



## THE MEDITERRANEAN GATEWAY TO THE ENERGY UNION



# THE MEDITERRANEAN GATEWAY TO THE ENERGY UNION

NOVEMBER 2017

### **AUTHORS**

Franco D'Amore

Stefano da Empoli

Gloria Marcotullio

### **THANKS TO**

Alessandra Bianchi for the editorial support

## TABLE OF CONTENTS

<b>1. INTRODUCTION</b>	<b>5</b>
1.1. An overview of the current energy situation	7
1.2. A look to the future	11
<b>2. MEDITERRANEAN ELECTRICITY SECTOR</b>	<b>15</b>
2.1. Main electricity indicators	17
2.2. Mediterranean electricity grid	20
<b>3. MEDITERRANEAN GAS SECTOR</b>	<b>25</b>
3.1. Exchanges between Mediterranean countries	27
3.2. Mediterranean gas infrastructures	29
3.3. Mediterranean new gas projects	32
3.4. Natural Gas Potential	37
<b>CONCLUSIONS</b>	<b>41</b>





PART



**INTRODUCTION**



## 1. INTRODUCTION

### 1.1. AN OVERVIEW OF THE CURRENT ENERGY SITUATION

The Mediterranean region offers a great diversity of population, languages and cultures and is the intersecting

point of three continents – Europe, Asia and Africa. In 2015, the 21 Mediterranean countries<sup>1</sup> considered accounted for 7% of the world population and 12% of global GDP (Fig. 1.1 and Tab. 1.1).

From the energy point of view, the region was third, after China and the USA regarding total primary energy consumption and CO<sub>2</sub> emissions.

Fig. 1.1 Mediterranean countries



<sup>1</sup> Albania, Algeria, Bosnia and Herzegovina, Cyprus, Croatia, Egypt, France, Greece, Italy, Israel, Jordan, Lebanon, Libya, Malta, Montenegro, Morocco, Slovenia, Spain, Syria, Tunisia, Turkey.

**Tab. 1.1** Global parallel – 2015

Source: I-Com elaboration on IEA data (2017)

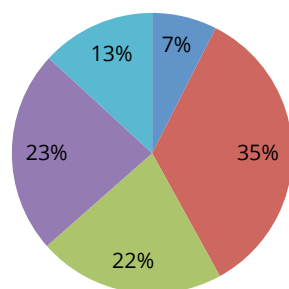
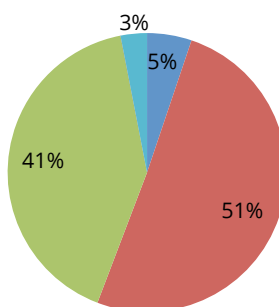
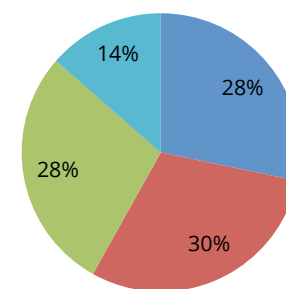
	Mediterranean countries	USA	China	Russia	Japan
<b>Population (millions)</b>	500 (6.82% of World population)	322 (4.39% of World population)	1,371 (18.70% of World population)	144 (1.96% of World population)	127 (1.76% of World population)
<b>GDP (billion 2010 USD)</b>	8560 (11.60% of World GDP)	16,597 (22% of World GDP)	8,910 (11.80% of World GDP)	1,724 (2.28% of World GDP)	5,986 (7.93% of World GDP)
<b>TPES (Mtoe)</b>	929 (6.81% of World TPES)	2,188 (16.03% of World TPES)	2,973 (21.79% of World TPES)	710 (5.20% of World TPES)	430 (3.15% of World TPES)
<b>CO2 emissions (Mt CO2)</b>	1,904 (5.90% of World emissions)	4,997 (15.47% of World emissions)	9,041 (27.99% of World emissions)	1,469 (4.55% of World emissions)	1,142 (3.53% of World emissions)

Energy supply in the Mediterranean was still dominated by combustible fuels, which accounted for 698,840 ktoe in 2015. Considering the whole region, oil was the leading fuel consumed (38%), followed by gas (27%), nuclear

and coal (14% and 10%). The EU-Med energy supply was the most variegated thanks to the contribution of nuclear (23%) and RES (13%), while the Balkans and Turkey were almost equally divided between oil (30%),

**Fig. 1.2** Total primary energy supply – 2015

Source: I-Com elaboration on IEA data (2017)

**EU-Med (TPES = 558,839 ktoe)****MENA (TPES = 230,192 ktoe)****Balkans&Turkey (TPES = 140,038 ktoe)**

■ RES

■ Natural gas

■ Coal

■ Oil

■ Nuclear

coal and gas (both at 28%). In the MENA countries, oil accounted for 51% of energy supply (Fig. 1.2).

The energy dependence on net imports is shown in Fig. 1.3. The EU-Med countries and the Balkans and Turkey registered a high dependence on energy imports (62% and 74%, respectively) compared to the Mena Region that, as a whole, is a net exporting area. This is due to the contribution of just two net exporting countries (Algeria and Libya).

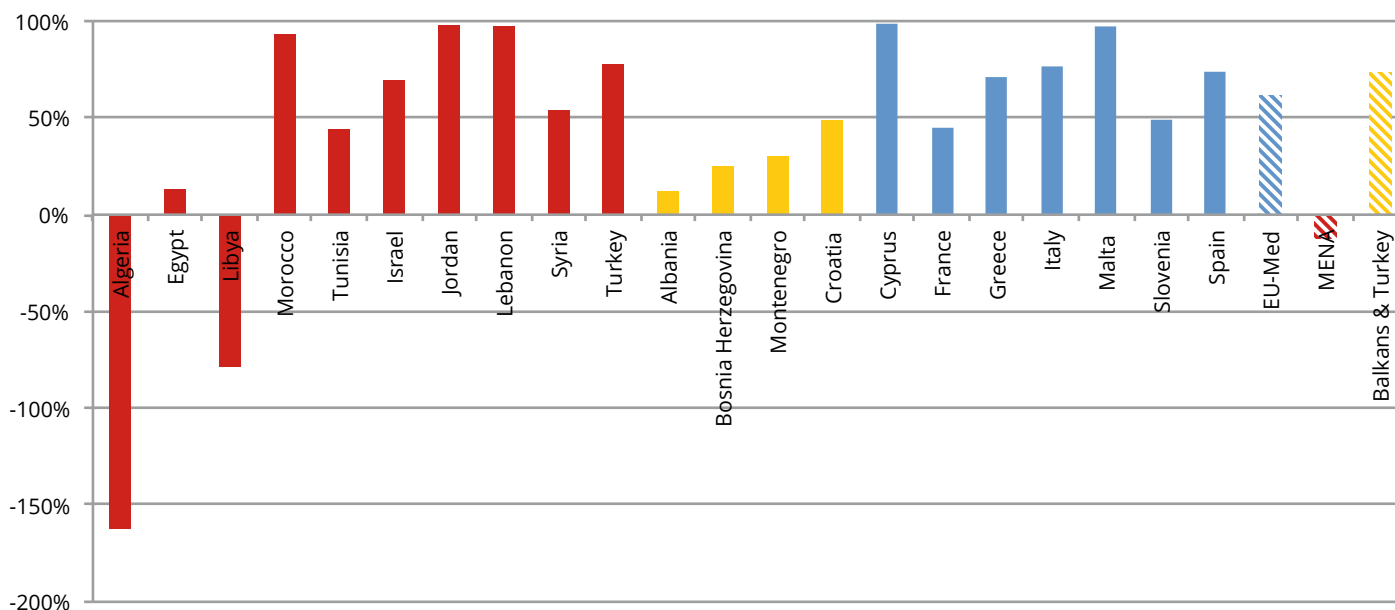
The contribution of renewables to the total primary energy supply (TPES) in the region in 2015 was 10.7%. There are clear differences between the different areas. The EU-Med percentage showed a constant increase,

from 6.4% in 2000 to 13.5% in 2015. The percentage of the Balkans and Turkey remained steady in the considered period while the figures for the considered MENA countries show a decrease, from 4.2% in 2000 to 3% in 2015 (Fig. 1.4).

The 2015 energy intensity of the economy in the region was 0.11 toe/thousand dollars 2010. The EU-Med countries resulted as being the best performers accounting for 0.08 toe/thousand dollars 2010, followed by the Balkans and Turkey with 0.12 and the MENA countries with 0.23 toe/thousand dollars 2010 (Fig. 1.5). In 2015, per capita CO2 emissions in the

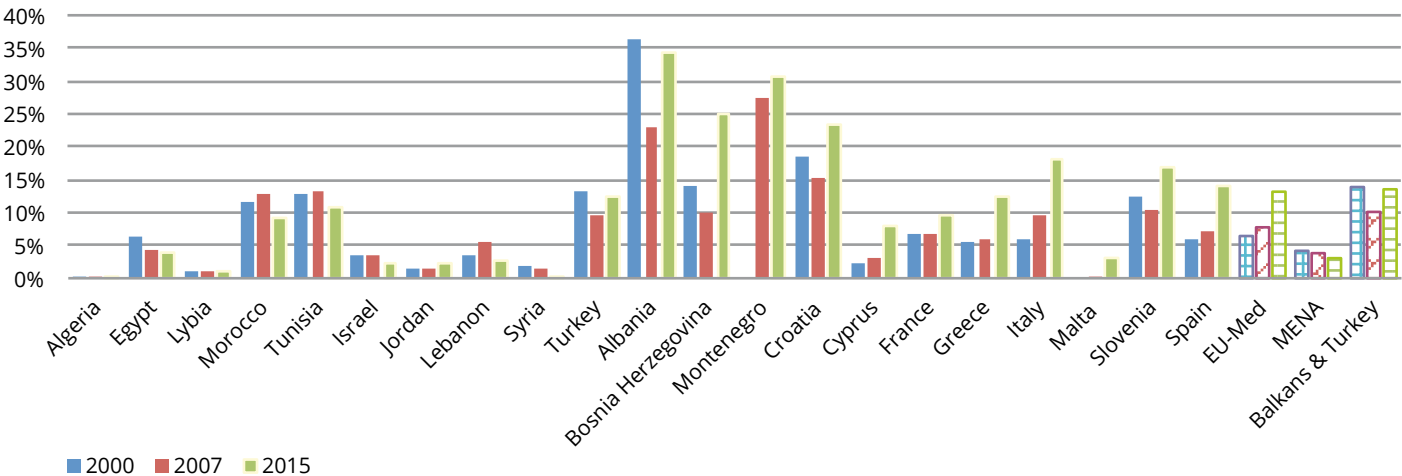
**Fig. 1.3** Net imports/total primary energy supply – 2015

