional regulator” with market discretionary powers.

(f) Need for a flexible approach to power sector reform. Competitive power markets are not a prerequisite for initial regional market integration and different levels of power sector reform among participating countries can be accommodated through tailored design of regional integration programs.

Deeper levels of integration will tend to require national electricity markets to be at similar stages of reform in order to address concerns that the benefits of integration are being captured by countries where electricity monopolies persist.

Competitive electricity markets can facilitate and complement the integration of regional markets but can also create obstacles to electricity trade due to their ability to reduce the market power of incumbents and the additional difficulties associated with financing of cross-border projects as long-term contracts become more difficult.

3.5 Lessons Learned from Market Models Around The World

3.5.1 The SIEPAC Model

For the SIEPAC model, the lessons learned from the corresponding regional market relate to:

a) Political support is a necessary condition: support towards the project is needed by all the countries involved in the process of creating the Regional Electricity Market, on the financial and technical aspects
b) No need for major modification of the rules of procedure and the organization
c) Effective design of power pool governance and operational rules is necessary
d) Establishment of an effective institutional framework, based on a Regional Regulator and a System Operator and a Market Operator was a success factor for the development of cross-border trade
e) Progressive establishment of market rules, enabling Market Participants and System and Market Operators to realize the benefits of effective market model design

3.5.2 The SAPP Model

The South African Power Pool (SAPP), despite having sufficient installed generation capacity among its member countries, was initiated by a regional market based mainly on bilateral trade.

In fact, beyond generation capacity, adequate transmission capacity is essential to develop network integration, the lack of substantial transmission capacity has hampered transactions in the SAPP (and also in the SIEPAC) market and prolonged the dominance of bilateral trade.

Indeed, a significant transport capacity contributes to significant levels of exchange, which is the case for the Pennsylvania-New Jersey-Maryland (PJM) and Nord Pool regional electricity markets.

The lessons learned in the case of SAPP, then, are that to have a regional market and significant exchanges, it is necessary to have production capacities among the members but also transport capacities both at the level of interconnections and of the internal networks in order to ensure fluidity of exchanges without system congestion.

3.5.3 The WAPP model

Even though the idea of the WAPP market was launched in 2000, there has been almost no electricity trading for more than a decade, due to inadequate installed capacity and weak infrastructures among some member countries.

It was only on June 29, 2018 that the Market Rules for electricity exchanges in West Africa came into force with the launch of the first phase of setting up the Regional Market (By Decision No. 012 /ERERA/18).

It appears from the Market Rules that the effective development of the Market "will be carried out in several phases in order to allow the adaptation of the countries to the new environment and to gradually operate the essential changes and the adaptation at the national level in order to give full effect to the Market Rules".

According to the market rules, the development of a regional, West African market for trading electricity was planned to evolve in three phases, as follows:

Market Phase 1: Trading with electricity and transmission services take place on the basis of bilateral agreements, but under the regional market rules approved by ERERA. The bilateral agreements can be for the short, medium, or long term.

Phase 1 also includes guidance for preparatory work for the transition to Phase 2, including more extensive regulations and procedures for operational and commercial transactions.

Market Phase 2: Standard contracts are used as a basis for bilateral trading, transiting through third-party countries. Transactions can take place between individual agents of these countries. At this stage, transmission pricing is regulated by ERERA and it is no longer possible to create bilateral transmission pricing agreements.

Market Phase 3: The introduction of a competitive regional market in West Africa with a sufficient number of regional producers and consumers as market participants for regional trading, underpinned by robust cross-border transmission infrastructure. Introduction of new products to the electricity market, such as various reserve products, balancing power, and financial products.

3.6 Benchmark Analysis of the Market Models Selected

Given their similarity with the electrical systems of the South-eastern Mediterranean Countries in terms of integration and type of exchanges implemented so far, the SIEPAC, WAPP, GCCIA and EIJLLPST systems (Interconnection of eight countries of the Middle East), have been analysed in order to perform a Benchmark and select the most suitable model for the South Eastern Mediterranean region and its future development.

	EIJLLPST	GCCIA	SIEPAC	WAPP
Structure between TSOs, Market Operator and Market Participants	No Regional Market Operator / No Regional Control Center / TSOs have horizontal bilateral relations and communicate when they plan to exchange electricity	The National Utilities of the Gulf Countries that have signed the agreements at the base of the GCCIA have access to the Regional Network as Buyers and Sellers and they participate in Transmission Capacity Auctions, organized by the GCCIA, to reserve the	EOR (Ente Operador Regional) is the Regional System and Market Operator that runs the MER (Mercado Regional de Electricidad)/The Interconnected Network is owned by the EPR (Empresa Propietaria de la Red), a public-private joint venture	For the WAPP region, the role of Regional System and Market Operators has been assigned to the WAPP-ICC (Information and Coordination Center) / There are about 40 Utilities among the Member Companies of the

	EIJLLPST	GCCIA	SIEPAC	WAPP
		rights / The GCCIA operates as a kind of Regional TSO and is involved in the Scheduling activity with the various National TSOs of the region / Progressively, in the plans of the GCCIA there is to allow access to the regional interconnection also to Third Parties, starting with Generators and Bulk Consumers.	between the governments of the Six Member States / In each country, the National TSOs that interface with the EOR remain active / Market Participants (named Agents) of the Six Countries are allowed to participate in the MER (See below point : Market Operations). Thus, the management of transmission networks is done at two levels. At the local level, the TSOs have the autonomy to manage their networks. At the regional level EPR acts as a national Supra TSO responsible for the management and coordination of international exchanges. This scheme requires strong coordination between EPR and the various TSOs.	West African Power Pool. There are Vertically Integrated Companies (Production, Transmission and Distribution), Production Companies, Distribution Companies, Public and Private Companies, and TSOs

	EIJLLPST	GCCIA	SIEPAC	WAPP
Type of Local Markets	Single Buyer Model for Jordan and Egypt, but partially unbundled sector: the Government owns the Transmission Network and privately owned IPPs are active in Distribution. In Syria and Lebanon Monopolistic Market: the Government owns Generation, Transmission and Distribution / In Palestine there is not Transmission Network, and Distribution is divided between Private and Public depending on the areas	United Arab Emirates: Power Sector is mixed: Abu Dhabi is unbundled, Dubai Vertically Integrated / Kingdom of Bahrain: Energy and Water Sectors are vertically integrated / Kingdom of Saudi Arabia : Vertical Integration / Sultanate of Oman : Unbundled Electricity Sector with Single Buyer / Qatar: Power Sector reformed by separating power generation and water production from transmission and distribution / Kuwait: Vertical Integration with IPPs	Guatemala: Competitive Wholesale Market. Net Energy Flow: Seller / El Salvador: Competitive Wholesale Market. Net Energy Flow: Buyer / Honduras: Integrated, controlled by State-Owned Company (ENEE) until 2014. The creation of a Competitive Wholesale Market is underway. Net Energy Flow: Buyer / Nicaragua: Competitive Wholesale Market. Only the Demand can purchase in MER. Net Energy Flow : Buyer / Costa Rica : Integrated, controlled by State-Owned Company (ICE). Net Energy Flow: Seller / Panama: Competitive Wholesale Market.	Among the 14 Member Countries that make up the WAPP there are Electrical Markets and Sectors with different characteristics. In Benin, Burkina Faso, Gambia, Guinee-Bissau, Mali, Niger, Senegal, Togo and Liberia there is a Vertically Integrated Public Company but the sector allows IPPs to participate. In Sierra Leone, IPPs are not allowed and there is only a Vertically Integrated Public Utility. The situation is different in Ivory Coast, Ghana and Nigeria. In Ivory Coast, there is a Public Company in Production, but through Public Service Concession

	EIJLLPST	GCCIA	SIEPAC	WAPP
			Net Energy Flow: Seller	there are Private Companies in Production, Transmission and Distribution. In Ghana, there are several Public Utilities (Integrated or Not) active in Distribution, Transmission and Production, while in Nigeria there is a Public Transmission Utility and the rest of the sector is private (Production and Distribution)
General Cross-border Arrangement	Through the agreement, each country committed to upgrading its electricity system to a minimum standard / General Trading Agreement, first, and the Comprehensive Agreement, afterwards, outline the terms and conditions for using the	At the base of all general cross-border arrangements and at the top of the hierarchy of founding legal sources of the GCCIA is the General Agreement. The General Agreement is the International Treaty signed by the political and governmental leaders, by the Ministers of Energy,	The Framework Treaty of the Central American Electricity Market (Signed in 1996) / First and Second Protocols to the Framework Treaty (Signed respectively in 1997 and 2007) / Regulation of the Regional Electricity Market (RMER) / Regulatory Resolutions of the	The WAPP (West African Power Pool) was created in 1999 and conferred in 2006 by decision of the Authority of ECOWAS (Economic Community of West African States) Heads of State as a specialized institution for the regional Power Sector. In 2008, the ECOWAS Heads

	EIJLLPST	GCCIA	SIEPAC	WAPP
	interconnection: Energy transaction emergencies periods, interchange power and energy by contract during specific periods. Agreements are established between the parties concerned by the interconnections and not globally and relate essentially to the management of interconnections and bilateral exchange contracts	Electricity and Water, of the 6 Gulf Countries (GCC), which establishes the roles, rules and responsibilities and provides for the creation of the different entities necessary to operate, regulate and coordinate the business of the regional interconnection and power trade. In addition to the General Agreement, located in a lower hierarchy of the legal sources of the GCCIA, there is the Commercial Agreement, better known as Power Exchange and Trading Agreement (PETA Agreement), which establishes the Framework for exchanging and trading electricity through regional interconnection.	Regional Commission for Electricity Interconnection (CRIE) / All these agreements define the principles, rules, procedures and mechanisms for running the MER	of State created the ECOWAS Regional Electricity Regulatory Authority (ERERA) which adopted by Decision N°005/ERERA/15 the Rules for the WAPP Regional Electricity Market

