EU Energy Strategy in the South Mediterranean
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Abstract
The study provides an overview of energy policies of South Mediterranean countries in and outside of the EU and describes the state of play regarding the development of energy routes and infrastructure. The study also offers recommendations on (external) energy policy and provides advice on fostering regional integration and the interconnection of energy networks of Mediterranean countries.
This document was requested by the European Parliament's Committee on Industry, Research and Energy (ITRE).

AUTHOR(S)
Bernard Duhamel, SOFRECO
Henri Beaussant, SOFRECO

RESPONSIBLE ADMINISTRATOR
Balázs Mellér
Policy Department Economic and Scientific Policy
European Parliament
B-1047 Brussels
E-mail: Poldep-Economy-Science@europarl.europa.eu

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ABOUT THE EDITOR
To contact the Policy Department or to subscribe to its monthly newsletter please write to: Poldep-Economy-Science@europarl.europa.eu

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<td>AC</td>
<td>Alternating Current</td>
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<tr>
<td>ACER</td>
<td>Agency for the Cooperation of Energy Regulators</td>
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<td>AfDB</td>
<td>African Development Bank</td>
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<tr>
<td>AFD</td>
<td>Agence Française de Développement</td>
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<td>AGRI</td>
<td>Azerbaijan-Georgia-Romania Interconnector</td>
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<td>AMU</td>
<td>Arab Maghreb Union</td>
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<tr>
<td>ANME</td>
<td>Agence Nationale de Maîtrise de l’Energie</td>
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<tr>
<td>bcm</td>
<td>billion cubic meters</td>
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<td>BEMIP</td>
<td>Baltic Energy Markets Interconnection Plan</td>
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<td>CBT</td>
<td>Cross Border Tariff</td>
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<tr>
<td>CHP</td>
<td>Combined Heat and Power</td>
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<tr>
<td>CCS</td>
<td>Carbon Capture and Storage</td>
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<tr>
<td>CEER</td>
<td>Council of European Energy Regulators</td>
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<td>CREG</td>
<td>Commission de Régulation pour l’Electricité et le Gaz (Algeria)</td>
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<tr>
<td>CSP</td>
<td>Concentrated Solar Power</td>
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<tr>
<td>DC</td>
<td>Direct Current</td>
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<tr>
<td>ECT</td>
<td>Energy Charter Treaty</td>
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<tr>
<td>EE</td>
<td>Energy Efficency</td>
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<tr>
<td>EERA</td>
<td>European Energy Research Alliance</td>
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<tr>
<td>EHV</td>
<td>Extra High Voltage</td>
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<tr>
<td>EIB</td>
<td>European Investment Bank</td>
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<tr>
<td>EII</td>
<td>European Industrial Initiatives (6: wind, solar, bioenergy, smart grids, nuclear fission, CCS)</td>
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**ELENA**  European Local Energy Assistance