Source: I-Com elaboration on IEA data (2017)



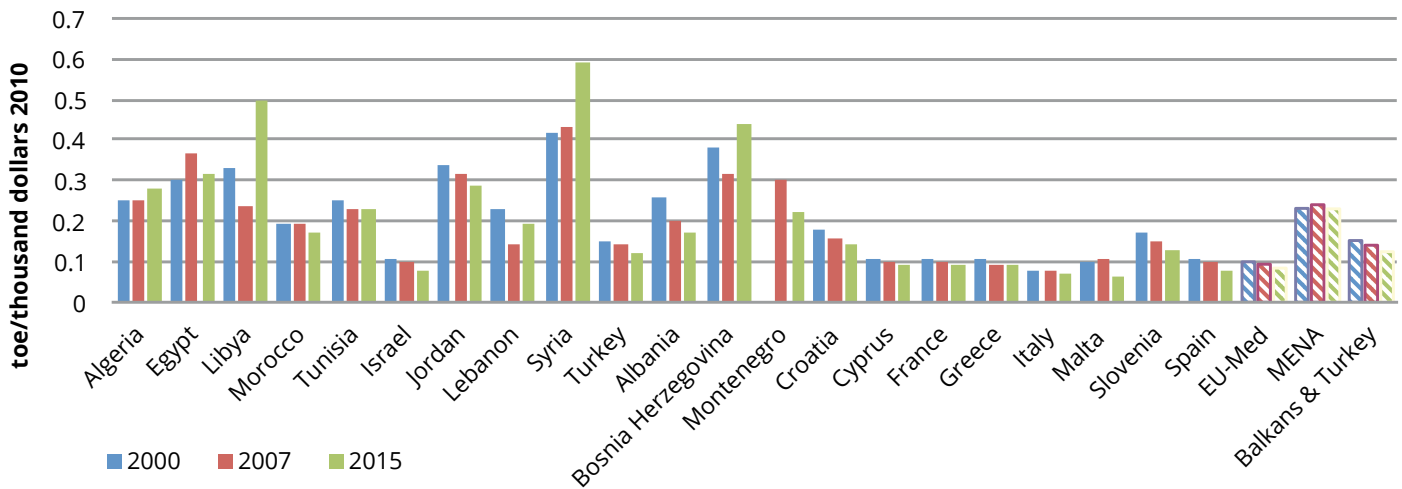
**Fig. 1.4** Total renewable energy supply/Total primary energy supply

Source: I-Com elaboration on IEA data (2017)



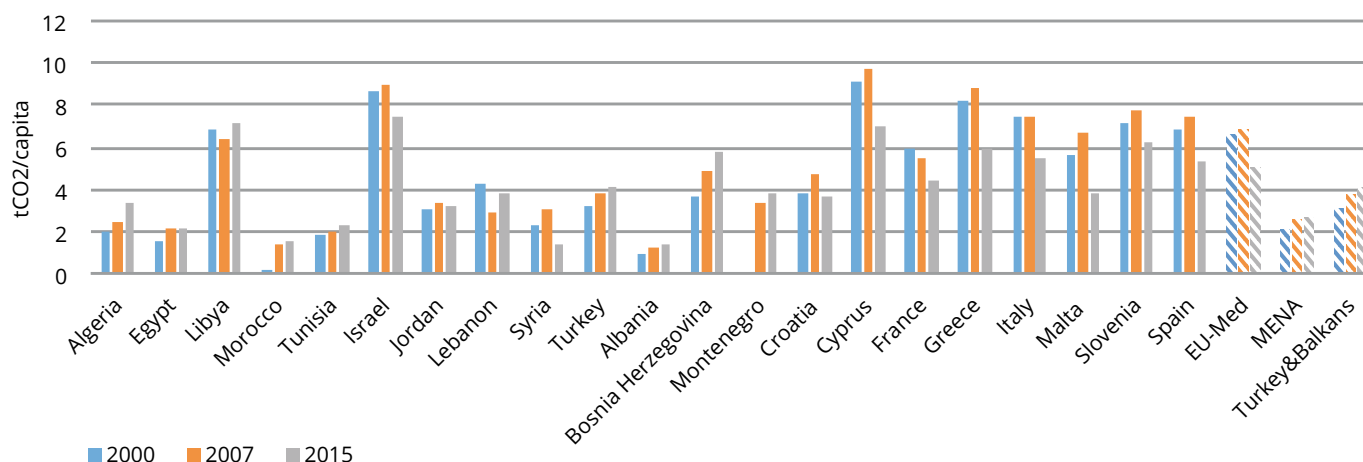
**Fig. 1.5** Total primary energy supply/gross domestic production (toe/thousand dollars 2010)

Source: I-Com elaboration on IEA data (2017)



**Fig. 1.6** CO2 emissions/population

Source: I-Com elaboration on IEA data (2017)



region were 3.81 tCO<sub>2</sub>/capita. The EU-Med countries were almost double compared to the MENA countries (5.05 tCO<sub>2</sub>/capita vs 2.63 tCO<sub>2</sub>/capita), with an opposite trend (decreasing over time for the EU and increasing for MENA). The Balkans and Turkey showed an average increase from 3.73 tCO<sub>2</sub>/capita to 4.07 tCO<sub>2</sub>/capita (Fig. 1.6).

## 1.2. A LOOK TO THE FUTURE

The Paris Agreement entered into force in November 2016 with the purpose to limit global warming to well below 2°C and, if possible, 1.5°C. In order to achieve

the long-term goal, all countries are required to present and periodically update their best effort in National Determined Contributions (NDCs).

Almost all Mediterranean countries have committed to modifying their energy consumption. (Tab. 1.2).

Based on these targets, OME, MEDREG and ADEME have drawn up a comprehensive energy scenario for the Mediterranean (NDC scenario). Led by the growth of Southern Mediterranean countries, the primary energy demand in the “current scenario” will be 45% over the 2015 value. According to the “NDC scenario”, in 2030, the Southern Mediterranean countries will account for 53% of primary energy demand, roughly 19% less than the 2030 current scenario (Fig. 1.7).

**Tab. 1.2** Mediterranean commitment

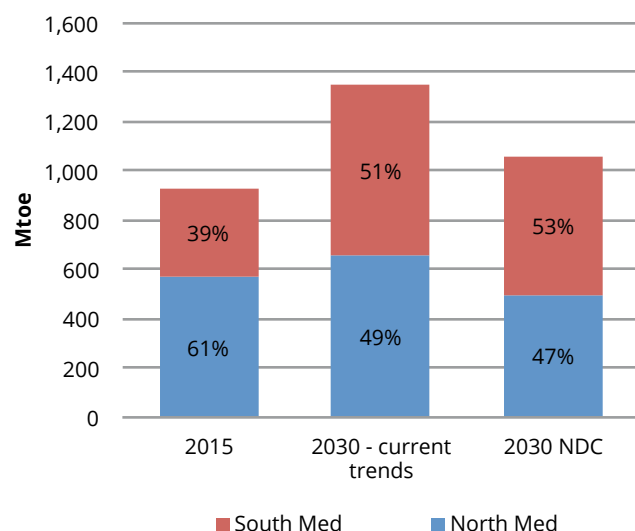
Source: OME (2016)

	Energy efficiency	RES	CO2 Mitigation
<b>Algeria</b>	-9% of energy consumption	27% of electricity generation	From -7% to -22%*
<b>Israel</b>	-17% of electricity generation (vs BAU)	17% electricity generation	-23% compared to BAU
<b>Jordan</b>		11% of the energy mix (2025)	From -1.5% to -14%*
<b>Lebanon</b>	-3% in electricity demand vs BAU	15% of electricity and heat (up to 20%)	From -15% to -30% compared to BAU
<b>Morocco</b>	-15% of energy consumption	52% of electricity capacity	From -13% -34% compared to BAU
<b>Tunisia</b>	-30% of energy demand vs 2010	30% of electricity generation	From -9% to -38% compared to BAU
<b>Turkey</b>		36 GW	-21% compared to BAU
<b>EU (Cyprus, France, Greece, Italy, Malta, Portugal, Slovenia, Spain)</b>	-27% of energy demand in 2030	27% RES in 2030	-40% compared to 1990

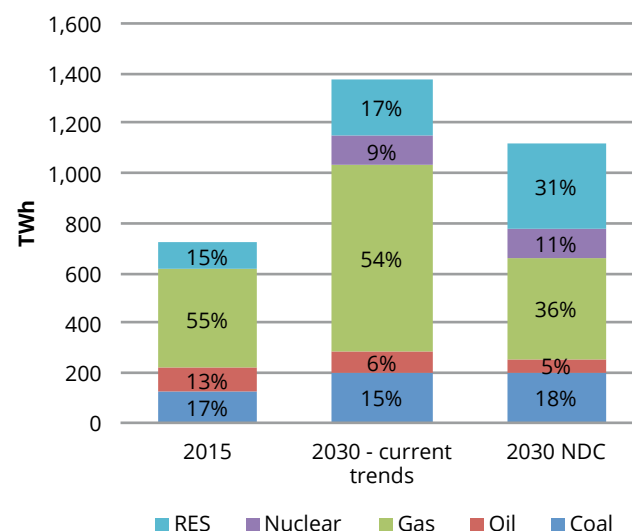
\*based on international financing availability

**Fig. 1.7** Mediterranean primary energy demand

Source: I-Com elaboration on OME data (2016)