	EIJLLPST	GCCIA	SIEPAC	WAPP
Respective roles and responsibilities, and related operational agreements	Steering committee: it is responsible for coordinating design, planning, and operating activities / The Planning Committee analyze the national plans to ensure coordination among the countries and determine if the plans conform to Steering Committee rules and guidelines. / Operating Committee: The operating committees are required to take all actions necessary to ensure delivery and payment for power in accordance with the interconnection agreement and any agreement	The Gulf Cooperation Council Interconnection Authority (GCCIA) has the role to facilitate and coordinate the business of the regional interconnection and power trade among the GCC Countries. Among its tasks and duties, for instance, the GCCIA: (1) It runs daily/monthly/yearly explicit auctions on Grid Capacities Rights (2) It facilitates and arrange energy schedules according to received notifications of bilateral exchanges (3) It generates periodic accounts and statements for energy exchanged between the member states (4) It generates and invoices member states for any deviations from	The MER's Steering Committee (CDMER) : the body that represents the governments of the Six Member States in the MER. It is responsible for promoting development of the MER / The Regional Commission for Electricity Interconnection (CRIE) is the Regional Regulatory Agency : responsible for enforcing the Treaty and its Protocols, the regulations, and for regulating relations between Market Agents, including : setting tariffs for the transmission, imposing penalties, settling disputes / Ente Operador Regional (EOR) is the Regional System and Market Operator that runs the MER (Mercado Regional de Electricidad). The EOR	WAPP and ERERA are the institutions created with the aim of promoting long-term cooperation in the ECOWAS Energy Sector and they govern the regional electricity integration process of West Africa. Their operations are closely interlinked. / ERERA is the regional regulator of the cross-border power trade. The Information and Coordination Center (ICC), future WAPP Regional System and Market Operator, is currently a specific Department of the General Secretariat

	EIJLLPST	GCCIA	SIEPAC	WAPP
	between the countries	agreed energy exchanges schedules (5) It implements the PETA Agreement and apply any penalties or defaults on co-signee parties / The Advisory and Regulatory Committee (ARC) is the Regulator of the Regional Interconnection business. The ARC is composed of National GCC Regulators' Representatives and is a committee that operates at the regional level without conflicting with any of the national jurisdictions	directs and coordinates the technical operations and conducts the commercial management of the MER. The EOR: 1) proposes to the CRIE the procedures for operating the Market 2) ensures that regional dispatch is conform to economic criteria 3) carries-out business operations for trades among the Market Agents 4) Ensures security, quality, and reliability of the interconnection 5) Elaborates expansion plans for generation and regional transmission	
Capacity Calculation Process	Very limited planning is done from the perspective of the EIJLLPST in part owing to National Transmission	Regarding the Allocation of Transmission Capacity on the GCCIA Interconnector, the Transmission Rights are mainly issued for :	A basic design objective for the MER was to enable large-scale regional generation projects to trade over the regional network. This required the	The ICC will develop a Methodology for Transmission Total Transfer Capability (TTC) Calculation: Criteria and process to evaluate TTC,

	EIJLLPST	GCCIA	SIEPAC	WAPP
	Network Limitations	1) meeting Installed Capacity Obligations 2) Operational Rights for meeting Spinning Reserves Requirements 3) executing Power Trade Transactions / In the GCCIA Regional Interconnection, the Total Transmission Capacity is to be considered as composed on the one hand of the Capacity necessary for the Emergency Services and on the other hand by the Capacity Usage that is distributed through Auctions. The Capacity allocated through Auctions is formed in turn by the Installed Capacity Interconnector Rights, on the one hand, and the Interconnector Rights for Operation on the other hand / Part III of the PETA Agreement (Terms Applicable to Trading) describes	availability of firm transmission rights. The original design concept also called for locational pricing signals to foster both short-term (consumption) and long-term (investment) efficiency. The allocation and pricing of transmission capacity in MER was modelled on the approach using a nodal pricing system with capacity allocation through auctions of financial transmission rights. The MER designed a system of nodal prices with auctioned capacity rights. Two types of capacity rights have been implemented in MER: the firm (physical) right and the financial hedge against a constrained network. Bilateral contracts	Transmission Reserve Margin (TRM) and Net Transfer Capacity (NTC)

	EIJLLPST	GCCIA	SIEPAC	WAPP
		the process for Allocation and Pricing of Interconnector Capacity. In particular, article 30.2 Method for the Allocation of Additional Interconnector Usage Rights /	with firm rights have dispatch priority	
Trading Platform	No Regional Trading Platform	There are mainly two Trading Platform Systems used in the context of the GCCIA Regional Interconnection: Trade Dart and GEMS.	SIIM Electronic Platform	There is no mention at the moment of a specific Trading Platform. The ICC is working on the installation of SCADA/EMS/MMS and WAMS Systems, providing to the WAPP the necessary tools and equipment to carry out its market operation functions as a Regional System and Market Operator
Characteristics of the Market Operator	No Regional Market Operator / No Regional Control Center / TSOs have	The GCCIA was created to facilitate and coordinate the business of Regional	The characteristic of the EOR (Ente Operador Regional) is to be a Regional	The WAPP ICC, having been designated as the Regional System

	EIJLLPST	GCCIA	SIEPAC	WAPP
	horizontal bilateral relations and communicate when they plan to exchange electricity	Interconnection between the Gulf Countries. As Power Trade Facilitator, and considered as a neutral body, the GCCIA has been preferred over the years by some Member States to enter into the Power Trade Agreements, mitigating the risks by providing back-to-back power trade agreements: Power Sale Agreement between the Energy Exporting Member State and the GCCIA and Power Purchase Agreement between the Energy Importing Member State and the GCCIA. Among its objectives and duties, by the way, the GCCIA has also the role to allow and promote electricity trading and has been mandated by the Member States to develop the	System and Market Operator that directs a Regional Market (MER) existing as a seventh market on top of the six national markets: the so called "6+1" model. The MER constitutes an additional market superimposed over the existing national markets and therefore the Six Member States can preserve National Regulations with limited changes necessary for compatibility with the MER Regional Code.	and Market Operator (SMO) and following the official launch of the commencement of the Regional Electricity Market on June 29, 2018, is putting in place the necessary policy, regulatory, technical and commercial framework required as part of the conditions for the implementation of the various market phases as prescribed in the Market Roadmap.

	EIJLLPST	GCCIA	SIEPAC	WAPP
		GCC Regional Power Market		
Membership of the Market	The EIJLLPST regional market includes Egypt, Iraq, Jordan, Libya, Lebanon, Palestine, Syria and Turkey. EIJLLPST countries have signed a comprehensive interconnection agreement	The Member States that form the GCCIA are mentioned in the General Agreement as follows: the Government of the United Arab Emirates, the Government of the Kingdom of Bahrain, the Government of the Kingdom of Saudi Arabia, the Government of the Sultanate of Oman, the Government of the State of Qatar and the Government of the State of Kuwait.	The Central American Electrical Interconnection System (Sistema de Interconexión Eléctrica de los Países de América Central – SIEPAC) was originally set up by the governments of Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua and Panama with the support of the Inter-American Development Bank (IADB) and the Spanish government through ENDESA, the largest electric utility company in Spain. The Member Countries established the public-private consortium Enterprise Owner of the Regional Electric Grid (Empresa Propietaria de la Red – EPR) to own and	The WAPP is an Organization with Membership open to any entity, public or private, which: (1) owns and operates generation facilities of 20 MW or more, and /or distributes and retails electricity (the "Transmission Using Members"); and/or (2) owns/operates "major transmission facilities in the region", if such facilities are physically interconnected and have an impact on coordination of system operations in the West Africa region (the "Transmission Owning/Operating Members"), or (3)

	EIJLLPST	GCCIA	SIEPAC	WAPP
			build the SIEPAC interconnection system. In 2005 and 2009, respectively, Mexico and Colombia joined the SIEPAC scheme as shareholders through their leading utility companies. Mexico and Colombia have, however, not yet become participants in system operation and trading under SIEPAC.	has an interest in the electricity sector in the West Africa region but does not fit the definition of either the "Transmission Using Members" or "Transmission Owning/Operating Members".
Market Operations	Despite the interconnection agreement, trade among the EIJLLPST countries has been modest. Jordan, Egypt, and Syria share mainly spinning reserves. Overall, the value of the EIJLLPST interconnection is currently suboptimal. It is used primarily for emergency exchanges, while	Power Trading operations on GCCIA Interconnection began to increase from 2016/2017 onwards initially with the development of bilateral contracts comprising of "in-kind" and "in-cash" models. Progressively, with the initiation of trade, Member States are now considering power exchanges for optimization and	The MER operates by scheduling electricity trades according to the following sequence: a) The day before the trade, for each hourly period, the System Operators/Market Operators (SOs/MOs) of the MER member countries perform a national pre-dispatch in accordance with the rules of each	Electricity trading within the WAPP is currently mainly on a bilateral basis. In a first phase, it was decided to standardize and formalize the existing trades carried-out on the WAPP interconnected system between countries on a "case-by-case" basis, through bilateral

	EIJLLPST	GCCIA	SIEPAC	WAPP
	energy transactions to take advantage of differences in production costs are limited.	efficiencies via day ahead markets. For operations, Market Timeframes and Opening Time vary: for the Monthly IRO Market and Contract Registration the timeframe is the Month Ahead, while the timeframe is the Day Ahead for the Daily IRO Market and for the Day Ahead Market (Continuous). There is not specific timeframe for the Bilateral Markets, which are always open. Regarding the Opening Time: the Monthly IRO Market is open from the 10th to the 20th of the Month, while the Daily IRO Market is open from 07:30 to 09:00 of the day. The Day Ahead Market (Continuous) is open from 09:30 to 12:00 of the day.	country, without considering MER imports or exports. After the national pre-dispatch is done, the SOs/MOs inform EOR of the pre-dispatch carried out, the opportunity offers for energy injection (export) or withdrawal (import) destined for the MER, the validated regional contracts, the flexibility offers and/or maximum-payment offers for transmission associated with the contracts, and the requirements of regional auxiliary services. b) Based on the information received, the configuration of the RTN, the quality, security, and performance criteria established to operate the Regional Electricity System	commercial contracts. Then subsequently, transactions are being developed including agreements with transit through third countries. During this phase of market development, the aim is to carry out short-term exchanges through a day ahead market. At this stage, transmission pricing is regulated by ERERA and it is no longer possible to create bilateral transmission pricing agreements.