**EMRA**  Energy Market Regulatory Authority (Turkey)

**ENPI**  European Neighbourhood and Partnership Instrument

**ENTSO-E**  European Network of Transmission System Operators Electricity

**ENTSO-G**  European Network of Transmission System Operators Gas

**EPIA**  European Photovoltaic Industry Association

**EREC**  European Renewable Energy Council

**ETS**  Emission Trading Scheme

**EUAS**  Electricity Generation Corporation (Turkey)

**EU-MED**  The eight EU Member States of the northern Mediterranean

**EWEA**  European Wind Energy Association

**FEMIP**  Facility for Euro-Mediterranean Investment and Partnership

**GECOL**  General Electricity Company of Libya

**GEM**  Gasdotto Enrico Mattei (Transmed)

**GME**  Gazoduc Maghreb Europe

**GPDF**  Gasoducto Pedro Duran Farell (GME)

**GTZ**  German Technical Cooperation

**GW**  Gigawatt

**GWh**  Gigawatt-hours

**HCV**  Higher Calorific value (also referred to as GHV – Gross Heating Value)

**HV**  High Voltage

**HVDC**  High Voltage Direct Current

**IEA**  International Energy Agency

**IEF**  International Energy Forum
**IFC** International Finance Corporation (World Bank Group)

**IFI*s** International Financial Institutions

**IMME** Intégration des Marchés Maghrébins de l’Electricité [Maghreb electricity market integration] (EU-MEDA)

**IOC** International Oil Companies

**IPEEC** International Partnership for Energy Efficiency Cooperation

**IPP** Independent Power Producer

**IRENA** International Renewable Energy Agency

**ITGI** Interconnector Turkey-Greece-Italy

**KfW** Kreditanstalt für Wiederaufbau (Germany’s development bank)

**kV** Kilovolts

**KWh** Kilowatt-hours

**LCV** Lower Calorific Value (also referred to as NHV – Net Heating Value)

**LEJS** Libya, Egypt, Jordan and Syria

**LFC** Load Frequency Control

**LNG** Liquefied Natural Gas

**MEDENER** Mediterranean Association of National Agencies for Energy Conservation

**MED-EMIP** Euro-Mediterranean Energy Markets Integration Project

**MED-ENEC** Energy Efficiency in the Construction Sector in the Mediterranean

**MEDREC** Mediterranean Renewable Energy Centre

**MEDREG** Association of Mediterranean Regulators

**MEDREP** Mediterranean Renewable Energy Programme

**MIGA** Multilateral Investment Guarantee Agency (World Bank Group)
**mmbtu**  million British thermal units

**mmtoe**  million tons of oil equivalent

**MoU**  Memorandum of Understanding

**MPC**  Mediterranean Partner Countries

**MS**  Member State

**MSP**  Mediterranean Solar Plan

**MOEE**  Egyptian Ministry of Energy and Electricity

**MW**  Megawatt

**MWh**  Megawatt-hours

**NG**  Natural Gas

**NEAL**  New Energy Algeria

**NER**  New Entrants Reserve

**NIGAL**  Nigeria-Algeria trans Sahara gas pipeline

**NORDEL**  Nordic Electricity market

**NTC**  Net Transfer Capacity

**OHL**  Overhead Line

**ONE**  Office National de l'Electricité (Morocco)

**PSPP**  Pumped Storage Power Plant

**PV**  Photo Voltaic

**RCREEE**  Regional Centre for Renewable Energy and Energy Efficiency

**RE**  Renewable Energy

**SCR**  Synchronous Continental Region

**SEMC**  South East Mediterranean Countries

**SET Plan**  Strategic Energy Technology Plan
SONELGAZ  Société Nationale d’Electricité et de Gaz (Algeria)
SPE  Société de Production d’Electricité (Algeria)
STEG  Société Tunisienne d’Electricité et de Gaz (Tunisia)
STEP  Station de Transfert d’Energie par Pompage
TAM  Tunisia, Algeria, Morocco
TAP  Trans Adriatic Pipeline
TEIAS  Turkish Electricity Transmission Corporation
TEN_E  Trans European Network Energy
Toe  Tons of Oil Equivalent
TSO  Transmission System Operator
TYNDP  Ten Year Network Development Plan
UCTE  Union for the Coordination of the Transmission of Electricity
UfM  Union for the Mediterranean
UGS  Underground Gas Storage Facilities
UNEP  United Nations Environment Programme
### GLOSSARY

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<th>Term</th>
<th>Definition</th>
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<tr>
<td>base load</td>
<td>Amount of energy that is consumed more or less evenly over a given period, generally a year, e.g. the amount of gas or electricity consumed by a household for cooking or water heating, as opposed to the consumption for space heating</td>
</tr>
<tr>
<td>discrete shipments</td>
<td>Energy supplies that are not transported in a continuous fashion, e.g. LNG as opposed to pipeline gas</td>
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<tr>
<td>gas/electricity island</td>
<td>Qualifies a country, region, etc. which is not connected to neighbours through gas or electricity interconnection lines</td>
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<tr>
<td>grid parity</td>
<td>The point at which alternative means of generating electricity (solar, wind, etc.) are at least as cheap as conventional means of generating electrical energy (hydro, coal, nuclear, gas, oil)</td>
</tr>
<tr>
<td>incumbent or legacy operator</td>
<td>An operator who started a given activity, e.g. in a country, and had remained the sole operator over a long period of time, and is now challenged by new entrants (new operators aiming at taking a market share in a given activity in the wake of market opening)</td>
</tr>
<tr>
<td>islanded development</td>
<td>Development of systems that are not inter-connected</td>
</tr>
<tr>
<td>load factor</td>
<td>Rate of utilisation of an energy system, e.g. percentage of its maximum capacity that is used over a certain period of time (generally a year)</td>
</tr>
<tr>
<td>load shedding measures</td>
<td>Technical or contractual measures implemented by an operator to offset the amount of demand that cannot be met by an energy system</td>
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<tr>
<td>market coupling</td>
<td>A mechanism for integrating electricity markets in different areas aiming at maximizing the total economic surplus of all participants</td>
</tr>
<tr>
<td>non-associated gas</td>
<td>Hydrocarbon reserves that include only gas, i.e. that are not compounded with oil</td>
</tr>
<tr>
<td>peak load</td>
<td>Maximum, instantaneous demand that an energy system is required to provide to meet the maximum demand</td>
</tr>
<tr>
<td>primary energy demand</td>
<td>Total amount of crude energy consumed in a country or a region, whether energy is directly used by the final consumers, e.g. gas for cooking, or transformed into secondary energy, e.g. gas used for power generation</td>
</tr>
<tr>
<td>spinning reserve</td>
<td>Amount of capacity (MW) available in excess of customer demand from generations units delivering energy (MWh) to the system</td>
</tr>
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<td>upside potential</td>
<td>Amount of energy that remains available for production in a given area, country or region</td>
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EXECUTIVE SUMMARY

The European Union’s electricity and gas situations are fairly different. Almost all electricity consumed in the EU is generated within the Union, whereas most of the gas consumed needs to be imported due to limited and declining domestic reserves (the gas dependency ratio is expected to reach 80% to 85% by 2030). However, electricity production is closely tied to issues affecting the gas industry’s development, particularly the security of gas supply. Over the past two decades, gas has gained an increasingly strong position in power generation through market liberalisation and the development of ever more efficient power plants. At the same time, a new context is emerging due to the development of new, non-gas-based technology, particularly renewable, and the need to reduce carbon emissions. This will affect the development of electricity and gas in the EU in different ways, leading to the specific policies that govern their development.

With regard to EU policy, the eight EU Mediterranean countries (EU-MED\(^1\)) are governed by the same set of legislative and regulatory documents that apply to the entire Union. Introducing a distinction between EU-MED and the rest of the EU-27 could therefore seem somewhat irrelevant. However, EU-MED countries have common features that create homogeneity within this sub-region. Due to their location on the Mediterranean with its long coastline, supply ties between EU-MED and Southern and Eastern Mediterranean Countries (SEMCs) are logically stronger than those linking SEMCs with the rest of the European Union. While there is currently only one power transmission route between SEMCs and the EU (Morocco-Spain), gas-producing SEMCs\(^2\) meet half the demand of EU-MED countries, whereas their share remains negligible in the supply patterns of the rest of the Union.

Electricity - state of play and outlook

Regarding electricity, EU-MED relations with the Southern Mediterranean are governed by the long-term completion of the Mediterranean Electricity Ring, whose purpose is to promote the coherent development of interconnections between the Mediterranean Basin’s power systems. In line with this objective, there are plans for several interconnectors to supply the North with power produced in particular from the significant renewable wind and solar potential of the South. Directive 2009/28/EC on Renewable Energy Sources sets the target of 20% of renewable energy by 2020 across the EU and a 20% reduction of CO\(_2\) emissions. Article 9 of the Directive foresees the possibility of “joint projects between Member States and third countries”. Thus it allows for the possibility of developing a substantial amount of RE generation abroad and the transfer of power through new South-North Mediterranean electricity corridors.