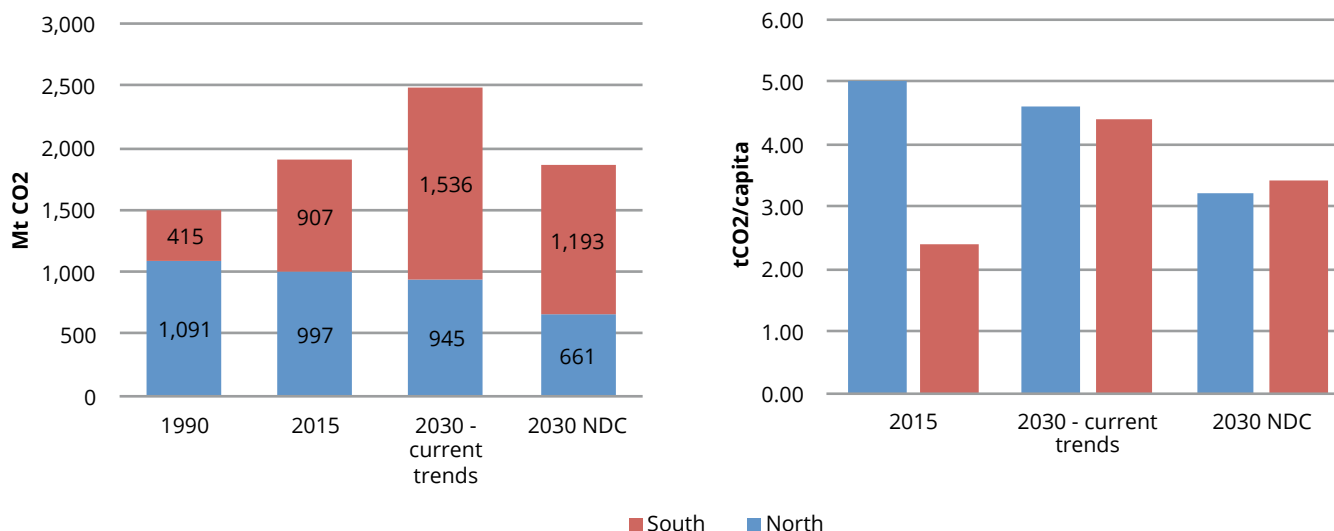

**Fig. 1.8** South Mediterranean power generation

Source: I-Com elaboration on OME and IEA data (2016)



**Fig. 1.9** Mediterranean CO<sub>2</sub> emissions and emissions per capita

Source: I-Com elaboration on OME (2016), UN (2014) data



According to estimates, in the “NDC scenario” the electricity demand of Southern Mediterranean countries (MENA + Turkey) will be roughly 20% lower than the “current scenario” and the share of renewables will be higher, 31% in the “NDC scenario” and 17% in the “current scenario” (Fig. 1.8).

CO<sub>2</sub> emissions should be countered with a decrease of

40% (compared to 1990 levels) in the Northern countries and a 22% reduction from the “current trend” for the Southern countries in 2030. The spread of renewables and the energy efficiency savings in the Northern Mediterranean (EU + Balkans) will reduce the CO<sub>2</sub> emissions per capita in all scenarios (Fig. 1.9).



A large, stylized orange number '2' is centered on the page. The left side of the '2' is a solid orange block containing the word 'PART'. The right side of the '2' is a white block containing the text 'MEDITERRANEAN ELECTRICITY SECTOR'.

PART

**MEDITERRANEAN  
ELECTRICITY SECTOR**



## 2. MEDITERRANEAN ELECTRICITY SECTOR

### 2.1. MAIN ELECTRICITY INDICATORS

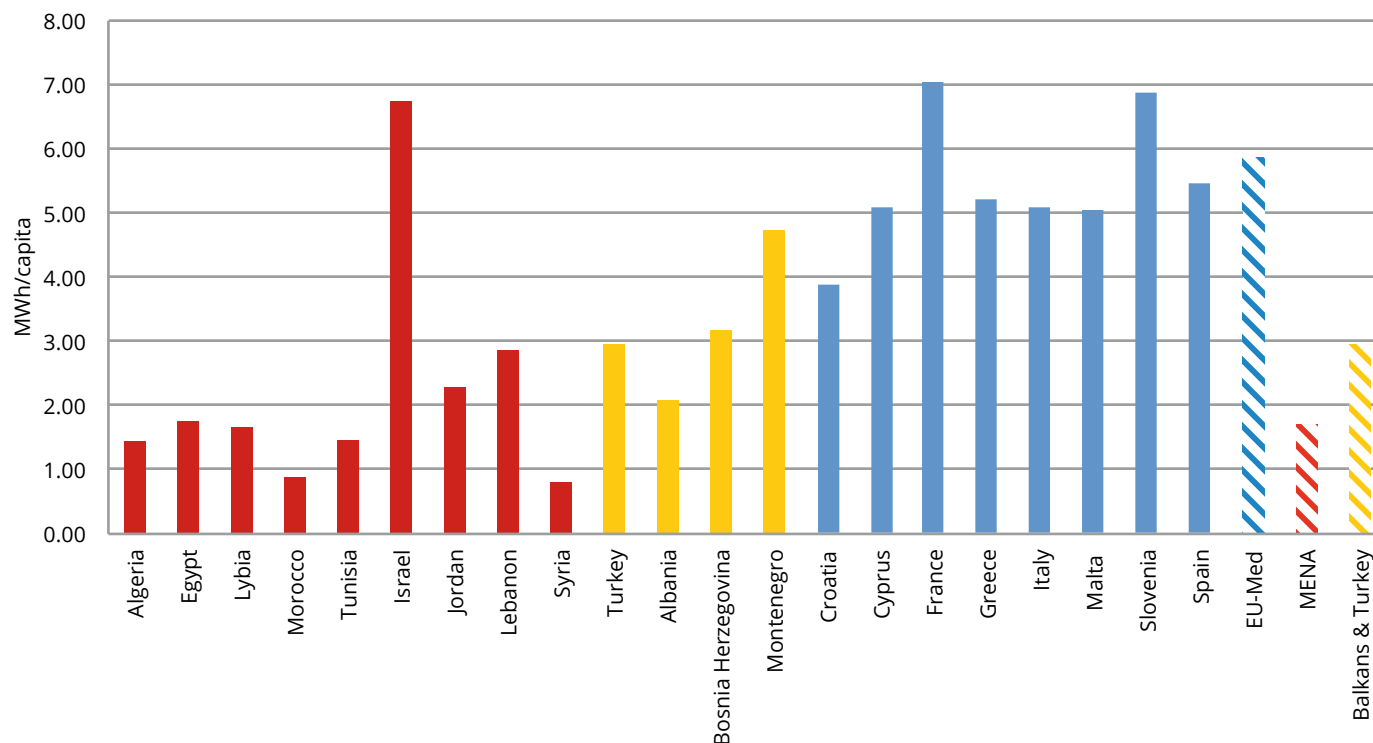
The average per capita final electricity consumption differs remarkably among countries in the Region (Fig. 2.1). In 2016, the EU-Med countries accounted for the

highest level (5.86 MWh/capita), followed by the Balkans and Turkey (2.95 MWh/capita) and MENA countries (1.71 MWh/capita).

Looking at the Mediterranean power generation capacity mix (Fig. 2.2), combustible fuels emerge as the most common source with 313,837 MW (43% in EU28 countries, 59% in Balkan countries and 92% in MENA countries). Nuclear power plants were only present in the EU28 (France, Slovenia and Spain) accounting

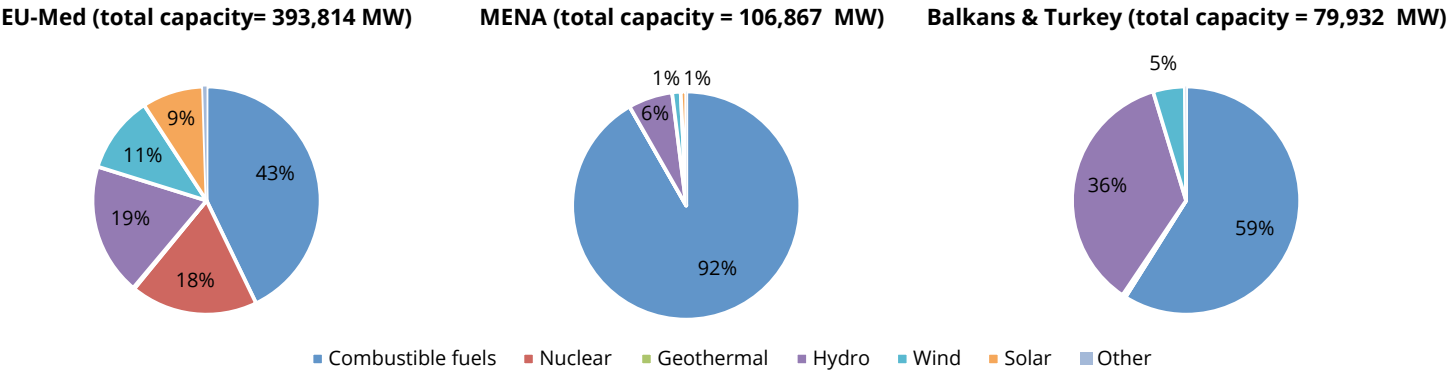
**Fig. 2.1** Electricity consumption/population – 2015

Source: I-Com elaboration on IEA data



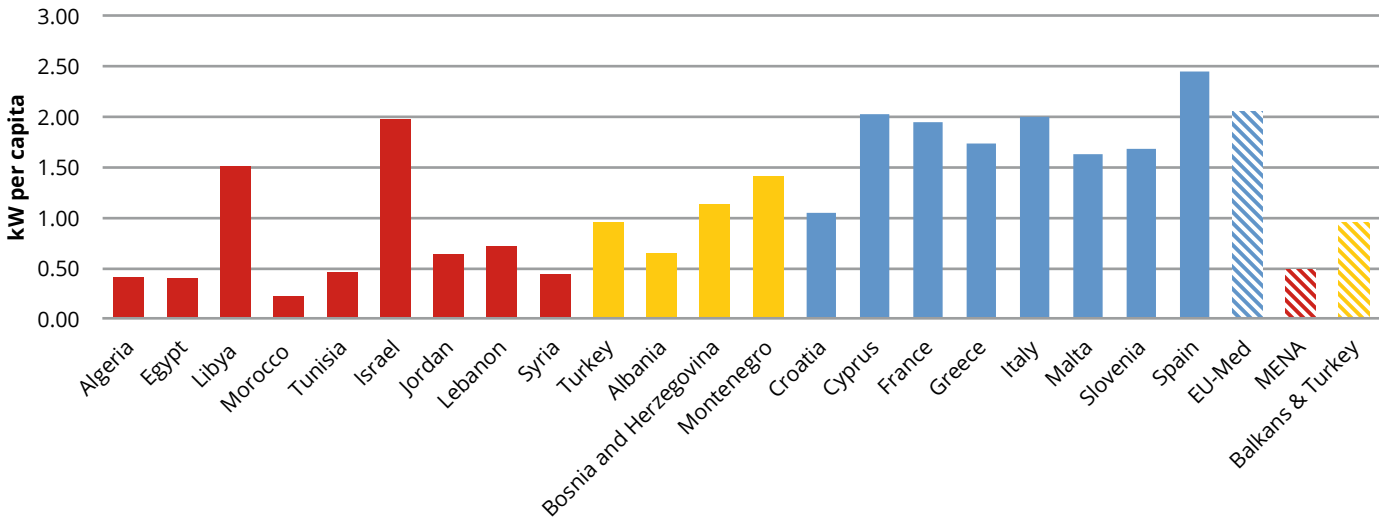
**Fig. 2.2** Installed electric capacity – 2014

Source: I-Com elaboration on UN data



**Fig. 2.3** Installed capacity per capita – 2014

Source: I-Com elaboration on UN data



for 71,217 MW. Among renewables, hydroelectric was the most widespread and reached 109,024 MW in the Mediterranean area.