	EIJLLPST	GCCIA	SIEPAC	WAPP
			(SER), and the limitations reported by the SOs/MOs, EOR performs the regional economic pre-dispatch and communicates its results to the SOs/Mos. c) During real-time operation of the regional market, EOR, in coordination with the SOs/MOs, takes the actions required to ensure that the regional electricity system is working properly	
Financial Settlement	Every year, TSOs review their Bilateral Agreements and Costs of Energy Exchanges. At the end of each month, TSOs review the programmed amounts of energy exchanged and settle the financial aspects, while for the non-	The Transmission charges for using the GCCIA Interconnector was initially fixed at US$ 5/MWh since 2010. Afterwards, the GCCIA Board of Directors realized the need to incentivize power trade among the GCC Member States and waived off the transmission charges for the years	As a first step, the six national system operators perform a pre-dispatch optimization where they determine least-cost dispatch using only domestically located generation. After, excess generation is made available to the MER. When the excess generation is	The WAPP has held a crucial role in preparing rules and regulations for more harmonized regional market practices. It has also been crucial in preparing template contracts for power purchase and transmission services, developing market

	EIJLLPST	GCCIA	SIEPAC	WAPP
	programmed exchanges they can be compensated "in-cash" or "in-kind"	2016 to 2018. With the reduction of the transmission charges the GCC Electricity Market witnessed a significant power trade volume increase since 2016. The Transmission charges are now fixed at US$ 0.5/MWh	dispatched, the plant receives the clearing price of the Regional Market MER. The EOR is in charge of elaborating the least-cost regional dispatch plan thanks to the excess generation made available by national system operators. When a generator is dispatched under this regional plan, it receives the regional clearing price. Other generators, dispatched under national plans receive local (national) clearing prices	rules. In particular, the WAPP ICC Department, as the future Regional System and Market Operator, shall among others carry out the following functions: Manage billing, settlement and payment processes, Administration of commercial databases, Settlement of imbalances. Following the Finance and Engineering & Operating Committee Market Taskforce Meetings, the Settlement Bank Agreement, the WAPP Day Ahead Market Book of Rules were drafted and validated. They were approved by WAPP

	EIJLLPST	GCCIA	SIEPAC	WAPP
				Executive Board on 05th October 2019
Products (Type of exchanges, power, etc.)	The Comprehensive Agreement signed in 1996, outlining terms and conditions, for the use of the regional interconnections, includes: 1) Reserve sharing during emergencies 2) Capacity transactions 3) Interchange of surplus power and energy 4) Regulation of energy flows and regulation of reactive power flows 5) Transmission services 6) Operating reserves. Despite its signature in 1996, the agreement according to its initial concept and extended to the	The GCC Electricity Market allows to trade: Installed Capacity Rights, Interconnector Rights for Operation, Spinning Reserves, Scheduled Energy Transfers.	Firm and Financial Congestion Rights allocated in Auctions / Spot Market: Day Ahead and Real Time Balance / Mutual Support in Emergencies / Regional Wheeling Tariffs / The market agents, with the exception of transmission companies, can buy and sell electricity freely, without discrimination of any kind, ensuring the free flow of electrical energy through the networks in MER member countries / Market agents can install their power plants in any of the MER member countries to sell the energy they produce throughout the region	Short-Term, Medium-Term or Long-Term Bilateral Commercial Contracts / Transactions for transiting through third-party countries / Day-Ahead Market to be introduced for short-term exchanges / Transmission Services: transmission capacity is allotted on a first come first served basis In terms of exchanges: Bilateral contracts between the operators of the control areas: is a direct agreement concluded between a Buyer and a Seller of

	EIJLLPST	GCCIA	SIEPAC	WAPP
	eight countries of the region has not yet been implemented			electricity within the framework of the Regional Market
Price Formation (Definition of Price)	Prices are usually higher in the summer when aggregate demand is high, due to the addition of more expensive generation sources. There is still no third-party access or published tariffs for using transmission. Independent Regulation remains an issue and retail tariffs remain heavily subsidized in most of the countries	According to the PETA Agreement (Annex 7, Article 7): Pricing of allocated Installed Capacity Interconnector Rights shall be determined by means of bids received in the auction process, except that the Authority may, where it believes it is efficient to do so, specify a minimum price for any Installed Capacity Interconnector Right below which bids will not be accepted and which is approved by the ARC from time to time. / According to the PETA Agreement (Annex 7, Article 15): Pricing of allocated Interconnector Rights for Operations shall be determined by	Transmission Use of Service (TUoS) charges are set by the CRIE for all transmission assets in the Regional Network. The MER Transmission Code provides for recovery of TUoS through three prices components: 1) A variable-cost component met through the nodal price residual and revenues from transmission right auctions 2) A transmission toll based on actual flows on the lines 3) A complementary charge levied on all participants to capture any remaining unrecovered cost	The recommended methodology is one that guarantees transport operators a reasonable cost for the recovery of infrastructure development costs. Revenues generated by those who bought bilateral exchanges and for transmission tariffs and losses, are collected by the regional Market Operation System (WAPP ICC). Transport capacity is allocated on a first-come, first-served basis.

	EIJLLPST	GCCIA	SIEPAC	WAPP
		means of bids received in the auction process, except that the Authority may, where it believes it is efficient to do so, specify a minimum price for any Interconnector Right for Operations below which bids will not be accepted and which is approved by the ARC from time to time.		

Table 8 Benchmark analysis of EIJLLPST-SIEPAC-GCCIA-WAPP Markets

3.7 Main Conclusions Of The Benchmarking: EIJLLPST, SIEPAC, GCCIA And WAPP Markets

The benchmarking of the four market models analysed highlights:

- A regional multilateral electricity market requires a **high level of political agreement** among the participants compared with bilateral contracts.
- Political Agreement is required to implement necessary reforms associated with harmonisation and market functioning.
- Effective cross-border trade depends on a **reliable power sector at the domestic level**.
- The establishment of markets will be progressive, evolutionary and coordinated in order to allow the different countries to adapt their regulations and procedures to the concept of an open regional market

- There is no single model to transpose from one region to a given region, but the **models are adapted to each region**, according to its specificities and existing practices in terms of coordination and exchanges.
- Needs **to set up regional institutions** with all the prerogatives with well-defined missions (coordination of exchanges, management of interconnections, Regional Regulation Agency, etc.),
- The regional coordination of exchanges is not in opposition to the maintenance of the autonomy of local TSOs on their respective networks (case of SIEPAC)
- Markets that have succeeded (SIEPAC, WAPP), have had strong support from the States for the development of the market
- Exchanges between countries are possible, even if the structures of the electrical systems are very different in terms of networks and availability of generation (excess or not, case of the WAPP)

3.8 Which Market Model For The South-eastern Mediterranean Region?

The integration of the systems of the countries of the South-eastern Mediterranean region could be **progressively achievable** during the years to come, considering the experiences already acquired in terms of electricity transactions and the existing opportunities to increase electricity exchanges and move towards an integrated market, as planned as well by the political authorities of the countries concerned **within the framework of the PAEM initiative** (Pan-Arab Electricity Market).

However, the choice to develop a path towards greater integration depends on the will of the regional relevant stakeholders and their perception of business opportunities and risks relative to their respective resources. Also, on the basis of the global experience, it appears that:

(a) There is no evidence to suggest that any of the existing or developing schemes got the model right at the initial stage of integration;
(b) The **more successful schemes are the ones that pursued an adaptive approach** and adjusted the course when needed, and the ones that remained persistent in dealing with the foreseen and unforeseen challenges.

(c) The establishment of strong political support is needed, as well as a monitoring mechanism that can quickly bring to the attention of the decision-makers the obstacles and challenges as they emerge.

In view of these considerations, in order to increase electricity trade, the countries concerned (Egypt, Jordan, Lebanon, Palestine) must undertake a process of building a new market that can take as an example the functioning of some models (such as SIEPAC and WAPP) but cannot simply reproduce in the region a pre-established model applied elsewhere. In building this own market model, countries can start from an existing framework (that of the EIJLLPST project) and enter the path already planned by local political authorities through the PAEM, starting from the strengthening and optimization of bilateral exchanges and the development of a common regional methodology for Transit Tariffs.

Also, the success of a regional electricity market requires that **the governance documents must allow all market players**, regardless of their origin, **fair and open access to the transmission network**. This includes not only transmission facilities interconnecting national markets, but also transmission facilities forming the national transmission network.

In addition, there is a **need to put in place high level institutions** with the necessary expertise and authority to guide and if necessary, enforce a level of consistency across the region.

Given the similarities, **the SIEPAC or WAPP model could be adapted and considered as a model for the establishment of an electricity transaction market** at the level of the South-eastern Mediterranean region. In addition, in the future, a greater exchange of electricity at regional level (between Egypt, Jordan, Lebanon and Palestine) could lead to an extension also towards the EU and GCCIA markets, passing through Saudi Arabia, Cyprus, Iraq and Turkey.

Defining a bilateral/multilateral power trade model is of paramount importance. Indeed, until now, the lack of clear business models between South-eastern Mediterranean countries has hampered the exchange of electricity, resulting in low or even poor exploitation of existing interconnections.

The absence of clear rules has delayed the transport of electricity through a third transit country (Egypt - Lebanon via Jordan for example, etc.) or even prevented cross-border trade beyond neighbouring electricity systems. In general, to promote CBT in the region, clear rules are needed in terms of:

- Procedures/Inter-TSO compensation
- Capacity allocation (CA) between interconnections;

- Congestion Management (CM)

3.9 Main Requirements for South-Eastern Mediterranean Market Integration and Trade

The development of multilateral electricity trade in the South-eastern Mediterranean region would offer several options to the countries of the region to increase their revenues. In addition to the current practice, based on relief transactions under bilateral agreements, daily or weekly surpluses could be sold under a bilateral or multilateral overnight or weekly market. The establishment of a specific business model should take due account of countries' preparedness in terms of their electricity sector structure and market, including third party participation, as well as their experience in cross-border electricity trade.

A business model such as the Central American Power Pool (SIEPAC) or the West African Power Pool (WAPP) could be adapted to the countries of the South-eastern Mediterranean region and give time to pursue domestic reforms while achieving the benefits of increased trade. Indeed, a model like that of SIEPAC does not induce major modifications in the internal regulations and organizations of the countries with a progressive implementation of the rules of the market, allowing market participants and network operators to become aware of the advantages of an effective design of the integration of systems and the development of electricity exchanges with a medium-term extension to other countries (e.g., Lebanon, Syria, etc.)

Also, regardless of the market model recommended, minimum political, technical and economic requirements should be adopted by countries to establish efficient multilateral electricity exchanges (figure 16).