The Mediterranean Solar Plan (MSP), defined at the Paris summit of June 2008, was launched in June 2009 with a view to developing power interconnections between the South and the North based on wind and solar energy. It aims to contribute to the convergence of national energy policies and to the emergence of a regulatory environment to enable the massive scaling up of renewable energy in the region. With the implementation of the MSP, effective changes to legal frameworks are expected in Morocco, Tunisia, Jordan and Syria. These will concern national solar plans, laws on renewable energy, and the introduction of specific tariffs. Similar changes are in progress in Egypt and Turkey. Promoting the development of electricity interconnections between the Northern and Southern

\(^1\) Cyprus, France, Italy, Greece, Malta, Portugal, Slovenia and Spain
\(^2\) Including the Caspian area, the Gulf and Sub-Saharan Africa
Mediterranean will imply compliance with market economy rules\textsuperscript{3}, monitored by a Regulation Authority as it is the case in the European Union.

However, at present, the only electricity interconnection is through Gibraltar, between the North and South-West Mediterranean, and in some respects it would appear that the currently fragmented MEDRING is more of an idea than an ongoing reality. The question of what should be done for its closure could remain unanswered far beyond 2020.

For the time being, the challenge is to build a West Mediterranean grid backed on the one hand by the forecast tripling of the Spain-Morocco line and the future Tunisia-Italy line, and on the other hand, by re-enforcing the Portugal-Spain interconnection with France and Italy. Setting up appropriate regulation rules (competition, transparency, unbundling) in the Southern Mediterranean countries will facilitate the convergence of norms and pricing in order to achieve a West Mediterranean grid which can be integrated into the future European Supergrid.

The imminent importance of renewable energy production in Europe makes this convergence more urgent as intermittence can best be mitigated in a large grid. The European “Supergrid” is the planned outcome of this approach, and the “smart grids” forecast in the new European “Energy 2020” strategy will allow supply to be optimised through decentralised energy sources, such as renewable.

It should be borne in mind that the weakness of West-East (horizontal) cooperation in the Southern Mediterranean favours South-North (vertical) cooperation. This well known feature of poor development should be considered as a challenge for development cooperation between the Northern and Southern Mediterranean.

Closing the Mediterranean Electricity Ring is therefore a genuine challenge for the coming years.

**Gas - state of play and outlook**

According to the PRIMES model\textsuperscript{4}, EU gas demand is expected to increase slowly over the long term due to the development of renewable energy sources, which will tend to curb gas demand for power generation.

There is strong upside potential in the South, both through the development of further reserves by existing exporters, e.g. Algeria, Libya, Azerbaijan and the Gulf, and the implementation of new export schemes in countries that do not yet export gas to Europe.

The supply infrastructure is well developed. No less than three cross-Mediterranean pipelines currently bring gas from Algeria and Libya to the northern shore, and two more are waiting either to be put on stream or for final construction to go ahead.

The Nabucco and South Stream mega-projects plan to carry 30 to 60 bcm to Central Europe from the Middle East and/or the Caspian area, and from Russia/Central Asia respectively. However, while both projects offer alternative routes to the existing supply scheme through Ukraine and Belarus, only Nabucco really meets the objective of source diversification.

However, European importers are facing a new issue. Heavily populated gas producing countries, such as Algeria and Egypt – and Iran is in a similar situation, have considerably developed domestic gas usage, in particular for power generation, with a view to earmark as much oil as possible for exports. Domestic gas demand is boosted by the combination of

\textsuperscript{3} It should be borne in mind that the 5th Euro-Mediterranean Ministerial conference of 17 December 2007 agreed a six-year Action Plan to create "a common Euro-Mediterranean energy market"

\textsuperscript{4} Baseline scenario, EU Energy Trends to 2030 – Update 2009 Report. DG Energy, August 2010
three factors: demographic growth, economic development, and very low domestic prices. Of these three factors, the subsidisation of domestic prices is the most troubling as it creates artificial demand and places an unbearable strain on the national budget, preventing operators from developing their operation in a sustainable, financially sound fashion.

**EU Policy**

Over the last two years, the European Union has adopted several key documents aiming to further define EU policy in the wake of the Lisbon Treaty. The Treaty emphasised the need for Member States to foster solidarity in the area of energy, and included interconnections to the objectives of its energy policy, as highlighted in the subsequent Strategic Energy Reviews as well as the Third Energy Package.

In November 2010, the European Commission delivered two key documents regarding the European Union’s energy policy. While the revised Strategy did not attract much acclaim among stakeholders, the infrastructure package presented one week later by Energy Commissioner Günther Öettinger drew a lot of interest thanks to a rather impressive and focused action plan aiming “to achieve energy and climate change goals, identify specific but flexible projects that enable the EU to adapt to a changing economic and technological environment and to create tools that can support this policy.”

An increasing number of analysts on both sides of the Mediterranean fear that EU policy develops imbalances between suppliers and consumers, in particular with regard to gas producers in the south, and alters the high level of interdependence that was prevailing.

Energy has been the main factor of interdependence between Europe and southern Mediterranean countries for decades, and interdependence has been providing security of demand for Mediterranean gas producers as much as security of supply for European consumers.

**Recommendations**

**Helping SEMCs improve electricity and gas demand management**

All of the SEMCs are in an ongoing process of developing their economy with the aim of gradually reaching the level of industrialised countries. Substantial efforts are required, particularly in the energy field, in order to: (i) cope with fast-growing populations; (ii) develop industry and infrastructure; and (iii) improve populations’ living conditions.

With about 200 million people each, the populations of the Northern and Southern Mediterranean (excluding Turkey) are currently roughly the same size, but that of the Southern Mediterranean is growing approximately 3.6 times faster. Energy use per capita is roughly 2.5 times higher in the Northern Mediterranean than in the Southern Mediterranean.

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8 Energy Infrastructure Priorities for 2020 and Beyond, COM(2010) 677 final, 17 November 2010

9 Hughes Belin, European Energy Review: “Finally, Brussels’ battle plan for the European energy market”, 25 November 2010

10 Except Israel, and Turkey to some extent
More specifically, electricity consumption per capita is approximately 3.8 times higher in the Northern Mediterranean (6,457 kWh) than in the Southern Mediterranean (1,704 kWh).

South Mediterranean governments are thus facing enormous pressure from their populations and economic players to develop domestic energy supply. Strict energy demand management is an ongoing challenge. Although energy efficiency legislation has been passed in several countries such as Tunisia, Jordan and Israel, energy efficiency policy continues to be a pioneer area in the Southern Mediterranean. Cooperation in this field should be improved to enhance North-South relations.