Figure 2.3 shows the Mediterranean installed electricity capacity per capita. In accordance with per-capita electricity consumption data, there is an uneven distribution among the different regions. On the one hand, the MENA countries had an average of 0.48 kW/capita, on the other, EU28 had 2.05 kW/capita, while the Balkans 0.95 kW/capita.

In 2015, the total electricity produced in the region was 1,962 TWh (Fig. 2.4). Gas was the first energy source for electricity generation in MENA and in the Balkans and Turkey block (respectively, 64% and 35%), while in

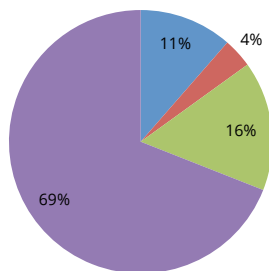
the EU-Med, electricity generation was led by nuclear and RES generation. Oil still had a non-negligible electricity production share in Mena countries, while coal contributed markedly in the Balkans and Turkey (30% production share) that is three times more than the rest of the Region.

Electricity prices for domestic consumers show higher levels in EU countries. Among the countries considered, in 2016, Italy registered the highest prices, followed by Spain and, much further behind, Jordan (especially for higher consumption classes) and Turkey. Depending on monthly consumption rates, electricity prices in MEA countries can be very low.

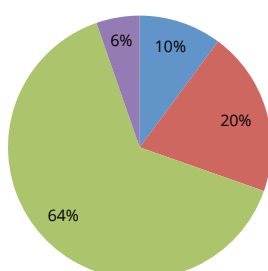
**Fig. 2.4** Electricity production – 2015

Source: I-Com elaboration on IEA data

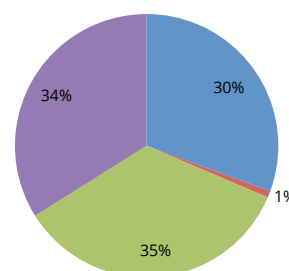
**EU-Med (total production = 1,217 TWh)**



**MENA (total production = 459 TWh)**



**Balkans & Turkey (total production = 286 TWh)**



■ Coal

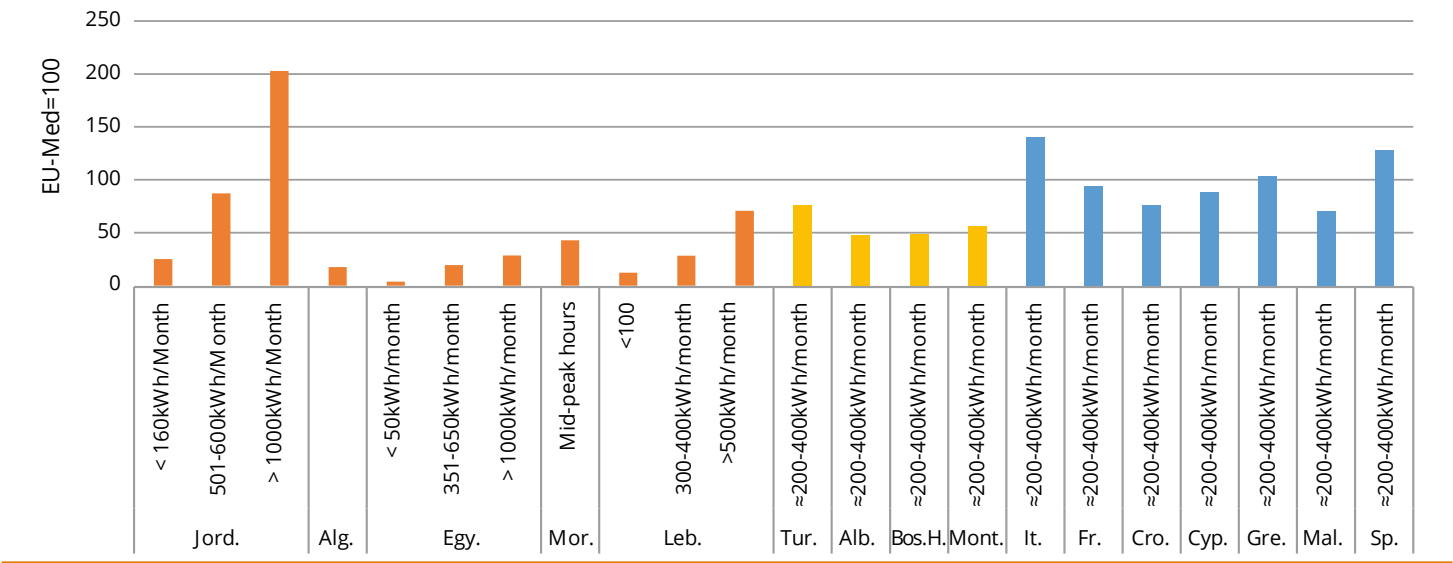
■ Oil

■ Gas

■ Other (Nuclear+RES)

**Fig. 2.5** Mediterranean electricity prices – 2016

Source: I-Com elaboration on different national data



## 2.2. MEDITERRANEAN ELECTRICITY GRID

A well-functioning and modern infrastructure is essential for economic development. Investments in infrastructures are important for both the most advanced economies and those at the early stages of development. On the one hand, in developing economies, infrastructures (e.g. roads and electricity grids) can have a huge impact on citizens' lives and businesses. On the other hand, in more mature economies, new and upgraded infrastructures can boost economic growth.

Electricity infrastructure, accounting for roughly \$819 billion worldwide in 2015, is the leading sector in infrastructure

investments (36%), followed by investment in road transportation (29%) and telecommunications (13%).

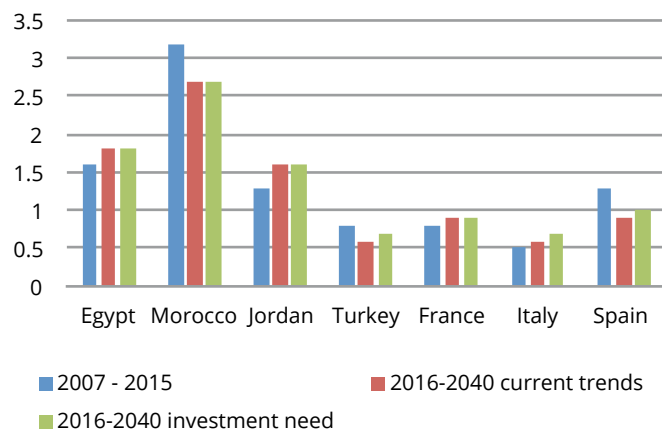
Data and projections on electricity infrastructure investments (as a percentage of GDP) in some countries of the Mediterranean area are shown in Fig. 2.6, where a business-as-usual and best case scenario (investment need<sup>2</sup>) is presented.

Given the importance of infrastructures in the energy sector, the European Commission has set a target of 10% electricity interconnection by 2020, in order to improve cross-border interconnection and foster market integration.

<sup>2</sup> Based on the investment that would occur if countries were to match the performance of their best peers.

**Fig. 2.6** Electricity infrastructure investments (as a percentage of GDP)

Source: I-Com elaboration on Global Infrastructures Outlook (2017) data



In the current situation (with EU overcapacity generation and strong demand growth in the south), interconnections may be a valid substitute for (or, at least, complement) investment in additional generation capacity<sup>3</sup>.

There are a few bilateral and sub-regional initiatives in place to interconnect electricity networks of Mediterranean countries, aiming at integrating electricity systems for electricity exchange and trade (Fig.2.7).

Including Algeria, Morocco and Tunisia, the Maghreb block was set up in the 1950s. It evolved into multiple high voltage transmission interconnections between these countries. In the 1990s, Morocco was connected to Spain, and the Maghreb regions are now synchronized with the European high-voltage transmission network.

**Fig. 2.7** Existing electricity interconnections

Source: Entso-E (2017)

#### Mediterranean existing interconnections

Algeria, Morocco, Tunisia

Spain-Morocco

Egypt, Iraq, Jordan, Lebanon, Libya, Palestine, Syria and Turkey

Turkey-Bulgaria

Turkey-Greece



3 Poudineh, R., Rubino, A. - *Business model for cross-border interconnections in the Mediterranean basin* (2016).

In 1998, Egypt, Iraq, Jordan, Syria and Turkey set up the eight-country block<sup>4</sup>, aiming at upgrading their electricity systems to a regional standard. Later Lebanon, Libya and Palestine joined the group.

The interconnections linking the Mediterranean shores are: Spain-Morocco line, a limited interconnection between Turkey and Bulgaria, as well as Turkey and Greece.

According to MedReg, although these interconnections in the Mediterranean area have existed for a long time, the electricity trade among these countries is extremely low, especially considering the resource availability and their

geographical proximity. North-South interconnection involves only the Spain-Morocco interconnection, which is the most used line in the region (in terms of energy exchanges). The main barriers are the limited generation reserve margins and the absence of a single regulatory framework at national and regional levels.

In order to create an integrated energy market, the EU defined (and periodically updates) the Trans European Network Strategy<sup>5</sup>. The EU defined nine priority corridors and three priority thematic areas<sup>6</sup>. In this strategy, there is also proposed the regime of “common

**Fig. 2.8** Planned North Mediterranean electricity interconnections

Source: EU Commission (2017)



<sup>4</sup> Which includes: Egypt, Iraq, Jordan, Lebanon, Libya, Palestine, Syria and Turkey.