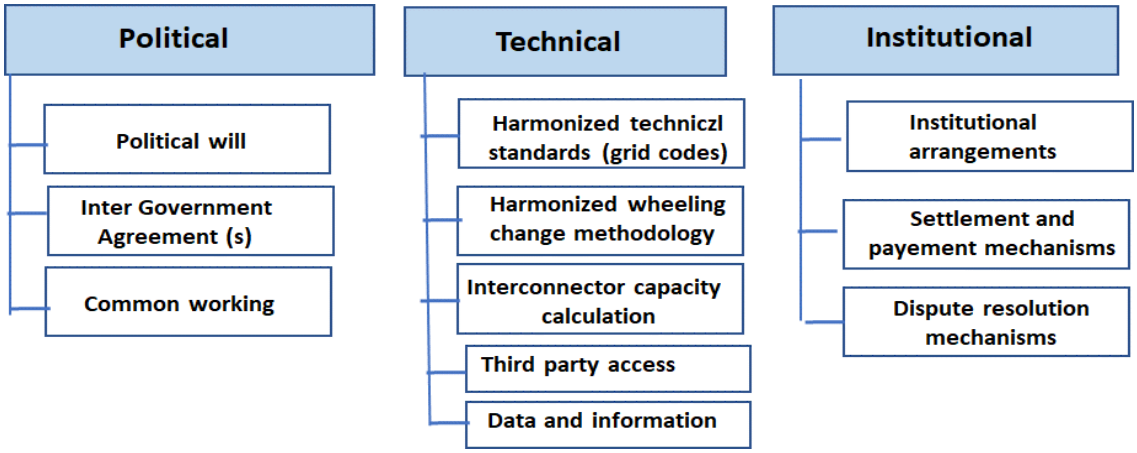


Figure 16 Minimum requirements to establish multilateral power trading (Source: IEA 2019)

3.9.1 Phases that need to be taken by each country to establish an electricity market

The proposal is composed of two phases:

- **First phase:**

Even without adding new transmission capacities, Egypt, Jordan and Syria could improve the use of their existing interconnections through:

- Extended bilateral contracts in the third countries and the establishment of transit agreement for the extension of exchanges via third-party networks (example Transaction from Egypt to Lebanon or Syria via the Jordanian network and vice versa).
- Development of common methodology and procedures for defining the transit cost via third-party networks
- Development of a common methodology for calculating and valuing NTC values,
- Establishment of rules and procedures for the sharing of reserves between interconnection systems
- Establishment of a common mechanism for the implementation of a joint defense plan between the countries concerned
- Strengthening of the skills of the various operators on the electricity market
- Promotion of trade mechanisms.
- Build trust and political consensus for cross-border power trade (coordinate, harmonize and institutionalize policy and regulatory frameworks).
- Coordinate cross-border transmission planning and system operation.
- Develop a regional master plan for the cross-border electricity network.
- Obtain stronger support from policy makers regarding cross-jurisdictional aspects for system operations, long-term planning and governance that require collaboration. The role of regional institutions is essential, and it is possible to integrate electricity systems across borders without sacrificing local autonomy
- Consider appropriate cooperation mechanisms between transmission system operators, to guarantee the maintenance of minimum levels of quality and reliability of supply.
- Rules and procedures for fair and non-discriminatory access to the physical infrastructure,
- Ensuring the continuation of electrical energy exchange under any circumstances or political disagreements regarding long-term market agreements
- Establish a platform for selling excess electric power to the common market

- Establish an independent third party to review the cost level and transparency of the network

- **Second phase:**

- Reinforcement of infrastructures (internal networks, interconnections and supply capacity, etc.), in particular with the Lebanese and Palestinian networks with a strong deficit and requiring an electricity supply from neighbouring networks and/or from Egypt
- Harmonization of legislative and regulatory frameworks (management of interconnections, resolution of technical problems, pricing of capacity and transit, etc.),
- Appropriate regional regulatory and market surveillance mechanisms implemented, including enforcement procedures and dispute resolution mechanisms.
- Appropriate consideration of the open market structure when building a new power plant (Use of take or pay agreement, etc)

4. Definition of the principles of cooperation and the operational agreements in view of an electricity exchange platform

On the basis of the activities and analyses carried out during the previous chapters, the Milestone 3 defines the Principles of Cooperation necessary for the Regional Electricity Market in the South-East Mediterranean Region. These Cooperation Principles will be designed to provide support to an Operational Agreement in view of a Power Trading Platform. The report also includes the elements of a Stakeholders Analysis, as a key tool to facilitate the Governance of the project.

Furthermore, the chapter includes a final Recommendation, including a second Road Map that will describe methods and measures of involvement of all stakeholders (not only TSOs) necessary to create a Regional Electricity Market in the Mashreq. This Roadmap will describe the steps to be taken to move from the current situation to the recommended final model.

Based on the analysis of the markets implemented at the world level and the benchmarking of the markets whose networks present similarities to those of the South-Eastern Mediterranean region in terms of structure and consistency, the WAPP model seems the best suited as a reference for the South-East Mediterranean region. The related model takes in account an evolutionary implementation, in order to allow the adaptation of the systems of the different countries to the new

environment and to bring, progressively, the essential changes at the national level in order to give full effect to the rules of the market.

In fact, the memorandums of understanding put in place within the framework of the EIJLLPST project and the PAEM, have already defined a number of governance bodies for the future development of an integrated Arab electricity market through the creation of specialized committees (executive, regulation, planning, operation, regulation committee, etc.). that paved the way to initiate the process for the harmonization of procedures and rules for the strengthening of systems and the development of electricity exchanges on a commercial basis through the establishment of a scalable market model and adapted to the region, in a process similar to that of the WAPP region. At the same time the experience of the Gulf Cooperation Council (GCC) countries in terms of promoting trading between the concerned countries has been growing and can be also used as a reference in the project for the South-East Mediterranean region. Also, the analysis of the gap analysis between the current situation in the South-East Med region and the proposed market model will be done in relation to the WAPP model.

4.1 Principles Of Cooperation to Increase Regional Electricity Exchanges in the South-Eastern Mediterranean Region

The integration of national power grids in the highly regulated electricity sector necessitates robust regional energy cooperation among member states. The establishment of regional institutional governance is imperative in directing the advancement of energy connectivity and integration. This necessitates a paradigm-shifting collaboration between member states, augmented by regional and subregional institutions, in order to formulate a regional institutional framework that can steer the integration process. The lessons gleaned from other subregions highlight the crucial role played by these institutions in the integration procedure. In the already taken important measures and clear political decisions for the establishment of an area of cooperation and development of the electricity market. e South-East Mediterranean region, through the interconnection project of the eight countries [3]"EIJLLPST Project" and the Arab Electricity Market project "PAEM", the stakeholders in the region have In this context the development of electricity exchanges among the four South-Eastern Mediterranean countries (Egypt, Jordan, Lebanon and Palestine) should be envisaged as the first stage of a more extensive market in the eight countries of the EIJLLPST project and its future extension to European

[3] Libya, Egypt, Jordan, Palestine, Syria, Lebanon, Iraq and Turkey.

and Gulf countries systems. The promotion of larger trading volumes, the introduction of new market segments and steps such as the introduction of a regional exchange power require rules for the common market and a codification of these rules as has been the case in the process of the EU network codes, SIEPAC, SAPP and WAPP.

According to a progressive approach with evolving rules to regulate the market, the **principles of Cooperation will focus on the following objectives:**

Objective	Discussion
System Security	Secure power supply for the countries of the region and Provision to each other of emergency services; which refers to the capability of a power system using its existing resources to maintain reliable power supplies in the face of unexpected shocks and sudden disruptions in real time, such as the unanticipated loss of key generation or network or rapid changes in demand
Energy resources	Optimize the use of the energy resources available in the region by encouraging complementary investment schemes in the production and transmission of electricity, taking into account the resources available in each of the member countries.
Power supply and adequacy	Enhance power supply in the region by using power system interconnections and increasing power exchanges between countries by sharing and optimize the Installed Capacity Resources Including the use of third-party networks. Strengthen and implement solidarity mechanisms for safeguarding interconnected systems in emergency situations.
Cooperation	Negotiate bilateral cooperation agreements for the exchange of electricity, including via third countries with payment of transit tariffs according to a methodology approved by the parties
Energy Trading	Energy trading for Scheduled Energy Transfers with the aim of bringing greater reliability of service to the South-Eastern Mediterranean region including contracts for the provision of operating reserves
Electricity market	Facilitate in the long term development of an electricity market.

	Establish an efficient and fully integrated internal market, in particular by improving the functioning of the internal electricity market.

Table 9 : Objectives of the Cooperation

For this, it is necessary to reinforce the use of the interconnections and networks between the countries by the improvement of exchanges for:

- ✓ **Promotion of reliable and efficient operation of interconnections** and interconnected power systems by coordinating design, planning and operation activities.
- ✓ **Arrangement of setting parameters and analyse the functioning of the interconnections**, with taking **measures to ensure the transactions between the systems and the payment of the electricity in accordance with the interconnection agreement** and any agreement between the countries.
- ✓ Implementation of management rules for an efficient, competitive, transparent and reliable market
- ✓ **Definition of the responsibilities** of operators in connection with the electricity market and control zone centres with regard to commercial exchanges, coordination, dispatching and qualification of contracts, management, metering and invoicing and payments.
- ✓ Establishment of rules for the operation of interconnected systems and the imbalance management system
- ✓ Promotion of regional integration for an **effective business environment conducive to public and private investments** in relation to the cross-border electricity market.
- ✓ **Bilateral trade contractual relations** would be the dominant mode and development of exchanges on the basis of commercial rules
- ✓ **Definition and adoption of a common methodology for transit tariffs** for trade via a third country.
- ✓ Strengthening of regional and bilateral cooperation, in terms of support for the harmonization of rules and legislation with a view to the gradual creation of a regional electricity market

- ✓ **Harmonization of the legislative and regulatory frameworks as well as the structures of the electricity industry of the four countries** to create an electricity market and make it compatible with international standards in order to be able to integrate it effectively into that of the Union European Union and that of the Gulf countries, within the framework of the development of the EIJLLPST Project and the PAEM.

- ✓ **Reinforcement of interconnection capacities and market segments** (eg exchanges of system services, etc.) in accordance with the developments of renewable energies envisaged by the various countries of the region in the context of sustainable development,

- ✓ Development of rules to govern the regional market with a view to greater openness, particularly in terms of market organization and its opening to other segments (intraday market, system services market, capacity allocation, etc.) and hardware and software necessary for cross-border electricity trading.