**Supporting Renewable Energy and Energy Efficiency Associations and Centres**

The EU, in support of its development policies and within the framework of its cooperation policies, should provide diversified support focused on developing local expertise through special funding and the transfer of know-how.

**Extending the ELENA (European Local Energy Assistance) mechanism to a specific MED-ELENA mechanism**

Many initiatives remain at a conceptual level and are difficult to implement due to insufficient technical expertise. Following the ELENA mechanism (linked to "Intelligent Energy Europe"), the MED-ELENA could be developed to provide specific support such as eco-buildings, eco-transport in towns, etc. This support could be managed by the European Investment Bank.

**Considering that market prices are not the sole indicators for energy decisions, and that nuclear can legitimately be an option**

Nuclear energy could remain an option for many south Mediterranean countries. Certain growing energy needs will require considerable amounts of energy, and nuclear energy could appear to be an alternative option to renewable energy. However, safety in this field continues to be a major concern. Moreover, nuclear waste disposal is a genuine and serious problem for which a sustainable solution is still under question.

Advice from the EU would help local decision-makers.

**Encouraging south Mediterranean countries to move towards energy pricing based on the real economic costs**

While energy policy in south Mediterranean countries obviously belongs to their sovereign decision, existing or future Euro-Med partnerships should include a component aimed at assisting governments to devise and implement measures leading to end-user and transfer prices that reflect the real cost of the energy delivered.

**Promoting North-South and South-South integration through inter-connections and regulatory convergence**

**Strategic Energy Partnerships with the main power pools in the Southern Mediterranean**

The partnership signed between the EU and Turkey should be followed by a partnership with the Maghreb Power Pool.

Negotiations with Algeria alone could be a mistake since the three countries of the Maghreb are already mutually committed to working together within the framework of the IMME project (Maghreb electricity market integration). A possible innovation could therefore be common negotiation of the EU with the three Maghreb partners.

Assistance from the MEDREG should be officially requested and encouraged.
**Considering that regional integration will be conducive to renewable energy**

Since the whole MEDRING is split into four parts, a duly regional approach is coherent with the Mediterranean Solar Plan. The new electricity production from renewable sources raises the question of power storage to regulate the grid’s supply, since a main feature of renewable is intermittence. Interconnected grids could minimise the electricity storage challenge. These grids allow the optimal dispatch of power among consumers at different times and in different locations across a large region.

**Ensuring the security of gas supply**

**Strongly supporting the diversification of gas sources**

The January 2009 crisis following that of 2006, and Russia’s withdrawal from the Energy Charter Treaty in August 2009, have severely altered the confidence of many stakeholders in Russia’s ability to maintain reliable gas supplies in the event of another major crisis. Strong support should be provided to those projects that genuinely improve the European Union’s security of supply through the diversification of sources, with a first application to the Nabucco pipeline.

**Devising new tools to facilitate the construction of European infrastructures**

A major obstacle to the development of infrastructures is the lengthy process of obtaining all the authorisations and permits required to build them. The ENTSO-G considers that reducing the permitting process from 10 years on average to 5 years for the main projects would provide an invaluable impetus for the achievement of key infrastructures. A specific fast-track procedure, based for instance on the French “Déclaration d’Utilité Publique” (Declaration of Public Utility), could be designed and applied to projects labelled “Project of European Interest”, and included in the new Regulation on the Security of Supply.

**Developing medium- and long-term Gas Master Plans at regional and EU levels**

Since the liberalisation of the gas market, the issue of supply security has led the Commission to favourably re-consider the concept of planning. A recent application is the Ten Year Network Development Plan (TYNDP) prepared by both ENTSOs. While limited in design (the TYNDP applies primarily to networks), it may constitute a first blueprint for more ambitious and in-depth planning.

**Strategic gas storage**

While gas operators have developed underground gas storage facilities (UGS) for operational purposes, these are definitely not intended for storing gas for long periods of time as a strategic facility. Whereas the Regulation on the security of gas supply\(^\text{11}\) focuses primarily on transmission networks and cross-border pipelines to ensure security of supply within and between Member States, some thinking should be given to the appropriateness of strategic storage – a task that the ENTSO-G could be entrusted with.

\(^{11}\) Regulation (EU) N° 994/2010
Strengthening EU capacity to manage Mediterranean projects

Ensuring MSP governance

An efficient scenario would be to combine the know-how/expertise of the three main categories of actors: 1) the European Commission and the EIB, 2) the Barcelona Secretariat, and 3) the World Bank. A governance team composed of specialists and civil servants should be appointed to support States and project sponsors and leaders, and to liaise with financial institutions. This team should be able to maintain the leadership of the Union for the Mediterranean (UfM) co-chairmanship. A charter would need to be drafted before convening a network of the three categories of actors.

Promptly launching technical, environmental, technological, and economic analyses for the closure of the Mediterranean Electricity Ring

These surveys are recommended in the “MEDRING Update 2010” Report. Taking into account the scale of the power transit corridors which could be built, a consensus should be obtained for the construction of these future electricity highways which are bound to the achievement of the MSP. Regulatory issues concerning the coordinated operation of the future interconnectors should then be addressed. International consensus is required.

Promoting a genuine and efficient energy strategy

The EU’s energy policy has been focusing on achieving a single market through market liberalisation, increased competition and the development of cross border infrastructures to enhance transmission fluidity between Member States.

The existing Directives focus to a large extent on the implementation of the internal market and climate issues. They should be complemented by a dedicated energy security package including a strong gas component, which would address, inter alia, such key issues as security of supply, supply diversification, long term planning, and strategic storage.
1. **INTRODUCTION**

The Mediterranean region is multifarious, and its geographical unity around the same sea cannot conceal its political diversity. It is shared by a wide range of populations, languages, and cultures. Indeed, the Roman Empire could only merge the politics and geography of the mare nostrum for a relatively brief period. Subsequent conquests and dismantlement have shaped a mixed arena, resulting in a continuous challenge to reach common achievements when dealing with the whole.