<sup>5</sup> Regulation 347/2013.

<sup>6</sup> The strategy covers electricity, gas, oil, carbon dioxide transport networks. For more information: <https://ec.europa.eu/energy/en/topics/infrastructure/trans-european-networks-energy>

interest” for projects contributing to implementing the identified priorities. To become a Project of Common Interest (PCI), a project must have a significant impact on energy markets and market integration in at least two EU countries, boost competition on energy markets and help the EU’s energy security by diversifying sources, and contribute to the EU’s climate and energy goals by integrating renewables.

PCIs may benefit from faster and more efficient planning and allow for improved regulatory conditions and lower administrative costs due to streamlined environmental assessment processes. They also have the right to apply for funding from the Connecting Europe Facility (CEF), which has allocated a total of €5.35 billion in funding to trans-European energy between 2014 and 2020.

Among the above-mentioned PCIs, which was updated in 2015, some projects concern the interconnections in the Mediterranean area (Fig. 2.8 and Tab. 2.1), such as:

- France-Italy interconnection between Grande Ile and Piosasco, which is under construction and will be operating in 2019;
- France-Spain interconnection between Aquitaine and Basque country, which is now in the feasibility study phase;
- Portugal-Spain interconnection between Vila Fria – Vila do Conde – Recarei and Bearitz Fontefria, which is now in the permitting phase;
- Israel-Cyprus-Greece interconnection between Hadera and the Attica region (Euro-Asia interconnector), which is currently planned, but not yet in the permitting stage;

- Italia-Montenegro interconnection between Villanova and Lastva, which is under construction and the commissioning date is scheduled for 2019;
- Italia-Slovenia interconnection between Salgareda and Divaca-Bericevo, which is under construction, but the commissioning data is still unknown.

There are also projects for reinforcing countries’ internal lines in order to increase the transmission capacity within the Mediterranean (e.g. in Croatia, France, Portugal, Slovenia and Spain).

Furthermore, other projects are relevant to the Mediterranean area, but are currently not on the PCI list – interconnection between Sardinia-Corsica and Italy (SACOI 3) and the interconnection between Italia-Tunisia, which are in the preliminary planning phase.

**Tab. 2.1** Mediterranean Electricity Projects (North and Balkans)

Source: EU Commission ([http://ec.europa.eu/energy/infrastructure/transparency\\_platform/map-viewer/main.html](http://ec.europa.eu/energy/infrastructure/transparency_platform/map-viewer/main.html)), Terna

From	To	Status	Commissioning data
France	Italy	under construction	2019
France	Spain	feasibility study	2025
Portugal	Spain	permitting phase	2018
Israel	Cyprus-Greece	planned	2019-2022
Italy	Montenegro	Under construction	2019
Italy	Slovenia	under construction	unknown
Sardinia*	Corsica	preliminary planning phase	
Italy*	Tunisia	preliminary planning phase	

\*projects out of the PCIs list

As stated by MedReg in 2015, regarding interconnection in the South Mediterranean, only the planned interconnection between Egypt and Saudi Arabia is in

an advanced status of planning (permitting phase), the rest of the projects are at preliminary stages, such as feasibility or earlier phases (Tab. 2.2).

**Tab. 2.2** South Mediterranean electricity interconnection projects

Source: MedReg (2015)

From	To	Status project	Voltage level	Nominal line capacity
Algeria	Morocco		400 kV	1200 MW
	Tunisia		400 kV	1200 MW
Egypt	Sudan	Feasibility phase	600 kV (DC)	2000 MW
	Saudi Arabia	Permitting phase	500 kV (DC)	3000 MW
	Libya	Feasibility phase	500/400 kV	500 MW
	Palestine	Feasibility phase	220 kV	150 MVA
Jordan	Palestine	Feasibility phase	400 kV	1000 MVA
	Saudi Arabia		400 kV	500 MVA
	Egypt		400 kV	1200 MVA
Libya	Egypt	Feasibility phase	400 kV (Libyan side)	500 MW
	Egypt	Feasibility phase	500 kV (Egyptian side)	
	Tunisia		400 kV	500 MW
Morocco	Algeria		400 kV	500 MW
	Spain			50 MVA
Palestine	Jordan	Feasibility phase	400 kV	150 MVA
	Egypt	Feasibility phase	220 kV	150 MVA
Tunisia	Libya			500 MW

PART

3

**MEDITERRANEAN  
GAS SECTOR**



## 3. MEDITERRANEAN GAS SECTOR

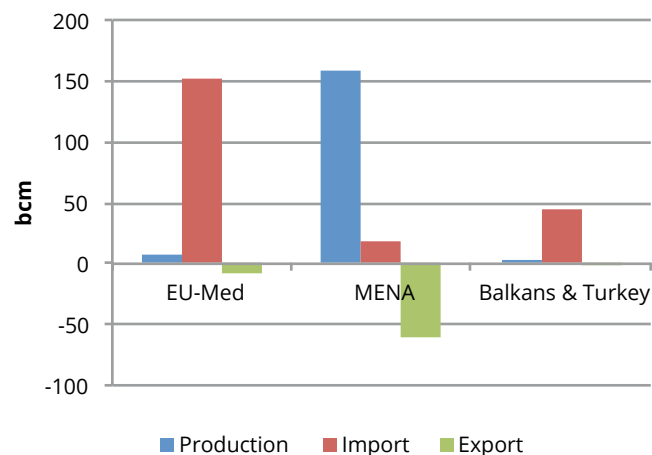
### 3.1. EXCHANGES BETWEEN MEDITERRANEAN COUNTRIES

In 2016, the Mediterranean natural gas production accounted for 166 bcm. As expected MENA countries were the main producers and exporters, producing 158 bcm and exporting 60 bcm in 2016 (Fig. 3.1). The EU 28 countries considered were the main importers (roughly 153 bcm), producing only 7 bcm, while the Balkans imported 46 bcm.

In 2016, the average per capita of gas consumption in the Mediterranean region was 626 mc/capita. Clearly, this value differs among the area considered. It was 792

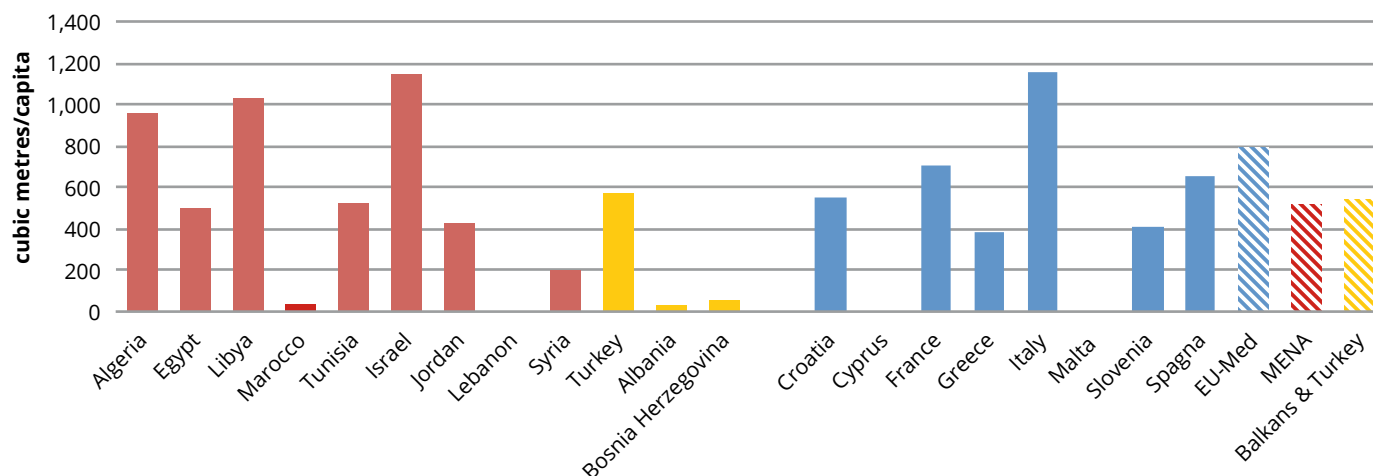
**Fig. 3.1** Gas production: import, export – 2016

Source: I-Com elaboration on ENI data (2107)



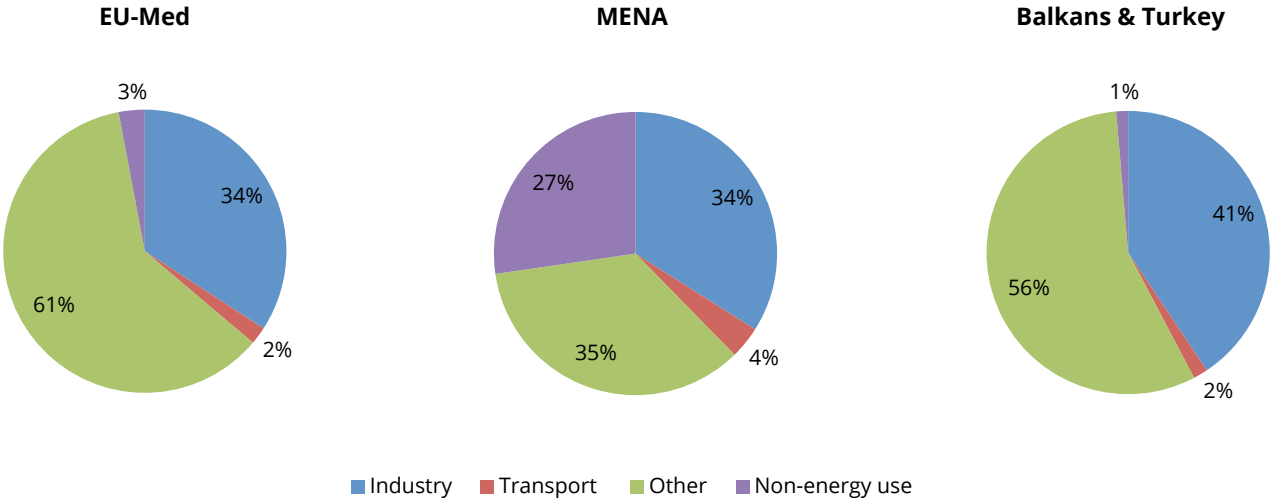
**Fig. 3.2** Gas consumption/population – 2016

Source: I-Com elaboration on ENI data (2017)