- ✓ **Unifying the terms of protection and telecommunications and metering facilities** on the interconnection lines.

- ✓ Unify the operation language and the concept of cooperation and terminology between the control centres of TSO's.

- ✓ Enhance the knowledge of the operators concerning the other networks conditions through exchange visits

4.2 Operational Agreements In View Of An Electricity Exchange And Networks Integration

4.2.1 Objectives of Operational Agreement

The objective of the operational agreements for interconnected systems is to ensure that the interconnected electrical networks are operated effectively and efficiently and that they participate equitably in the obligations and in the benefits resulting from the Interconnection. The operators in charge of the interconnected systems must comply with the rules for the operation of the interconnections and the conduct of the electrical systems, subject of the agreement.

Beyond the overall agreement governing the interconnections, each concerned TSO will establish more detailed operating instructions governing the operation of each of its local networks.

To manage exchanges within the framework of the regional market, the TSOs must ensure:

- **Maintaining scheduled flows** in the interconnections under their responsibility
- **Maintaining the technical parameters** of the interconnections as voltage in the both side of interconnection, reactive flows, voltage return direction for interconnection closure
- **System security** to avoid impacts on neighbouring networks
- **Support for neighbouring networks** (Mutual Aid and Solidarity) in the event of an incident without affecting overall security

4.2.2 Current achievements and open issues in the South-East Mediterranean Countries

Egypt- Jordan- Lebanon- Palestine- Syria	
Achievements	**Open issues**
Existing Reasonably strong international connections	Egypt, Jordan, Syria and Lebanon are synchronized. But the interconnection line between Jordan-Syria-Lebanon are not open because of the political situation in Syria. Further cross-border connections and upgrades to national transmission networks to enable synchronization within EIJLLPST countries are under consideration phase. The demand for the Palestinian Authority's electricity network is partly satisfied from the Jordanian network on the basis of an import contract via the 33 kV line
Limited reserves and energy sharing at Country level in the region	Mostly limited to Egypt and Jordan, and to a lesser extent, Syria and Lebanon. There is still no third-party access or published tariffs for using transmission.

Limited progress on market reform such as unbundling.	Market opening limited to a few IPPs whose energy is delivered to a single buyer in each country. Regulatory agency set up in each of the countries with missions oriented to the local market. Retail tariffs remain heavily subsidized in all countries
Limited regional planning.	Jordan relies on its interconnections for reserves, but no planning is done from the perspective of EIJLLPST in part owing to national transmission network limitations. The only exchanges of data and project plans are made within the framework of the Med-TSO Mediterranean Masterplan of interconnections
Regional documentation governing trade exists in the form of the Interconnection Agreement Some related Regional organizations exist with regional steering, operating, and planning committees for the EIJLLPST project	Although regular meetings are held, regional institutions appear to have limited functionality. Almost each country tried to solve its own energy problems based on their capabilities
Some success in attracting private sector capital to the power sector.	Private sector involvement limited primarily to IPPs sector involvement with some private in distribution in Jordan.

Table 10 : Achievements and open issues in the South-East Mediterranean Countries

4.2.3 Content of Operational Agreement for interconnection operation and power exchange

The agreement for the operation of interconnections and power exchange in the context of cross-border electricity transactions comprises two parts, a general relating to the technical operation of interconnections and a part relating to the power exchange. The content of the agreement is given in figure 17 below

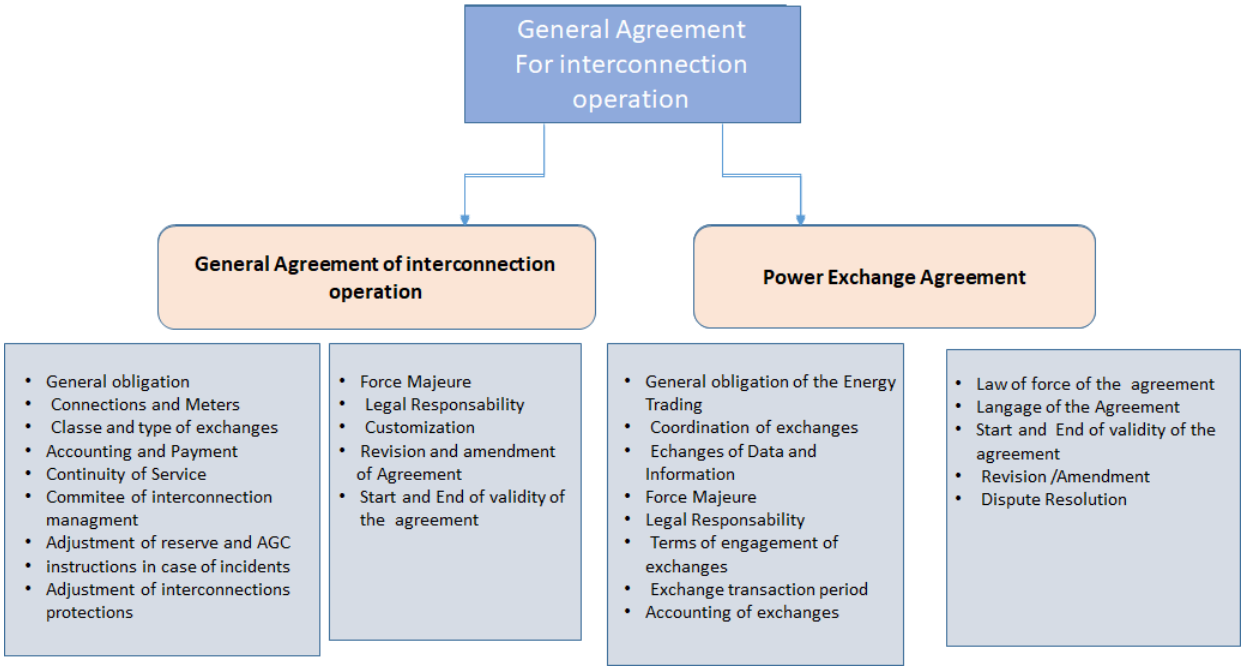


Figure 17 Content of General Agreement of Interconnection Operation

The technical content of the operational agreement to be drawn up by the TSOs in coordination with the stakeholders concerned by cross-border electricity exchanges is detailed and given in Annex 1.

4.2.4 Coordinate cross-border transmission planning and system operation

The secure operation of interconnections requires that technical standards such as Grid codes encompassing frequency, voltage, contractual exchange limits and operating conditions agreed between the TSOs, and operating limits are harmonised. Also, meter connection, protection systems, transmission planning and scheduling must be coordinated between TSO's in the region for a safe and reliable flow of electricity.

System operators, transmission utilities and technical institutions in each country, should create committees for coordinated transmission planning and system operation of the interconnection system network.

These bodies can facilitate the development of common sets of grid codes and technical regulations, grid master plans, protection schemes and scheduling, along with feasibility studies for the smooth interconnection of power systems.

4.3 Stakeholders Analysis

4.3.1 Stakeholders identification

The engagement of Regional Stakeholders is fundamental to the effectiveness of the project. The main Stakeholders involved in the region are below:

- EDL (Lebanon TSO)
- EETC (Egyptian TSO)
- EgyptERA - Egyptian Electric Utility & Consumer Protection Regulatory Agency
- EMRC - Energy and Minerals Regulatory Commission of Jordan
- ERA (Lebanon Electricity Regulatory Authority should be operational in 2024)
- MedREG
- Ministry of Electricity and Renewable Energy of Egypt (MOEE)
- Ministry of Energy and Mineral Resources of Jordan (MEMR)
- NEPCO (Jordanian TSO)
- PENRA – Palestinian Energy and Natural Resources Authority
- PERC – Palestinian Electricity Regulatory Council
- PETL (Palestinian TSO)

4.3.2 Stakeholder classification and responsibilities

Stakeholder analysis is based on a ranking of stakeholders who interact with the project. This classification is made with the aim of meeting the technical, commercial and societal needs related to the establishment of an integrated electricity market. Stakeholder ranking is based on:

• Those with a Direct interest in the power exchange platform, including their readiness to commit to the establishment and success of the project as well as their influence on the creation process the platform and the results of the project,

• Those with indirect interests and which could be influenced by the opening of the market and international transactions.

With reference to the four countries participating in the exchange platform project, the analysis of stakeholders will be limited to those who are directly linked to the project, such as the Energy Ministries, regulatory agencies, and the electricity system operators of the concerned countries.

Here below some key roles and responsibilities are identified and proposed for each stakeholder.

Ministries:

- Development of the sector while considering public interest and protecting the interests of companies operating in the sector
- Preparation of conditions for market establishment and development of regulations and governance models
- Encouragement of local and foreign investment to ensure reliable and affordable supply of electrical energy to consumers
- Strengthening the role of the Regulatory Commission in the development of the sector and market control
- Collaboration with other countries for electrical interconnection and energy trade and conclusion of necessary agreements
- Determination of principles for tariffs for sale and purchase of electrical energy during the transitional period before open and competitive market establishment

Energy Regulation Commissions:

- Determination of electric tariff, subscription fees, services fees, disbursements, royalties, and connection charges to the transmission and distribution system
- Recommendations for transition from single buyer model to competitive electricity market

TSOs:

- Operation of power system safely and economically, planning and development of power system
- Purchasing electricity from different sources and selling to distribution companies
- Importing and exporting electricity with neighbouring countries and contracting new generation capacity to meet future demand.

4.3.3 Level of influence and interest of stakeholders:

	Jordan	Egypt	Lebanon	Palestine
Ministries of Energy				
Level of Influence	**High**: Ministry approval is required for the Operational Agreement. The MEMR also has the power to schedule all the necessary consultations	**High**: The Ministry establishes the outlines of the Operational Agreement and has the power to organize the necessary high-level discussions and to approve the agreement	**High**: Considering the urgent need to restore the national electricity sector, the Ministry can promote the project through initiatives of a political nature with its counterparts. The Ministry must approve the project	**Medium**: The Palestinian Authority is working to strengthen the energy sector institutional framework. There is currently no Ministry of Energy, but in any case, the Palestinian Executive will have to support the project of Operational Agreement
Most involved departments/divisions	At the MEMR the General Secretariat and the Directorate of Electricity	The First Undersecretary for International Cooperation of the Ministry is	The Minister's Advisors and the Study	The main energy sector government institutions in Palestine:

	Jordan	Egypt	Lebanon	Palestine
- Even if they are not the official interfaces to which the Project is sent	and Rural Electrification are in charge of International Interconnection Projects	responsible for cross-border cooperation and international agreements	Center of the Ministry LCEC (Lebanese Center for Energy Conservation) may be called upon to examine the project of Operational Agreement	PENRA and PERC. No more details are available
Level of Interest	**High**: Among the Strategic Objectives of MEMR is the Security of Electricity Supply and Interconnections play a very important role in achieving this goal for Jordan	**High**: The project of Operational Agreement is a high-level priority for the Ministry; the agreement is consistent with the national energy policy and strategic framework. It is a means to ensure capacity and energy security/sustainability for the country in the medium/long term	**Very High**: The Ministry of Energy has included in its Policy Statement 2022 with Action Plans the strengthening of electricity exchanges with Jordan as a high priority and an agreement has been signed recently between Lebanon and Jordan for additional supply in	**High**: The Palestinian government has a high interest in strengthening electricity exchanges between countries in the region. Palestine is almost totally dependent on imports through interconnections with Jordan and Israel. There is a political interest in diversify the supply sources.