The Mediterranean is nevertheless a place of convergence. Built by drifting continents, the Mediterranean trench is at the summit of great civilizations. It belongs to Africa as much as to Asia and Europe. The sea has facilitated exchanges and trade since ancient times, allowing the transportation of raw materials and commodities, and the transmission of ideas from one point of the shore to another.

Since the Euromed Conference in Barcelona (27-28 November 1995), economic and financial partnership has been continuously deepened in order to build a co-prosperity area around the Mediterranean Sea.

The energy aspects of the Euro-Mediterranean relationship are strongly involved in this context. They were addressed in the Barcelona Declaration by all the participants from across the south and east Mediterranean region, who declared to “acknowledge the pivotal role of the energy sector in the economic Euro-Mediterranean partnership and decide to strengthen cooperation and intensify dialogue in the field of energy policies. They also decide to create the appropriate framework conditions for investments and the activities of energy companies, cooperating in creating the conditions enabling such companies to extend energy networks and promote link-ups; [...]”.

As far as energy is concerned, the Barcelona process was marked by several milestones: the Conferences of Athens, Rome and Naples in 2003, of Brussels in 2006, of Limassol in 2007, and the “Algiers Declaration” of June 2010. Energy cooperation has been launched with neighbouring countries, as has bilateral energy dialogue (with Algeria, Egypt, Syria, etc.). The signature of a Euro–Maghreb Energy Community Treaty is an ongoing objective, as is the development of sub-regional energy markets in the Mashreq region, which could be progressively integrated into the Balkan and EU energy market. Moreover, the EU has aimed to promote energy cooperation between Israel and the Palestinian authority.

In July 2008, the Union for the Mediterranean (UfM) was launched as an upgrade of the Barcelona Process, to “create new dynamism” with a view to revitalising EU relations with neighbouring countries from North Africa and the Middle East. The Mediterranean region is of strategic importance to the European Union in terms of access to resources, and especially regarding the EU’s energy supply diversification strategy. The EU’s priority areas include initiatives of common interest, such as the greater integration of energy markets by completing the Mediterranean electricity and gas rings.

A closer examination of the regions surrounding the Mediterranean, and a comparison between the north and the south, reveals specificities and differences in terms of development, energy structure, population, energy use, consumption and demand.

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14 For more information about the UfM, please see relevant articles provided by Wikipedia, the free encyclopedia
As illustrated hereunder in the statistics table appended to the present introduction (table 1.1), the current differences in development between the north and the south are such that they can be reduced only very progressively. In 2010, the GDP (at purchasing power parity) of the northern Mediterranean EU countries was 2.5 times higher than in the Southern Mediterranean, but 4.7 times higher excluding Turkey. By 2015, these differences should have reduced to 2 times higher and 3.7 times higher respectively, and this trend is likely to continue after 2015.

In terms of energy, the north is basically structured by the existence of the European Union. The south encompasses several areas which can be distinguished according to electrical interconnections and gas corridors:

- In the west, the three Maghreb countries, Algeria, Morocco and Tunisia, are interconnected among themselves and with the European Union. They constitute a region in itself with which specific energy links can be formed.
- In the east, two Power Pools structure the Southern Mediterranean: Turkey and Egypt. They are similar in terms of population but Turkey’s GDP is twice as high as that of Egypt, and the former is already engaged in the EU membership process. The Turkish grid is to be synchronised with that of the Energy Community\(^\text{15}\) in 2011 further to successful testing in 2010.
- From Libya to Syria, the interconnections between the grids of Egypt and Jordan form the South East Pool of the Mediterranean.
- Lebanon and Israel could currently be described as energy islands. This situation could change rapidly for Lebanon since interconnections with Syria are planned for 2011, and it could thereafter be considered as belonging to the South East Pool.

A comparison between the Northern and Southern Mediterranean based on the statistical data presented in the table below (page 26), brings three further aspects to the fore:

- With approximately 200 million people each, the populations of the Northern and Southern Mediterranean (excluding Turkey) are currently roughly the same size, but the Southern Mediterranean is growing approximately 3.6 times faster.
- Energy use per capita is roughly 2.5 times higher in the Northern Mediterranean than in the Southern Mediterranean (with the exceptions of Israel and Libya).
- Electric power consumption per capita in the Northern Mediterranean (6457 kWh) is approximately 3.8 times higher than in the Southern Mediterranean (1704 kWh), 2.9 times higher than in Turkey (2238 kWh), 4.4 times higher than in Syria, Lebanon, Jordan and Egypt altogether (1460 kWh), and 7.4 times higher than in Morocco, Algeria and Tunisia altogether (869 kWh).

In terms of energy demand, according to a survey of the “Plan Bleu”\(^\text{16}\), the Southern Mediterranean will face unprecedented energy pressure between now and 2025. The energy demand growth rate of these countries will be four times that of the European Union.

\(^{15}\) The members of the Energy Community, created on 29 May 2010, are the 27 EU Member States and seven states or territories in the Balkans. The Energy Community is not merely a framework of cooperation but a legally binding instrument to prepare accession to the EU. Ukraine and Turkey are in the process of joining.

\(^{16}\) “Climate change and energy in the Mediterranean” Plan Bleu, Centre d’Activités Régionales, Sophia Antipolis, July 2008
This difference in growth rate reveals a genuine contrast with energy demand in the Northern Mediterranean. According to the Commission\textsuperscript{17}: “The latest update of the "Energy Trends for 2030 – update 2009" based on the PRIMES modelling framework foresees slight growth of primary energy consumption between today and 2030 according to the so-called Baseline scenario, while growth is set to remain largely stable according to the Reference scenario. It should be noted that these projections do not include energy efficiency policies to be implemented from 2010 onwards, a possible step-up of the emission reduction target to -30\% by 2020 or additional transport policies beyond CO\textsuperscript{2} and car emissions regulation. They should therefore rather be seen as upper limits for the expected energy demand [...].

In these scenarios, the share of coal and oil in the overall energy mix declines between today and 2030, while gas demand remains largely stable until 2030. The share of renewable is set to increase significantly, both in primary and final energy consumption, while the contribution of nuclear, at about 14\% of primary energy consumption, is set to remain stable. The EU’s dependency on imported fossil fuels will continue to be high for oil and coal and will increase for gas [...].