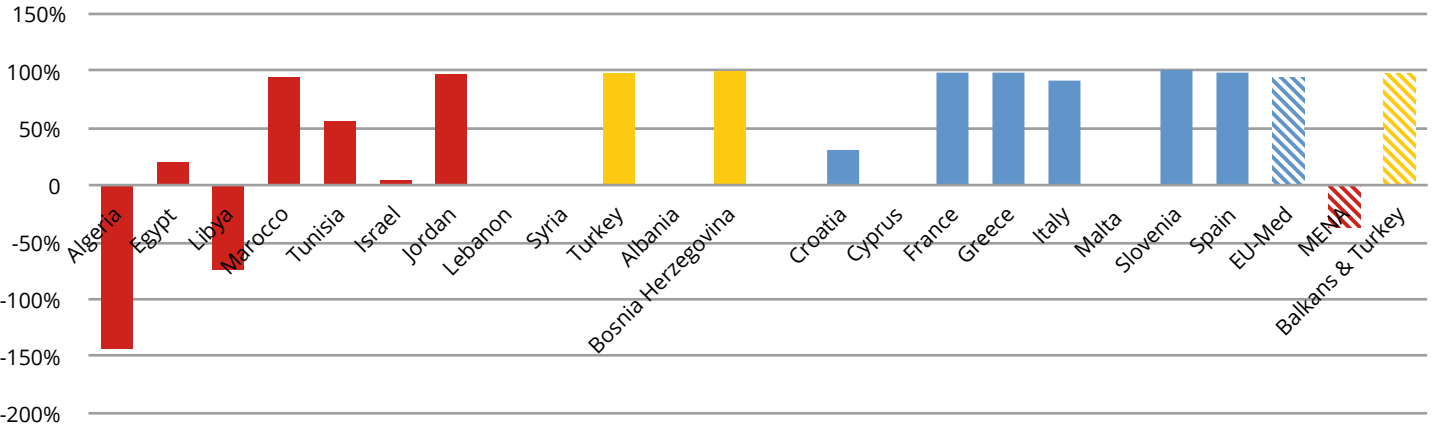
**Fig. 3.3** Gas final consumption per sector – 2015

Source: I-Com elaboration on IEA data (2017)



**Fig. 3.4** Net gas import/consumption – 2016

Source: I-Com elaboration on ENI data (2017)



mc/capita in the EU28, 541mc/capita in the Balkans and Turkey and 516 mc/capita in MENA (Fig. 3.2).

As for the final gas consumption, industry accounted for 34% in the EU-Med and MENA countries, while 41% in the Balkans and Turkey. Other sectors (which includes residential, services, agriculture/forestry, fishing and other non-specified) accounted for 61% in the EU-Med, 56% in the Balkans and Turkey and only 35% in the MENA Region. In MENA countries, 27% of gas consumption was absorbed by non-energy uses – the highest share in the Region (Fig. 3.3).

Fig. 3.4 shows the countries dependence on net gas imports in 2016. The EU-Med and the Balkans and Turkey were highly dependent on gas imports, 95% and 98% respectively (Fig. 3.4).

### 3.2. MEDITERRANEAN GAS INFRASTRUCTURES

There are three vertical gas trade links, which divide the Mediterranean into three corridors and trade zones – Western, Eastern and Central Mediterranean. The Western market extends from Algeria through Spain to Portugal and France. Algeria is one of the main suppliers to Portugal, Spain and France. The Algerian gas is transported to the Iberian Peninsula through two transmission lines: the oldest Maghreb-Europe gas pipeline (which connects Algeria, to Morocco, Spain and Portugal) and the recent Medgaz pipeline (from Algeria to Spain).

In the Central trade zone, the main consumers of

the corridors, Italy and the Balkan countries, are interconnected (Slovenia has a bidirectional flow with Italy, and Croatia is connected to Slovenia). The main producers of the area are Algeria and Libya. Slovenia, Croatia, Bosnia-Herzegovina have relatively small markets. Albania, Malta and Montenegro have no gas consumption. The main link in the Central Mediterranean is the TransMed pipeline, connecting Algeria, Tunisia, Italy and reaching the Slovenian borders. The Greenstream pipeline links Libya to Italy.

Bosnia-Herzegovina is not linked to regional countries and imports gas from Russia through Serbia. With no gas consumption at present, Montenegro and Albania have not yet set up a gas infrastructure.

The Eastern Mediterranean zone is less interconnected than others. The two main gas markets in the region, Egypt and Turkey, are not linked to each other. On the one hand, Egypt is connected to Jordan and Israel, though the lack of alternative sources and routes is a barrier to the security of the supply as well as to trade. On the other hand, although Turkey could be a gas hub in the region, the potential has not been fully exploited due to the lack of a connection with the Arab gas pipeline<sup>7</sup>. The completion of the Arab gas pipeline would be essential to remove trade barriers in this area.

<sup>7</sup> The Arab Gas Pipeline (also known as the Trans-Mashreq Gas Pipeline) linking Egypt with Jordan, Syria and Lebanon up to Turkey, aiming at boosting regional gas cooperation in the “Euro-Arab Mashreq Gas Market”. In the past, an ambitious project to expand the Arab Gas Pipeline to Iraq was also proposed. However, the Arab Gas Pipeline interrupted its operations in March 2012 due to specific geopolitical issues. The pipeline has not been re-opened.

**Fig. 3.5** Existing Mediterranean natural gas interconnections

Source: GIE (2017)



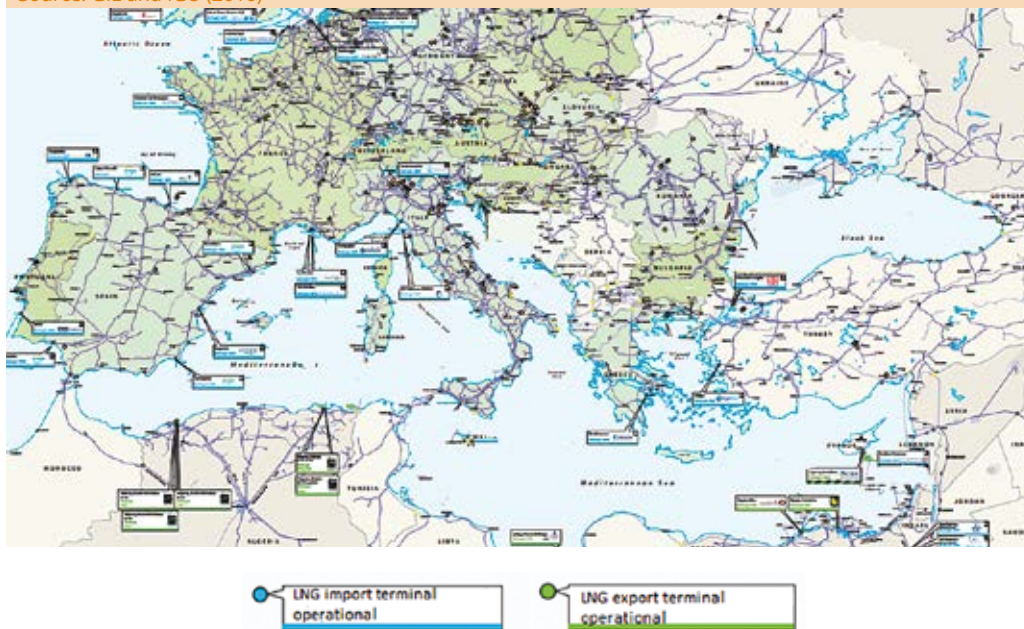
Area	Name	Interconnected countries
<b>Western</b>	Maghreb-Europe gas pipeline	Algeria-Morocco-Spain-Portugal
	Medgaz	Algeria-Spain
<b>Central</b>	TransMed	Algeria-Tunisia-Italy-Slovenia
	Greenstream	Libya-Italy
<b>Eastern</b>	Arab gas pipeline	Egypt-Jordan-Syria-Lebanon-Turkey

There are several LNG operational terminals in the Mediterranean area (Fig. 3.6). Some LNG large scale import terminals are in France, Spain, Italy, Greece, Turkey, Israel and Egypt. In addition, there are LNG large scale export terminals in Algeria, Libya, and Egypt. In 2016, the total import capacity of the Mediterranean LNG terminals was roughly 99 billion mc/year (Fig. 3.7).

Spain was the country with the highest LNG import capacity (35%), followed by Italy (14%) and Egypt (13%). According to the International Gas Union (IGU), the total trade volume of LNG in 2016 was 356 bcm worldwide. Among considered countries, Spain emerged as first importer, accounted for 4% of global trade, followed by Egypt and France, 3% and 2% respectively.

**Fig. 3.6** Existing Mediterranean LNG large scale terminals

Source: GIE and IGU (2016)

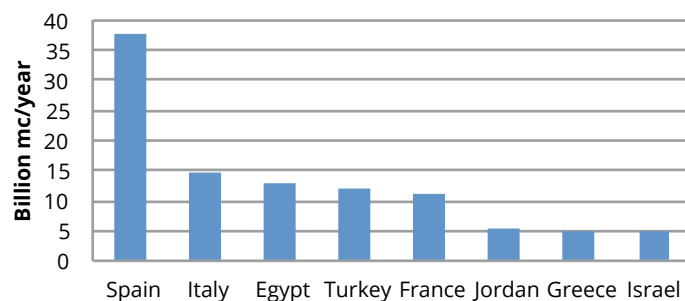


	Number of LGN export terminal
Algeria	5
Egypt	2
Libya	1
	Number of LGN import terminal
Spain	3
Italy	3
Egypt	2
Turkey	2
France	2
Greece	1
Israel	1
Jordan	1

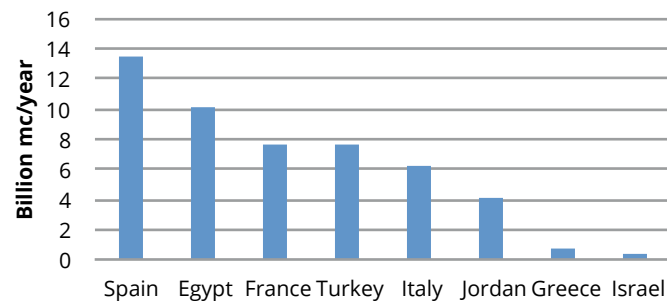
**Fig. 3.7** Capacity of Mediterranean LNG import terminals and net LNG imports – 2016

Source: I-Com elaboration on GIE and IGU data (2017)

**Annual capacity LNG import terminals**



**Net LNG imports - 2016**



### 3.3. MEDITERRANEAN NEW GAS PROJECTS

The Mediterranean is also involved in some gas interconnection projects of common interest (Fig. 3.8 and Tab. 3.1). In the Western area some projects allowing for bidirectional flows between Portugal, Spain and France are planned:

- The third interconnection point between Portugal and Spain, which is currently planned, but not yet in the permitting phase. The commissioning date is set for 2021;
- The Midcat project will link Spain to France, with the commissioning scheduled for 2022.