	Jordan	Egypt	Lebanon	Palestine
			EDL's Grid. An Operational Agreement for the region is therefore of high interest	
TSOs / Vertically Integrated Utility				
Level of Influence	**High**: As responsible for the implementation of the Operational Agreement NEPCO has a high level of influence et will have to provide to the Ministry the necessary elements for approval	**High**: The EETC is crucial in contributing to the Operational Agreement by providing guidance on technical and also commercial content. The TSO has detailed knowledge of the operational level and related needs	**High**: EDL has a high level of influence on the Ministry in the process of elaboration of an Operational Agreement because the organization owns the necessary expertise	**High**: PETL as a single buyer and transmission system operator in Palestine will have to provide the Government with recommendations and technical advice for approval
Most involved departments/divisions - Even if they are not the official interfaces to which the Project is sent	The **Division of Planning** and the **Division of Operation** at NEPCO	The Planning Department and the Central Dispatcher, involved in long-term planning and short-term operational planning	A key department in the review of the Agreement will be the **High Voltage Transmission Networks**	

	Jordan	Egypt	Lebanon	Palestine
			Department of EDL	
Level of Interest	**High**: NEPCO considers strengthening electricity trade with countries in the region as a high-level priority	**High**: The EETC is the main negotiator of the Operational Agreement that is considered as a high priority. The Agreement promotes the achievement of strategic objectives such as continuity and diversity of supplies and can be an opportunity to develop more knowledge at the commercial level	**Very High**: To restore the normal functioning of the national electricity sector, Lebanon is focusing on strengthening imports from Egypt (Gaz) and Jordan (Electricity). EDL has a very high interest in the elaboration of an Operational Agreement for power exchanges in the region	**High**: PETL strategic objectives are in line with the Palestinian National Strategic Plan for the Energy Sector that aims to achieve as a priority the diversification in the provision of electricity. Therefore the Operational Agreement is of high interest
National Regulatory Authorities				
Level of Influence	**Medium/High**: The EMRC will provide recommendations to the Ministry for the possible approval of an	**Medium/High**: Currently the Regulatory Authority in Egypt has a focus rather on the National Electricity Market	**Low**: At the regulatory level, there is currently no Authority for the Electricity	**Medium/High**: Among the general objectives of PENRA is the coordination with the countries of

	Jordan	Egypt	Lebanon	Palestine
	Operational Agreement		Sector in Lebanon. Temporarily, the Ministry of Energy has performed some of its functions. However, the Electricity Sector Modernization Plan provides for the creation of the Authority ERA, which should be operational at the end of 2023	the region to ensure the security and cost-effectiveness of Palestine of electricity supplies. PENRA therefore has influence on the project of Operational Agreement
Most involved departments/divisions - Even if they are not the official interfaces to which the Project is sent	**Department of Energy Affairs** and **Directorate of Electricity and Renewables** at EMRC		**N/A**	
Level of Interest	**Medium/High**: The EMRC will have an interest in keeping the	**Medium**: The International Operational Agreement is not one of the main	**N/A**	**High**: The Operational Agreement project is of high interest to

	Jordan	Egypt	Lebanon	Palestine
	Operational Agreement consistent with the legislative framework of the Electricity Law in force in Jordan	responsibilities of the Regulatory Authority, which is most committed to the domestic market.		PENRA, as the organization is responsible for building the Palestinian electricity sector and promoting International Agreements that favor the diversification of electricity supply sources

Table 11 : Level of influence and interest of stakeholders

In Conclusion: for the Operational Agreement project promoted by Med-TSO in the region, it is recommended to include Syria as Stakeholder Interested in the Project, because the country plays an important role in strengthening regional energy exchanges.

4.4 Proposed Road Map Towards A Zonal Power Trading In South-East Mediterranean Countries And Gap Analysis

Med-TSO plays the role of promoter, facilitator and centre of exchange and cooperation among the TSOs of the Mediterranean region. In this sense he plays the role of adviser and incubator to support and contribute to the organization of sub-regional markets, through the expertise of its members. Leveraging this expertise also develop some critical analysis and/or activities in order to present and submit well-founded and argued proposals to the main stakeholders for their relevant decision-making.

4.4.1 Gap Analysis between current situation and the market model proposed

	Eastern Mediterranean Current situation	Market Model Proposed (WAPP)	GAP
Agreement of exchanges signed and third party access	-Existence of a signed agreement with a view to mutual assistance and improvement of the reliability of supply through the exchange of electricity. There isn't wheeling charge methodology but just a compensation of electrical losses. -There are no rules for third party access at the region level. Exchanges are between single buyers at the level of each country (TSO's)	Creation of the ECOWAS Regional Electricity Sector Regulatory Authority (ERERA) whose mission is to ensure the regulation of cross-border electricity exchanges between ECOWAS Member States. Signed Agreement and Governance by a General Assembly (GA) that comprises representatives from all member countries and is the highest decision-making authority within the WAPP. The Executive Board serves on a part-time basis and is primarily responsible for setting policy, and	Establishment of a governance entity between the four countries concerned and which falls within the scheme of the committees provided for in the PAEM project and that of the interconnection of the eight countries. So that in the long term, with the extension of transactions to other countries, this is part of the governance scheme will be consistent with the PAEM

	Eastern Mediterranean Current situation	Market Model Proposed (WAPP)	GAP
		overseeing the operations of the WAPP as well as the planning for its future development.	
Structure between TSOs, Market Operator and Market Participants	No Regional Market Operator/No Regional Control Center/TSOs have horizontal bilateral relations and communicate when they plan to exchange electricity	The role of Market and System Operator is assigned to the regional entity With the creation of an Electrical System operator as responsible for operating the Electrical System and Market Operator	Creation of a Commission of the Interconnections between the TSOs engaged in the region, for the coordination of exchanges, the development of technical rules of interconnections operations
Type of Local Markets	Single Buyer Model for Jordan and Egypt, but partially unbundled sector. Lebanon have Monopolistic Market In Palestine, there are several distribution companies and a Single Buyer	Electrical Markets and electricity sectors with different characteristics. Vertically Integrated Public Company and IPPs and several Public Utilities active in Distribution, Transmission and Production	Strengthen the role of the single buyer with regard to the organization of the market, the establishment of access rules, settlement of transactions, settlement of disputes, development of market segments In the first phase, identify and expand trade opportunities among the countries engaged in the region

	Eastern Mediterranean Current situation	Market Model Proposed (WAPP)	GAP
General Cross-border Arrangement	Comprehensive Agreement, afterwards, outline the terms and conditions for using the interconnection. The Agreements are established in bilateral and not globally and relate essentially to the management the bilateral exchange contracts	Market created by decision of the regional authority Heads of State as a specialized institution for the regional Power Sector. Regional Electricity Regulatory Authority created by Heads of state	Integrate the technical agreement for electricity exchange into an overall cooperation framework at the regional level, including third-party networks
Respective roles and responsibilities, and related operational agreements	There are three committees The Steering committee for coordinating design, planning, and operating activities. The Planning Committee to analyze the national plans to ensure coordination among the countries The Operating Committee is required to take all actions necessary to ensure delivery and payment for power in accordance with the interconnection agreement and any agreement between the countries	The Regional Electricity Regulatory Authority has the role to promote long-term cooperation in the Energy Sector and govern the regional electricity integration process. The regional System and Market Operator proposed is currently a specific Department of the General Secretariat the regional Authority in charge of Market development	Establishment of regional regulatory agency with the necessary autonomy as a driver for the integration of markets, with the establishment of rules and procedures for payment and dispute resolution

	Eastern Mediterranean Current situation	Market Model Proposed (WAPP)	GAP
Capacity Calculation Process	Very limited planning is done	Methodology will be developed by system and market operators for Transmission Total Transfer Capability Calculation: Criteria and process to evaluate , Transmission Reserve Margin and Net Transfer Capacity	Development of common methodology and procedures for defining the capacity allocation and transit cost via third-party networks
Trading Platform	No Regional Trading Platform	No specific Trading Platform. The TSO's and stakeholders working on the installation of SCADA/EMS/MMS and WAMS Systems, providing to the region the necessary tools and equipment to carry out the market operation	Establishment of an exchange platform at the level of each control centre for the planning and programming of exchanges
Characteristics of the Market Operator	No Regional Market Operator/No Regional Control Center / TSOs have horizontal bilateral relations and communicate when they plan to exchange electricity	One regional entity having been designated as the Regional System and Market Operator (SMO) The Market System Operator (OSM) is in charge of the regional market operating functions as well as other operational functions relating to the coordination of power flows and the distribution of transmission capacities as provided for by the Market Rules.	Establishment of a team dedicated to the coordination of exchanges at the level of each control centre in view of developing a market operator

	Eastern Mediterranean Current situation	Market Model Proposed (WAPP)	GAP
Membership of the Market	A comprehensive interconnection agreement signed by the parties	The regional entity in charge of the regional cooperation is an Organization with Membership open to any entity, public or private, which: (1) owns and operates generation facilities of 20 MW or more, and /or distributes and retails electricity and/or (2) owns/operates "major transmission facilities in the region", if such facilities are physically interconnected and have an impact on coordination of system operations in the region or (3) has an interest in the electricity sector in the region	Clear definition of the entities in charge of the organization of the market, the conditions of eligibility, access and membership of the market
Market Operations	Despite the interconnection agreement, trade among the countries has been modest. The Interconnections are used primarily for emergency exchanges	Electricity trading is currently on a bilateral basis. The existing trades on the interconnected system are on a "case-by-case" basis, through bilateral commercial contracts. Then subsequently, transactions are being developed including agreements with transit through third countries	Extension of commercial-type exchanges on the basis of bilateral and/or transit contracts