The main challenges for electricity infrastructure is growing demand and increasing shares of generation from renewable sources, in addition to additional needs for market integration and security of supply [...]. The share of renewable in gross electricity generation is expected to be around 33\% in 2020 according to the Reference scenario, out of which variable sources (wind and solar) could represent around 16\%”.

North-south differences notwithstanding, the EU has several types of energy links to the Southern Mediterranean.

The Mediterranean Basin is characterised by the “regional pertinence” of its energy interlinks. Indeed, the countries and regions that encircle the Mediterranean Sea are involved in an energy project known as the “Mediterranean Ring” or MEDRING. The objective of the MEDRING Project is to interconnect the countries of the Basin, some of which are EU Member States, through electricity and gas exchanges. Although the Ring is currently broken or interrupted in several places, its completion in the coming years is an ongoing objective\textsuperscript{18}.

On the field, this “pertinence” is demonstrated by the energy networks’ compliance with the guidelines of the Trans-European Energy Networks (now ENTSO), ensuring diversification of supply and energy security. Interoperability between European energy networks and third countries is essential. This is one of MEDRING’s challenges concerning the power grids surrounding the Mediterranean.

The “energy infrastructure package” published in November 2010, and forecast to cost hundreds of billions of euros, is extremely important for the future EU Energy Network. Together with the ENTSO’s (Electricity and Gas) Ten Year Plans, it should revitalise energy network planning and implementation. But how will this affect infrastructure development in the Southern Mediterranean?

One possible outcome is that the energy requirements will require a fully fledged set of infrastructures linking all countries around the Mediterranean Basin. Indeed, this process is already underway and several partnership programmes are in progress.

\textsuperscript{17} "Energy infrastructure priorities for 2020 and beyond" (COM(2010) 677 final), pp 20-21

\textsuperscript{18} Cf. volume II of the Medring Update Report by MED EMIP: "Analysis and Proposals of Solutions for the Closure of the Ring and North-South Electrical Corridors" Final Draft, April 2010
Several south-east Mediterranean countries have already developed strong specific cooperation links with the EU. This is the case of Morocco, which is aiming to further its "advanced status" and is already interconnected with Spain in terms of both electricity and gas, while promoting the most intensive renewable programme of the Southern Mediterranean. Egypt too is a major supplier of LNG to Europe, benefiting from EU budgetary support for energy (as does Morocco). Furthermore, Turkey plays a strategic role as a transit country. Other countries in the South-East Mediterranean are also worth being considered (Algeria, Tunisia and Jordan for instance).

According to the “New Energy Strategy for Europe 2011-2020”, three priorities should shape the implementation of an EU energy strategy in the Southern Mediterranean:

1) Moving towards a low carbon energy system to face the challenges of climate change, implying, amongst others:
   - The promotion of energy efficiency and renewable energy (the 20–20–20 initiative);
   - An increased penetration of natural gas;
   - Innovation and technology;
   - Carbon capture and storage.

2) Modern integrated grids to face the challenge of strengthening European energy security, since on the one hand, energy imports, mainly oil and gas, are rising, and on the other hand, pan-European electricity and gas interconnections still need to be strengthened. Electricity and gas networks in Europe need to be improved in order to:
   - cope with the fully fledged production of renewable, and the resultant increase in decentralised power production;
   - diversify and strengthen EU gas supply by building new import pipelines and managing LNG development. This would involve building liquefaction and regasification facilities, and ensuring the existence of maritime routes from supply areas to EU importers.

3) A strong and coordinated external energy policy, related not only to the need to increase coordination with Member States, but also to the deployment and enforcement of a genuine EU external energy policy. As underlined by European Energy Commissioner, Mr Oettinger19, “Despite a possible doubling of energy demand in developing countries in the next twenty years and despite threats or actual cuts in gas and oil imports, there is still no common external approach towards suppliers or transit countries”.

In the Southern Mediterranean, the challenge is to design and enforce integrated systems with emerging or developing countries – some of which are already or are becoming the next energy suppliers – requiring a larger share of the world’s energy resources to sustain their economic and demographic growth.

The specific involvement of Mediterranean EU Member States will help shape an efficient EU energy strategy towards Southern Mediterranean countries. Their solidarity is a stated objective. These countries, mainly Spain, France, Italy, Greece and Cyprus, are currently directly involved in setting up new energy routes between the northern, southern and eastern shores of the Mediterranean, to which non-Mediterranean EU Member States are also linked through electricity and gas interconnections.

19 Speech at the European Energy Forum debate, Strasbourg, 19 October 2010
In consideration of the above factors, the present study is structured in three parts:

I. In section 2, an assessment is made of existing infrastructures guiding the forecast of possible links between MEDRING countries by 2020 and beyond;

II. In section 3, existing policies are assessed and analysed, concerning:
   – the electricity sector: SEM Power Pools, renewable energy and energy efficiency, and the development of regional interconnections.
   – the gas sector: the security of gas supply, pricing and contract types, alternative pipelines or LNG.

III. In section 4, recommendations are proposed on the basis of the preceding chapters.
Table 1.1. Statistical data on the Mediterranean EU Member States and southern Mediterranean countries