In the Central area there are many projects aiming at diversifying trade routes and sources:

- The connection of Malta-Italy (Gela) and/or offshore Floating LNG Storage and Re-gasification Unit (FSRU). Commissioning date in 2026;
- The Adriatica pipeline will allow gas from the Southern Gas Corridor to flow through Italy towards the North-Eastern Europe. It is now in permitting phase;
- The Galsi pipeline should interconnect Algeria, Sardinia and Italy. The commission date is set for 2019;
- The Trans-Adriatic Pipeline (TAP) will link Italy to Greece via Albania. The project is under construction and the commissioning date is foreseen for 2020;
- The Poseidon pipeline will connect Italy to Greece, it is now in the permitting phase;

- The Krk LNG terminal and evacuation pipelines towards Hungary and beyond. Both, the LNG terminal and the evacuation pipelines are in the permitting phase. The commissioning of the LNG terminal is scheduled for 2018, 2022 for the pipelines;
- The Northern Greece LNG offshore Floating Storage and Regasification Unit (FSRU), is now in the permitting phase;
- The Croatia-Slovenia gas interconnection will improve gas transportation in the area and boost transport of gas from the Krk LNG terminal to the neighboring countries. It is in the permitting phase, with commissioning dates expected for 2019-2020.

The Eastern projects encompass:

- A gas pipeline to the EU from Turkmenistan and Azerbaijan, via Georgia and Turkey (currently known as the combination of Trans-Caspian Gas Pipeline (TCP), Expansion of the South-Caucasus Pipeline and Trans-Anatolia Natural Gas Pipeline (TANAP)). The project is under construction, with a commissioning date set for 2019;
- A pipeline from offshore Cyprus to Greece via Crete (EastMed Pipeline). Currently in the permitting phase, with the commissioning date scheduled for 2022;
- A LNG onshore terminal in Cyprus, which should help in removing internal bottlenecks in Cyprus and allow for the transmission of gas from the Eastern Mediterranean region. It is currently being planned.

**Fig. 3.8** Mediterranean natural gas – projects (pipelines and LNG)

Source: EU Commission (2017)



**Tab 3.1** Mediterranean natural gas – projects (pipelines and LNG)

Source: EU Commission, GIE (2017)

	From	To	Name	Status	Commissioning data
Western area	Portugal	Spain		planned	2021
	Spain	France	Midcat	planned	2022
Central area	Malta	Italy		planned	2026
	Malta	LNG project		planned	2021
	Algeria	Sardinia-Italy	Galsi	permitting	2019

**Tab 3.1** Mediterranean natural gas – projects (pipelines and LNG)

Source: EU Commission, GIE (2017)

	Greece	Italy via Albania	TAP	under construction	2020
	Italy	Greece	Poseidon	permitting	2022
	Croatia	Slovenia		permitting	2019-2020
	Albania	Montenegro-Bosnia and Herzegovina	IAP*		
	Krk (Slovenia)	LNG projects		permitting	2018
	Greece (Northern)			permitting	2020
Eastern area	Cyprus	Greece via Crete	EastMed	permitting	2022
	Cyprus	LNG project		planned	
	Turkmenistan and Azerbaijan	via Georgia and Turkey to Europe	TCP and TANAP	under construction	2019

\*project out of the PCI list

In the Mediterranean region, there are other projects proposed or under study, currently not included in the projects of common interest. For example, the Ionian Adriatic Pipeline (IAP) aims to deliver gas to Northern Albania, Montenegro and Bosnia-Herzegovina. This

project is particularly important for Montenegro and Albania, because it will create the preconditions for the development of the natural gas market of the countries. The construction could begin in two or three years. There are also some LNG projects not in the PCI list.

**Box 3.1** The Southern Gas Corridor and TAP – Trans Adriatic Pipeline

Natural gas is expected to play an increasingly key role in the European energy mix for decades to come. As the cleanest fossil fuel, it has clear environmental advantages and it also provides an important and flexible energy option in conjunction with renewable energy.

For more than a decade, one of the most key questions of the European energy security has been the realization of the Southern Gas Corridor (SGC), the network of pipelines connecting Caspian resources to Europe. The

opening up of the Southern Gas Corridor is of strategic significance for Europe: it will provide Europe with a new route to secure a new source of natural gas supplies from the Caspian Sea, thus enhancing the energy security. Moreover, the SGC is designed to be expanded as soon as additional natural gas becomes available from complementary sources that will further increasing competition on the European market to the benefit of the consumers. The SGC opens a new and competitive route for Europe to import natural gas.

In addition, the economic growth generating energy demand rise, and a collective aspiration for EU membership, South East Europe will also need a more environmentally balanced energy portfolio that includes natural gas. The SGC is envisioning as becoming a multi-source “superhighway” that would bring new source of natural gas to an increasingly import-dependent Europe. It will initially transport 10bcm/a from the natural gas from the Shah Deniz Phase 2 development of the natural gas and condensate giant field Shah Deniz in the Azerbaijani sector of the Caspian Sea to Europe representing around 2% of the EU’s gas consumption.

The SGC is a complex of multiple upstream and midstream projects: Shah Deniz 2 upstream in Azerbaijan, the South Caucasus Pipeline expansion (it is an expansion to increase the capacity of the existing pipeline SCP), the Trans-Anatolian Pipeline (TANAP) and the Trans Adriatic Pipeline (TAP).

### The Trans Adriatic Pipeline – TAP

Trans Adriatic Pipeline is the European leg of the Southern Gas Corridor. TAP will pave the way for new sources of energy to enter these markets and promote development of their energy sectors. TAP will be 878 kilometers in length (Greece 550 km; Albania 215 km; Adriatic Sea 105 km; Italy 8 km). It will start near Kipoi on the border of Turkey and Greece, where it will connect with the Trans Anatolian Pipeline (TANAP). From there, TAP will continue onshore, crossing the entire territory of Northern Greece, its longest stretch, then onwards east to west through Albania to the Adriatic coast. The offshore section of the pipeline will begin near the Albanian city of Fier and it will traverse the Adriatic Sea, landing in San Foca, in the Melendugno Municipality. Then it will tie into Italy’s gas transportation network in Southern Italy through TAP Interconnection, SNAM pipeline project.

TAP is a real project, which is currently under construction. It is on track to deliver first gas on time and on budget beginning 2020: considerable progress has been made in Albania, Greece and Italy. TAP is more than 50% complete. This includes all engineering, procurement and construction scope. In addition, 100% of pipelines have been delivered in the three Countries with more than 45% of welded steel pipe in the ground.

Recognizing its crucial contribution to the strategic goal of enhancing Europe’s energy security and diversity, Europe and the TAP Host Countries strongly support the realization of the project. This is also linked to the fact that TAP will facilitate natural gas deliveries to Bulgaria and the Western Balkans through the Interconnector

Greece-Bulgaria (IGB) and Ionic Adriatic Pipeline (IAP). TAP is also cooperating with Albanian state for the domestic natural gas market development.

TAP is a long and successful business story. After an international pipeline competition, in late June 2013, TAP was selected by Shah Deniz field development consortium as the Southern Gas Corridor's European leg and the final investment decision (FID) (incl. gas sales agreements with European buyers in September 2013) on Shah Deniz Phase 2 upstream venture was taken by the consortium in mid-December 2013. Intergovernmental Agreement and Host Government agreements strengthen the support of the National governments (Italy, Albania and Greece) for the TAP Project.

TAP has six highly committed and experienced shareholders (BP – 20%, SOCAR – 20%, Snam – 20%, Fluxys – 19%, Enagas – 16% and Axpo – 5%), with a very robust track record in delivering and managing pipelines. Snam, the most recent shareholder to join the project (December 2015) continues to enhance TAP's strategic position as a truly European project and reinforces TAP's successful joint-venture model which brings producers, leading infrastructure players and gas buyers together.

### **The strategic meaning of TAP for the Host countries: investments and benefits**

TAP brings several benefits to Greece, Albania and Italy. These include the creation of direct and indirect jobs. Currently more than 5,500 people work for the project in Greece, Albania and Italy, with these numbers expected to increase as the project progresses through construction. This also includes numerous sub-contractor companies, which provide various goods and services to TAP.

The project will directly contribute to the three countries' Gross Domestic Product (GDP) through millions of Euro in taxes. TAP has also rehabilitated 58 kilometres of access roads and bridges in Albania, which also benefit over 200,000 people.

TAP is investing more than 55 million Euros in total in Social and Environmental Investments (SEI) projects across all of its three host countries. With many SEI projects already underway many more are in the various stages of preparation. These programmes are developed in line with TAP's funding principles to promote sustainable development and in full consultation and cooperation with communities along the pipeline route. The overall objectives of TAP's SEI programme are:

- support improving community quality of life,
- strengthen livelihoods within local communities,
- enhance environmental management, including through support for biodiversity,
- enable improving skills and abilities through support for education and training initiatives.

Each of TAP's host countries have different development priorities. For example, in Italy, TAP and Snam are jointly investing in the local territory with specific project proposals. The investments are focused on: Decarbonisation, energy efficiency; local content and SEI projects. In addition, Snam has committed to invest in the development of certain industrial projects that focus on decarbonisation (LNG, SSLNG, biomethane etc.) following the results of feasibility studies and the granting of the necessary local authorizations. In conclusion, clearly, TAP plays a crucial contribution to the strategic goal of enhancing Europe's energy security and diversity. Europe and the TAP Host Countries strongly support the realization of the project which is set to deliver Shah Deniz gas in 2020.