	Eastern Mediterranean Current situation	Market Model Proposed (WAPP)	GAP
Financial Settlement	Every year, TSOs review their Bilateral Agreements and Costs of Energy Exchanges. At the end of each month, TSOs review the programmed amounts of energy exchanged and settle the financial aspects, while for the non-programmed exchanges they can be compensated "in-cash" or "in-kind"	The regional entity in charge of energy exchanges carry out the following functions: Manage billing, settlement and payment processes, Administration of commercial databases, Settlement of imbalances. Following the Finance and Engineering & Operating Committee Market	Establishment of settlement and payment procedures for market transactions
Products (Type of exchanges, power, etc.)	The Comprehensive Agreement outlining terms and conditions, for the use of the regional interconnections, includes: 1) Reserve sharing during emergencies 2) Capacity transactions 3) Interchange of surplus power and energy 4) Regulation of energy flows and regulation of reactive power flows 5) Transmission services 6) Operating reserves.	Short, Medium or Long-Term Bilateral Commercial Contracts/Transactions for transiting through third-party countries/Day-Ahead Market to be introduced for short-term exchanges. transmission capacity is allotted on a first come first served basis. For the exchanges: Bilateral contracts between the operators of the control areas: is a direct agreement concluded between a Buyer and a Seller of electricity within the framework of the Regional Market	Development of bilateral contracts between the operators of the control areas via a direct agreement, including for transactions via a third-party network through the establishment of a transit contract

	Eastern Mediterranean Current situation	Market Model Proposed (WAPP)	GAP
Price Formation (Definition of Price)	No third-party access or published tariffs for using transmission. Independent Regulation remains an issue and retail tariffs remain heavily subsidized in most of the countries	The methodology is one that guarantees transmission operators a reasonable cost for the recovery of infrastructure development costs.	Methodology of transit cost to be established to guarantees transmission operators a reasonable cost for the recovery of infrastructure development and operation costs.

Table 12 : Gap Analysis between current situation and integrated market model

Starting from the current situation in terms of organization and typology of electricity exchanges between the electricity systems of the Eastern Mediterranean region and considering the projections made within the framework of the EIJLLPST and PAEM projects, in which Egypt, Jordan, Lebanon and Palestine are stakeholders, the analysis of the gaps shows that in order to strength exchanges and to improve use of interconnection capacities, minimum political, technical and economic requirements should be put in place by the countries concerned in order to establish effective multilateral power exchanges.

To do this, in order to ensure maximum success for the establishment of an electricity market and reduce the gaps with respect to an open and functional market, the countries concerned should consider the following steps:

- Obtain stronger support from policy makers regarding cross-jurisdictional aspects for system operations, long-term planning and governance
- Build trust and political consensus for cross-border power trade (coordinate, harmonize and institutionalize policy and regulatory frameworks).
- Agree on the appropriate market model for the South-eastern Mediterranean based on an assessment of the advantages and disadvantages in relation to participating countries.
- Establishment of a regional entity for the governance of the market integration project and regional regulatory agency as a driver for the integration of markets Extended bilateral contracts in the third countries and the

establishment of transit agreement for the extension of exchanges via third-party networks with common methodology and procedures for defining the transit cost via third-party networks

- Strengthen the role of the single buyer with regard to the organization of the market, the establishment of access rules, settlement of transactions, settlement of disputes, development of market segments
- Define technical standards such as harmonisation of grid codes, wheeling charge methodologies, interconnector capacity calculation methodology, third-party access, data and information sharing requirements.
- Outline rights and obligations of national utilities: rights to access regional transmission networks; obligations to operate in a secure and reliable manner; to grant grid access to approved producers and consumers; and to allow power transfer through national networks.
- Improve financial viability and governance in the power sector with continuing reforms and their effective implementation. Ensure appropriate co-ordination with relevant stakeholders
- Increase transparency by developing open access for supply, demand and transmission, and other relevant data. The scope, frequency and resolution of additional data shared with trading partners would be determined based on the agreed market model.

4.4.2 Road map towards a zonal power trading

The roadmap proposed for the establishment of a regional power exchange market identifies the structure and development activities as well as the main stakeholders involved in the development of a zonal pilot project for the integration of electricity markets (Ministries, TSOs, regulators, consumer and industry associations, PAEM, etc.). The final Roadmap is based on the tentative roadmap developed in Milestone 1, supplemented by the proposals resulting from the analysis of Milestone 2 and it is consistent with the projections of the PAEM project (Pan Arab Electricity Market). For both phases, stakeholder engagement is essential, and the success of the project will depend on establishing a continuous and quality dialogue with all stakeholders involved.

The actions of the roadmap to be carried out to implement the project and achieve the desired objectives are as follows:

STEPS	ACTIONS	HORIZON	Stakeholders Engaged
1. Launch of the market project process			
1.1	Creation of a governance structure for the implementation of the roadmap by all stakeholders who have the power and responsibility for its implementation, according to defined phases.	Short term	*TSOs/NRAs/Med-TSO/ MINISTRIES/PAEM*
1.2	Creation at the level of Med-TSO of the Project Management Unit at the level of the TC Regulation committee of Med-TSO, composed of high-level experts from the Directorates of management of electrical systems (Dispatching), regulation, electricity markets/ Planning.	Short term	*TSOs/Med-TSO/NRAs*
1.3	Analysis by the PMU of the current technical, institutional, regulatory and commercial framework in the region and its compatibility with the rules defined within the framework of the PAEM, in particular it will be a question of analyzing the exchange capacities and the possible revision of the procedures existing ones and their updating for harmonization if necessary.	Short term	*TSOs/Med-TSO/NRAs/PAEM*
1.4	Definition of the Governance Structure, the stakeholders directly involved on the basis of the analysis and results of Activity 3.2 TEASIMED Elaboration of zonal target regulatory framework in the Eastern Region. Especially with regard to : Minimum Requirements for the functioning of the regional market and Definition of Cooperation Principles and Operational Arrangements	Short term	*TSOs/Med-TSO//PAEM/NRAs*
	Definition by the Project Team of the processes and procedures of the exchange platform consolidating the	Short term	*TSOs/NRAs/ Med-TSO*

STEPS	ACTIONS	HORIZON	Stakeholders Engaged
1.5	relevant rules and organization in a Trading Agreement in accordance with the international best practice.		
2. Build trust and political consensus for cross-border electricity trade - Ensuring the development of commercial exchanges and Implementing the initial market design			
2.1	Promotion of continuous dialogue among the decision makers and stakeholders of member States in region by organizing focused regional meetings	Short term	Ministries/PAEM/NRAs
2.2	Design of the transitional market in the accordance of PAEM project as first stage to achieve some of the benefits of regional trade, while allowing time for Member States to determine their best course of action to participate in the Pan Arab Electricity Market.	Short term	TSOs/Med-TSO/NRAs/Ministries
2.3	Adopt a common methodology for the calculation of cross-border tariffs, congestion management and Transit Tariffs, Rules and procedures to facilitate and promote bilateral contracts and Mechanisms to allocate the cross-border transmission capacity	Short term	TSO's/Med-TSO/MEDREG /NRA's
2.4	Support for the acceleration of the reforms undertaken for the establishment of legislative and regulatory frameworks allowing the gradual establishment of national markets and their evolution towards an integrated regional market	Short term	TSO's/NRA's/Med-TSO /MEDREG
2.5	Structuring the cooperation of regulatory authorities or public authorities currently assuming this function in order to exchange experiences, harmonize regulatory procedures and develop common methodologies	Short term	MINISTRIES/NRAs/TSO's

STEPS	ACTIONS	HORIZON	Stakeholders Engaged
2.6	Define institutional arrangements including settlement and payment mechanism and dispute resolution.	Short term	NRA's/TSO's/Med-TSO/ MEDREG
2.7	Definition of TSOs roles and obligations for countries that support transit and Procedures for daily scheduling of bilateral and multilateral contracts,	Short term	TSO's/NRA's/Med-TSO /MEDREG
2.8	Reinforce the capacities of the interconnections between the countries of the South-Eastern Mediterranean for a better flexibility of the systems with regard to the development of renewables	Short term	TSO's/NRA's/Med-TSO /MEDREG
2.9	Formalize agreements on regular data sharing with utilities and other relevant stakeholders	Short term	TSO's/NRA's/Med-TSO /MEDREG
3. Expand Regional Market function and implement intergovernmental agreements on energy cooperation and interconnection			
3.1	Development and implementation of agreements or memorandums of understanding between the member states of the region to underline the political commitment of each country to promote energy cooperation and integration according to a specific time frame.	Short term	MINISTRIES/NRA's/TSOs
3.2	Develop and agree upon a grid master plan for the interconnection of the region's power grids and reference blueprint for interconnection among and within the region that will identify current and planned cross-border transmission and generation assets	Short term	TSO's/NRA's

STEPS	ACTIONS	HORIZON	Stakeholders Engaged
3.3	Improve financial viability and governance in the utilities by sustaining on-going reforms and formalising coordination with important stakeholders.	Short term	MINISTRIES/NRA's/TSO's
3.4	Provide enabling environments to increase trade frequency and integration by establishing regional co-operation among national regulatory authorities	Medium term	MINISTRIEs/NRA's/TSO's
3.5	Establishment of rules governing national markets taking into account the regional dimension and definition of the function and structure of the market operator	Medium term	MINISTRIES/NRA's/TSO's /Med-TSO
3.6	Establish regulations that guarantee third-party access to the network and common rules for the use of networks within an integrated regional market framework	Medium term	TSO's//NRA's/MEDREG /Med-TSO
4. Market Integration and open to other market services			
4.1	Reorganize the electricity sectors in the partner countries from a market perspective and **Unbundling** TSOs and introduce the wholesale market competition	Long term	MINISTRIES/NRA's/MEDREG/ Med-TSO/TSO's
4.2	Implementation of the Day Ahead Market with specific software, hardware and equipment (mainly metering).	Long term	MINISTRIES/NRA's/MEDREG/ Med-TSO/TSO's
4.3	Implementation of a Real Time Market for the full wholesale competition and full access to the networks with the possibility to implement an Ancillary Services market	Long term	Ministries/NRA's/MEDREG/ Med-TSO