<table>
<thead>
<tr>
<th>COUNTRIES</th>
<th>POPULATION million</th>
<th>GDP* PPP Billion current int'l $</th>
<th>ENERGY USE (kg of oil equivalent per capita)</th>
<th>GDP per unit of energy use PPP $ per kg of oil-equ</th>
<th>Electric Power Consumption (kWh per capita)</th>
<th>Electricity Production in %</th>
<th>NET ENERGY IMPORTS (% of energy use)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PORTUGAL</td>
<td>10.67</td>
<td>2010: 10.74, 2015: 10.74</td>
<td>234.95, 271.43</td>
<td>2363</td>
<td>4860</td>
<td>26%</td>
<td>10% 28% 0% 22% 82%</td>
</tr>
<tr>
<td>SPAIN</td>
<td>46.02</td>
<td>2010: 46.57, 2015: 46.57</td>
<td>1364.36, 1606.94</td>
<td>3208</td>
<td>6296</td>
<td>n.a.</td>
<td>6% 31% 18% 9% 79%</td>
</tr>
<tr>
<td>FRANCE</td>
<td>62.92</td>
<td>2010: 64.38, 2015: 64.38</td>
<td>2155.05, 2606.95</td>
<td>4258</td>
<td>7772</td>
<td>5%</td>
<td>1% 4% 78% 10% 49%</td>
</tr>
<tr>
<td>ITALY</td>
<td>60.21</td>
<td>2010: 62.11, 2015: 62.11</td>
<td>1766.87, 2063.55</td>
<td>3001</td>
<td>5713</td>
<td>16%</td>
<td>11% 56% 0% 11% 85%</td>
</tr>
<tr>
<td>SLOVENIA</td>
<td>2.02</td>
<td>2010: 2.03, 2015: 2.03</td>
<td>56.76, 72.22</td>
<td>3632</td>
<td>7138</td>
<td>36%</td>
<td>0% 3% 38% 22% 53%</td>
</tr>
<tr>
<td>GREECE</td>
<td>11.19</td>
<td>2010: 11.24, 2015: 11.24</td>
<td>329.11, 366.52</td>
<td>2875</td>
<td>5628</td>
<td>55%</td>
<td>13% 22% 0% 4% 62%</td>
</tr>
<tr>
<td>CYPRUS</td>
<td>0.82</td>
<td>2010: 0.89, 2015: 0.89</td>
<td>22.75, 28.62</td>
<td>2854</td>
<td>5441</td>
<td>0%</td>
<td>99.9% 0% 0% 0% 97%</td>
</tr>
<tr>
<td>MALTA</td>
<td>0.42</td>
<td>2010: 0.44, 2015: 0.44</td>
<td>9.93, 12.22</td>
<td>2120</td>
<td>4865</td>
<td>0%</td>
<td>100% 0% 0% 0% 100%</td>
</tr>
<tr>
<td>TOTAL EU North Mediterranean</td>
<td>194.27</td>
<td>2010: 198.40, 2015: 201.40</td>
<td>6039.78, 7028.45</td>
<td>3419</td>
<td>6457</td>
<td>28%</td>
<td>3% 50% 0% 19% 73%</td>
</tr>
<tr>
<td>TURKEY</td>
<td>71.43</td>
<td>2010: 76.05, 2015: 76.20</td>
<td>932.20, 1224.48</td>
<td>1370</td>
<td>2238</td>
<td>0%</td>
<td>60% 31% 0% 9% -24%</td>
</tr>
<tr>
<td>SYRIA**</td>
<td>20.08</td>
<td>2010: 20.58, 2015: 20.58</td>
<td>105.36, 139.01</td>
<td>978</td>
<td>1469</td>
<td>0%</td>
<td>94% 0% 0% 6% 95%</td>
</tr>
<tr>
<td>LEBANON</td>
<td>3.91</td>
<td>2010: 4.17, 2015: 4.17</td>
<td>58.57, 79.37</td>
<td>959</td>
<td>2154</td>
<td>0%</td>
<td>94% 0% 0% 6% 95%</td>
</tr>
<tr>
<td>ISRAEL</td>
<td>7.43</td>
<td>2010: 8.29, 2015: 8.29</td>
<td>214.51, 281.71</td>
<td>3059</td>
<td>7002</td>
<td>70%</td>
<td>11% 20% 0% 0% 88%</td>
</tr>
<tr>
<td>WEST BANK GAZA</td>
<td>3.83</td>
<td>2010: 3.93, 2015: n.a.</td>
<td>n.a., n.a.</td>
<td>n.a.</td>
<td>n.a.</td>
<td>n.a.</td>
<td>n.a. 0% n.a. n.a. n.a.</td>
</tr>
<tr>
<td>JORDAN</td>
<td>6.13</td>
<td>2010: 6.86, 2015: 6.86</td>
<td>35.28, 49.67</td>
<td>1259</td>
<td>1956</td>
<td>0%</td>
<td>23% 77% 0% 0% 96%</td>
</tr>
<tr>
<td>EGYPT</td>
<td>78.24</td>
<td>2010: 86.38, 2015: 86.38</td>
<td>496.60, 725.22</td>
<td>859</td>
<td>1384</td>
<td>0%</td>
<td>19% 68% 0% 12% -22%</td>
</tr>
<tr>
<td>LIBYA</td>
<td>6.46</td>
<td>2010: 7.13, 2015: 7.14</td>
<td>96.14, 147.26</td>
<td>2889</td>
<td>3871</td>
<td>0%</td>
<td>55% 45% 0% 0% -470%</td>
</tr>
<tr>
<td>TUNISIA</td>
<td>10.53</td>
<td>2010: 11.07, 2015: 11.07</td>
<td>90.15, 128.63</td>
<td>864</td>
<td>1248</td>
<td>0%</td>
<td>16% 83% 0% 0% 11%</td>
</tr>
<tr>
<td>ALGERIA</td>
<td>35.50</td>
<td>2010: 38.25, 2015: 38.25</td>
<td>252.93, 339.04</td>
<td>1089</td>
<td>902</td>
<td>0%</td>
<td>2% 97% 0% 1% -346%</td>
</tr>
<tr>
<td>MOROCCO</td>
<td>31.97</td>
<td>2010: 33.35, 2015: 33.35</td>
<td>151.72, 210.57</td>
<td>460</td>
<td>707</td>
<td>57%</td>
<td>22% 14% 0% 6% 95%</td>
</tr>
<tr>
<td>TOTAL South Mediterranean</td>
<td>275.51</td>
<td>2010: 296.06, 2015: 296.06</td>
<td>2433.46, 3374.63</td>
<td>1351</td>
<td>1704</td>
<td>0%</td>
<td>0% 0% 0% 0% 0%</td>
</tr>
<tr>
<td>Without Turkey, Israel and West Bank-Gaza</td>
<td>196.65</td>
<td>2010: 211.72, 2015: 211.72</td>
<td>1286.75, 1868.44</td>
<td>1278</td>
<td>1302</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*PPP GDP is gross domestic product converted to international dollars using purchasing power parity rates. Data are in current international dollars. An international dollar has the same purchasing power over GDP as the US dollar has in the United States.