### 3.4. NATURAL GAS POTENTIAL

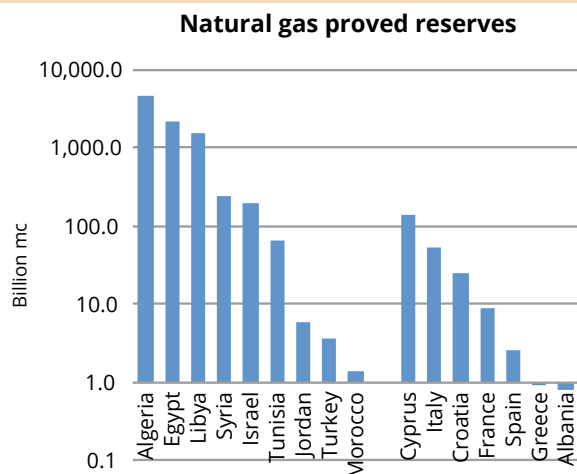
According to 2016 CIA data, natural gas reserves in the Mediterranean region accounted for roughly 5% of the global proved reserves (Fig. 3.9).

In recent years, a series of natural gas reserves were discovered in the Levant Basin, able to alter the situation

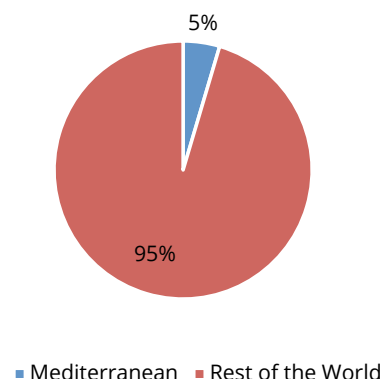
in the Mediterranean region. According to the European Council on Foreign Relations (ECFR), with confirmed recent reserves reaching roughly 2,000 billion cubic meters (bcm) of gas, and the possibility of more discoveries to come, the Levantine Deep Marine Basin can potentially offer the European Union energy security and an improved cooperation with Middle Eastern countries.

**Fig. 3.9** Natural gas proved reserves (2016)

Source: I-Com elaboration on CIA data (2017)



**Share of Mediterranean natural gas proved reserves**



The first of a series of large-scale natural gas discoveries in the region was the Tamar field off the Israeli coast. Other important subsequent discoveries have been made in Israel, Cyprus and Egypt (Fig. 3.10). Encouraged by the above-mentioned discoveries, exploration is still ongoing in the region and Lebanon is currently assessing its resources. Discovered in 2011, Aphrodite is a small/medium field with a roughly estimated 200bcm (billion cubic meters) of gas<sup>8</sup>. Given the relatively low level of consumption, the discovery of Aphrodite could open the way for Cyprus to begin producing gas for both national and European markets. However, with no infrastructure currently in place, the site is too small to justify the capital investment needed. Given the current size of the reserves in this region, Cyprus should discover additional resources in order to act as a sole exporter, otherwise, it should consider regional options for co-exporting jointly with another country in the region.

Off the Israeli coast, after the Tamar discovery (a 283bcm gas field<sup>9</sup>), a larger gas field, Leviathan, was found in 2010, which was estimated to hold roughly 500bcm<sup>10</sup>.

Changing the relations among the regional actors

and strengthening relations with Europe, this find could transform Israel into a net exporter. Although, Israel will be able to produce and deliver gas locally and to its neighbors, neither the Jordan nor Palestine markets are large enough to cover the costs of full-scale production or justify major investment in export infrastructures. Instead, Israel should secure a commitment from larger markets, such as Turkey or the EU and consider options for joint exportation.

In 2015, Israel's aspirations to become the main gas-exporter of the region were undermined by the Zhor discovery, over 150 kilometers off the Egyptian coast. The field is estimated to hold 849bcm, more than the Cyprus and Israeli fields together.

Egypt has the largest natural reserves and the infrastructure to export, and, indeed, the country has operated as a regional exporter since 2003, initially by pipeline and then by LNG. Because no huge capital investment is needed, the Egyptian LNG would be cheaper than Cypriot and Israeli gas. Clearly, the country's exporting ability depends on the local economy, political stability and energy sector developments.

---

8 IEA:<https://www.eia.gov/beta/international/regions-topics.cfm?RegionTopicID=EM>

9 Ibidem.

10 "Israel: Differing opinions on the Leviathan field size", *Offshore Energy Today*, 6 June 2016, available at <http://www.offshoreenergytoday.com/israel-differing-opinions-on-the-leviathan-field-size/>.

**Fig. 3.10** New natural gas discoveries

Source: ECFR (2017)





## CONCLUSIONS



## CONCLUSIONS

A secure, competitive and sustainable supply of energy for all European citizens is the main goal of the EU energy policy, and the first pillar of the Energy Union. A transnational cooperative approach is the basis of this policy perspective and only a full integration of regulations, resources and markets will ensure fulfilling such challenging goals.

The complexity of the long-term energy targets has led the EU to enlarge the scope of energy cooperation, moving outside its borders towards the Mediterranean Area, for clear reasons relating to geographic and cultural/historical proximity. In spite of the existing differences in political and institutional frameworks, as well as social and economic contexts, the reasons for cooperating are much stronger. We have just limited our analysis to energy aspects, not introducing any key geopolitical issues related to security and migration that would further enlarge the scope of the cooperation between the two shores of the Mediterranean.

The Mediterranean Region accommodates 7% of the world population (approx. 500 million people) and produces 12% of the global GDP. The share of total primary energy consumption is 6.8% and the contribution to GHG emissions 5.9%. There are clear differences among the different regions of the Mediterranean in socio-economic indicators, as well as in the time evolution of trends. European countries carry more weight in terms of GDP production and energy consumption – associated

with a higher share in GHG emissions. On the other hand, the improvement of economic and social conditions in most of the Southern Mediterranean countries and the quickly growing population trends are expected to rebalance this situation. We would underline that the population is expected to grow by less than 3% in the European Mediterranean countries in the next 15 years, while in the Balkans and Turkey an overall population growth of about 12% is expected and in the Southern Mediterranean of 20%. This will clearly have marked consequences on the increase in energy demand and the related environmental impact, if appropriate policies are not put in place.

The above general consideration can help in rethinking the mainstream approach to energy relations between the two shores of the Mediterranean generally orienting main energy flows from South to North. This is the case for hydrocarbons (North Africa is one of the main gas exporters to Europe), but also for some past renewable energy development cases that were based on a projected large-scale export of electricity from the South to the North. The change in the energy supply and demand trends has led to a radical change in this view.

As highlighted in the report, there is a power generation capacity deficit in the Southern Mediterranean countries, based on per capita electricity consumption and per capita generation capacity indicators.

Without using sophisticated energy modelling, and just to highlight the magnitude, if we assume an equal consumption in 2030 of Southern Med. per capita consumption to the Northern consumption (relative

to 2015), that would result in an increase in electricity consumption of more than 300% compared to the 2015 figures. The outcome is a combination of growth in both per-capita energy consumption and population. In the same way, assuming a convergence in 2030 of the per-capita generation capacity of the Southern Mediterranean area to the 2015 value of the EU Mediterranean countries, this would imply new installations for a total of approximately 450 GW (more than the actual installed capacity in the EU Mediterranean countries), that is, an increase of more than 400% of the total current installed capacity in the respective Southern countries.

Although derived from simple extrapolations, these numbers are striking and point towards the need for massive investments from one side and for the need to minimize the impact of this additional generation on GHG emissions. More sophisticated modelling would result in the identification of a proper mix for energy efficiency, renewable energy and natural gas, which are the three main ingredients for this recipe. A crucial role is also played by the strengthening of the interconnection capability, both between the Southern countries (as is already ongoing between EU countries) and between the two shores of the Mediterranean.

As well, large changes are expected in the gas sector. The penetration of this energy source is expected to grow considerably in Southern Mediterranean countries, both in final use and for power generation. This could reshape the market, as was the case in Egypt that is experiencing a considerable contraction in its exporting capacity due to the steep increase in domestic consumption.

Diversification of supply and new discoveries will drive the change both in the EU and in the Southern Mediterranean countries.

The afore-mentioned themes concerning energy resources recall the central role of investments and infrastructures and, in particular, interconnection facilities. Such investments are quite complicated from a financial standpoint due to the uncertainties on energy prices and general economic stability. On top of this, there must be added concerns about the political instability of the region and energy market structures that risk hindering foreign investment.

The development of East-West interconnection gas infrastructures could represent an important source of diversification for European countries, taking into account the recent important gas discoveries in the Southeastern quadrant. This potential development must take into account other competing destinations for this gas supply, considering the steep increase in gas consumption forecasts in the Southern Mediterranean countries.

As well, electricity interconnections are strategic for the region. Algeria, Morocco and Tunisia on one side and Egypt and Jordan on the other side already present a certain degree of interconnection. Regarding the North-South interconnection, Spain and Morocco are already linked while the interconnection between Italy and Tunisia is in an advanced project phase.

It is clear that the development potential of physical interconnections between different countries and regions cannot be fully exploited unless a harmonization of grid technical rules is implemented and common

market regulation is achieved. Possible technical cooperation models are represented by ENTSO-E and ENTSO-G and by the ongoing integration process among the six Western Balkan countries' electricity markets.

The opening up of the energy market is a crucial aspect for attracting investments necessary for the development of infrastructures (both interconnection and in the single country).

Furthermore, an extraordinary effort has to be made in order to meet the de-carbonization targets agreed on in Paris. Thus, a consistent development is expected for renewable energies and energy efficiency technologies boosted by the cooperation between the two shores of the Mediterranean.

European institutions can play a crucial and direct role in fostering this cooperation, strengthening capacities of public and private actors, raising institutional awareness and increasing financial backup for investments.

Europe can also play an important role in promoting the dialogue between institutions, market actors and civil society. For example, lighthouse examples are bottom-up initiatives, such as MEDREG (Association of Mediterranean Energy Regulators), MEDENER (Association of Mediterranean Energy Agencies) and MEDTSO (Association of Mediterranean TSOs). Europe's role should be to continue supporting these successful initiatives and putting in place new possible energy dialogue platforms.







## PARTNERS

---



### **I-Com – Istituto per la Competitività**

#### **Rome**

Piazza dei Santi Apostoli 66

00187 Rome, Italy

Phone +39 06 4740746

[info@i-com.it](mailto:info@i-com.it)

[www.i-com.it](http://www.i-com.it)

### **I-Com – Institute for Competitiveness**

#### **Bruxelles**

Rond Point Schuman 6

1040 Bruxelles, Belgium

Phone +32 (0) 22347882

[www.i-comEU.eu](http://www.i-comEU.eu)