STEPS	ACTIONS	HORIZON	Stakeholders Engaged
5. Reinforcement of the skills of the various operators within the market of partner countries			
5.1	**a) Strengthen Skills**		
	Encourage the development of "good practices" around the concept of market and regulation between partner countries	Short term	TSO's/NRA's/Med-TSO /MEDREG
	Strengthen the dialogue on the concept of the market between the heads of the sector of the countries concerned in order to increase their involvement in the process undertaken	Short term	TSO's/NRA's/MINISTRIES /Med-TSO
5.2	**b) Trainings**		
	Identify the training needs of government officials and implement training actions to support the market opening process	Short term	TSO's/NRA's/Med-TSO /MEDREG
	Training of stakeholders (Regulator, OM, OS, TSO, etc.) with a view to an integrated and functional regional market	Short term	TSO's/NRA's/Med-TSO /MEDREG
	Strengthen regulatory authorities through training and capacity building, increasing independence, and legislating reporting requirements that aid decision-making.	Short term	TSO's/NRA's/MEDREG

Table 13 - Road Map for the zonal market integration pilot project

4.4.3 Med-TSO proposal for the Eastern IEEZ

The proposal for the Eastern IEEZ is to adopt the same approach proposed for the Western Region, composed of 3 phases:

In Phase 1, the current bilateral agreements are improved with an enhanced process of pre-defined prices, which enables the TSOs to modify prices depending on the market and grid situation, and with some additional specific commercial aspects (see Report 3.1.C, Part 2 [1]). This proposal would be a light modification of existing commercial terms that cannot affect the technical operation of the current power flow systems and exchanges between the concerned TSOs.

In Phase 2, the principle of pre-defined price is opened more widely so that the TSOs participate in daily auctions. Each TSO builds a daily order book. The optimization of the order books in an auction, considering the cross-border constraints, allows to create implicit allocation of cross-border transmission rights and optimizes the exchange possibilities between the three countries. Although this phase could be developed directly from the current situation, the project partners deem it more appropriate to implement it after Phase 1. The objectives of applying a phased approach are to implement changes progressively and to build on the progresses piled up from the previous phase.

In Phase 3, the implicit cross-border auction market is opened to additional participants in at least one country. An independent market operator steps in to organize the market neutrally with standard procedures (see Report 3.1.C Part 2). The participation of other market participants is supposed to bring more competition and liquidity in the regional trade for the benefit of all grid users. This phase requires a range of changes in the regulatory framework of the involved countries.

Phase 3 opens the cross-border power market to other participants besides the TSO and is based on local regulatory changes and the implementation of standard procedures.

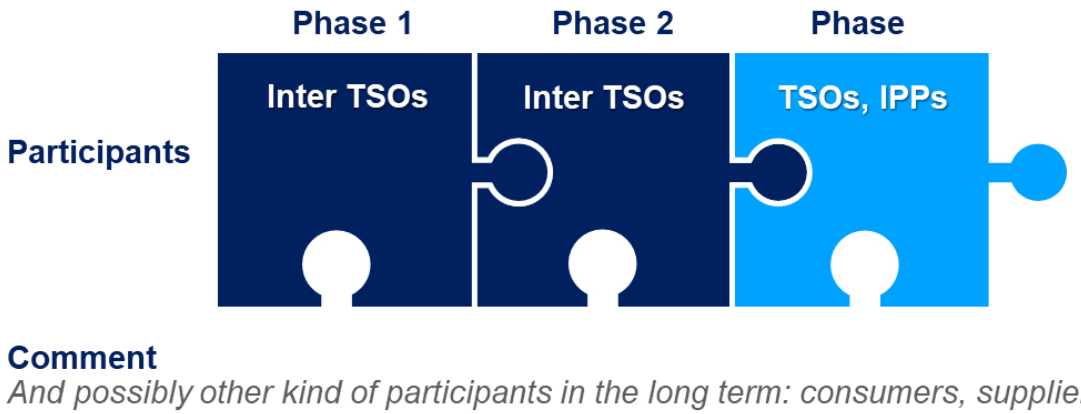


Figure 18 Market participants for each phase

Every proposal should be aligned with the development of the PAEM initiative. Med-TSO believe that a gradual approach as it is proposed, would be the best way to agree on the roadmap promoted by the governments of the area.

ANNEX 1

TECHNICAL CONTENT OF OPERATIONAL AGREEMENT FOR INTERCONNECTIONS OPERATION

Interconnection operating instructions drawn up jointly by the TSOs of the interconnected networks

1. Load-frequency-control

The need for continuous and instantaneous balancing of generation and demand, requires adjusting generation output to match demand in real time and balance control by using the two main functions:

- Frequency control, and
- Cross border exchange control.

2. Interchange scheduling and accounting between control areas

This Policy address the following issues:

- Determination of the maximum capacity on tie-lines between Control Areas;
- Scheduling and implementing interchange between Control Areas;
- Real-time monitoring of cross-border power flows between Control Areas, and
- Accounting for inadvertent deviations.
- Accounting for scheduled and involuntary exchanges and the corresponding hourly and seasonal levels

3. Operational security

The Control Area Operator is responsible for preparing and executing procedures for reliable operation in real time and for future conditions, under normal, contingency and emergency operations. To achieve this, close cooperation has to be developed particularly in the following areas:

- operational planning and in real time operation,
- general supervision of the power system,

- maintenance coordination,
- system protection co-ordination,
- power system stability,
- voltage and reactive power control,
- Exchange of information between the Control Area Operators.

4. Operational planning and system reliability

Power system reliability (generation and transmission facilities) can be defined by two functional attributes: adequacy and security.

Adequacy

The adequacy issues involve:

- Monitoring the existing and forecast system status, especially the adequacy between demand forecast, generation investment and transmission projects, while maintaining sufficient reserve margins;
- Identifying new system constraints, and new generation needs or transmission capacities.

Security

Security is a measure of the ability of a power system to withstand sudden disturbances such as electric short circuits or unforeseen loss of system components.

Every year, the TSO's of each interconnected power system shall establish a System Reliability Report, indicate the state of art of the operation of interconnection during the year and the major disturbances in each system that affecting the interconnections. Retrospective reports related to years Y-1 will be published in year Y.

Forecast reports published in year Y shall cover two levels of forecasts:

- Short term forecast: years Y+1,
- Medium term forecast: year Y+2 and Y+3

5. Operations under normal and abnormal conditions

5.1 Operation under normal conditions

Under normal conditions all limit values are adhered to e.g.

- Adherence to the maximum and minimum permissible voltages, maximum currents on the network equipment, and agreed system short-circuit levels on the individual network nodes.
- Operation of the network with a voltage profile which is as balanced as possible and generally high, and consequently results in reduction of transmission losses and improvement in system stability.

5.1.1 Operation of electrical systems

The interconnection structures are managed by the Electrical System Operators of each country (Dispatching).

Frequency and operating voltage: The frequency is normally set at its nominal value of 50 Hz with a tolerance of 0.2 Hz (plus or minus 0.2 Hz).

The voltage settings must be harmonized in the two networks in order to keep the exchange of reactive power at values as low as possible

5.1.2 Reserve Adjustment

- Three types of reserves - primary, secondary, tertiary - to reduce imbalances between electricity production and consumption.
- The primary and secondary reserves (known as “frequency system services”) are automatically activated to contain the frequency deviation, restore the frequency to 50 Hz and bring the energy exchanges at the borders back to their expected value
- **Primary control reserve**

In accordance with ENTSOE recommendations, Each partner must maintain a control reserve for primary control of at least 2.5% of the power developed in its network.

The primary reserve, automatically activated in a decentralized manner at the level of each production group, intervenes in 15 to 30 seconds.

- **Adjustment of Secondary adjustment**

The instantaneous spinning reserve is distributed by country in proportion to the maximum power required by each network and the size of the largest group in service of each network.

Secondary reserve, automatically activated, in approximately 400 – 500 seconds

The activation of the tertiary reserve is done manually by soliciting producers and/or consumers connected to the network.

Whenever a country is unable to develop its reserve quota, it must immediately notify its partners and request an import equivalent to its deficit so as to always respect its quota.

However, if necessary, each company can ask its partner to make a quantity of power available to it for a limited period.

5.1.3 Remote adjustment

The production groups of the interconnected network likely to be operated under remote control (AGC), must be part of the operating agreement and appear in the appendix to said agreement.

5.2 Operation under abnormal conditions

All conditions deviating from normal operation shall be deemed to be abnormal conditions. The system operator of the affected system shall be obliged and therefore authorized to take all necessary measures to prevent any disturbance from spreading, and/or to ensure efficient restoration of supply. These measures shall take priority over the individual interests of the system users.

5.3 Defence plan of interconnections

The operational procedures provided for in the defence plan applicable to the interconnections and implemented by the network managers, are intended to maintain the interconnections in operation up to the limit presenting a risk for the safety of one or the other interconnected systems through the establishment of a common and united defence plan. The adjustment stage of the interconnection opening protections is agreed between the network operators concerned and aimed at preserving the security of the interconnected assembly. In any case, the opening of the interconnection only takes place after agreement between the network managers who must inform the other controls centres.

For the network separation, three types of protection are installed on the interconnecting lines:

-1- Protections against synchronism failures.

-2- Unlooping protections based on power criteria (known as Watt metric protection).

-3- Unlooping protections based on frequency criteria

5.4 communication infrastructure

Each Power System and Control Area shall be equipped with adequate and reliable telecommunication facilities internally and with other Power Systems and Control Areas to ensure the exchange of information necessary to maintain the reliability of the Interconnected power system. Redundant facilities using alternate routes and medium shall be provided.

5.5 information exchange between systems

This Policy addresses the general rules for data handling and the rules that the interconnected Power Systems involved should follow for the provision and usage of these data by system operators and other interconnected Power Systems.

Each system operator, who provides information to another party or receives information that is commercially sensitive, has the right to request that such information be protected under an agreement of confidentiality. Such, agreements shall not conflict with this Policy.

5.6 Framework agreement for the exchange of electrical energy:

The contracts relate to:

- Preferential programmed type energy exchange;
- Back-up energy exchange between countries;
- The differences between the programmed energy and that actually transited;
- Energy compensation for discrepancies between the various partners concerned;
- Energy billing (Determination to be billed according to hourly increments
- Methods for metering transit between networks for the purposes of transit billing Energy metering and compensation for involuntary discrepancies.

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