**Syria: own estimation based on 2008 PPP GDP in current international $ = 94.31 billion, and the continuation of the growth trend between 2004 and 2008 = + 5.7 % per annum.

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20 Taken from the World Bank – International Monetary Fund [www.Tradingeconomics.com](http://www.Tradingeconomics.com) at the end of 2010 (the data are continuously updated)
2. STATE OF PLAY AND POTENTIAL FOR THE FURTHER DEVELOPMENT OF ENERGY INFRASTRUCTURE

2.1. Introduction

Infrastructure development in the Southern Mediterranean is linked to the intensification of exchanges with the north and between countries of the south. Such development is necessary to meet the energy demand spurred by the demographic growth in the south, and the need for better living conditions.

Another current major driving factor is the European Union’s energy import requirements.

As stated by the Directorate General for Energy of the European Union in November 2010: “Delivering the energy infrastructures that Europe needs in the next two decades requires a completely new infrastructure policy based on a European vision. [...]”

The Commission proposes a new method which includes the following steps:

- Identify the energy infrastructure map leading towards a European smart supergrid interconnecting networks at continental level.
- Focus on a limited number of European priorities which must be implemented by 2020 to meet the long-term objectives and where European action is most warranted.
- Based on an agreed methodology, identification of concrete projects necessary to implement these priorities – declared as projects of European interest – in a flexible manner and building on regional cooperation so as to respond to changing market conditions and technology development.”

The European energy infrastructure priorities for electricity and gas involving southern Mediterranean countries are the following:

- South-west electricity interconnections involving Morocco, Algeria and Tunisia on the one hand, and Portugal, Spain, France and Italy on the other;
- Central south-eastern electricity connections involving EU Member States from Germany to Bulgaria and Romania, and consequently the interconnection with Turkey;
- The north-south gas corridor in western Europe involving gas suppliers, Spain, France, Benelux and the United Kingdom;
- The north-south gas corridor in eastern Europe linking the Baltic, Adriatic, Aegean and Black seas;
- The southern gas corridor involving south-east EU Member States, south-east Mediterranean countries, and Near Eastern countries.

Among these priorities, the first and last should require special attention within the scope of this study. In particular, the first priority concerns:

“Interconnections in South Western Europe to accommodate wind, hydro and solar, in particular between the Iberian Peninsula and France, and further connecting with Central Europe, to make best use of Northern African renewable energy sources and the existing infrastructure between North Africa and Europe.”

The increasing shares of renewable energy are a genuine challenge for electricity infrastructures due to intermittent generation and storage capacity problems. The focus on North Africa and its integration into the Western Mediterranean Power Block should be considered carefully and analysed in the context of building up the Mediterranean Electricity Ring.

21 Energy infrastructure priorities for 2020 and beyond - Blueprint for an integrated European energy network (p. 9)
22 See Map 2.1 Priority corridors for electricity, gas and oil, in section 3.1.
2.2. Routes, infrastructures and interconnections in the electricity sector

2.2.1. The MEDRING concept

The purpose of the Mediterranean Electricity Ring is to promote the coherent development of interconnections between the power systems of the Mediterranean Basin. The interconnection system must be reliable and aim to match electricity demand with electricity generation in each country surrounding the Mediterranean Sea, and beyond in so far as these countries are interconnected with other power systems, as is the case in the European Union.

The Mediterranean grid is intended to connect various electric corridors in technical compliance with agreed standards, and with the necessity of being synchronised. This obligation raises numerous problems, from adopting compatible grid codes to setting up electric lines in each country with sufficient long-distance capacity, as distances along sea shores can be considerable (in the case of Libya, 2,500 km from the Tunisian border to the Egyptian border). While interconnections in the north could be completed through the creation of a supergrid in the EU in the coming years, they are fragmented in the Southern Mediterranean, as shown in the following diagrams.

Figure 2.1: MEDRING: Annual energy exchanges, physical values in GWh (2008)
A comparison between South Mediterranean energy exchanges and North Mediterranean energy exchanges highlights the limitations of the former. The performance of power systems is clearly much lower in the south\textsuperscript{23} than in the north. The reasons for this will be analysed in chapter 3. However, the following statement made by the authors of the MEDRING Update MED EMIP Report\textsuperscript{24} can already provide a better understanding of this situation:

“In some cases poor energy exchanges are not only due to the limited capacity of the interconnections or constraints inside the countries. Rather, a lack of commercial agreements and commercial benefits hinders larger energy flows. Interconnections are mainly exploited for mutual aid with remuneration in kind, but new agreements for energy exchanges are emerging. In particular, commercial agreements are in place between Egypt and Jordan for energy import from Egypt and, more recently (since 2007), Egypt started exporting power to Syria (200-270 GWh/yr). The agreement of power export from Egypt to Syria implies a transit across Jordan. Hence, a scheme for the remuneration of the Jordanian TSO (NEPCO) had to be put in place” [...] .

Improving the MEDRING in order to increase electricity exports/imports is an ongoing issue. According to the MEDRING Update Report (volume II, final draft, April 2010), the Ring should be completed with submarine lines directly linking the Northern and Southern Mediterranean, and closed before 2020, as broadly forecast in map 1.1 on the following page.

For the time being, several projects are in progress in order to increase the capacity of the only interconnection through the straits of Gibraltar with a third line.

**Map 2.1: Possible corridors for exporting power from SEMC to EU countries**

![Map 2.1](image)

The bubble to the west represents the Maghreb electrical system, disconnected from the Mashreq electrical system in the east, due to the Libya cut

*Source:* MEEDDAT-France, prepared by CESI, MEDRING Vol. II p. 64

The most advanced projects connecting the South and North-Western Mediterranean power block are described/analysed in the following chapters.

\textsuperscript{23} Note: The transmission system of the South East Mediterranean countries is based on several voltage levels:
- Extra high voltage (EHV): 500 kV (only in Egypt), 400 kV and 220 kV in almost all the other countries;
- High voltage (HV): 161 kV (Israel only); 154 kV (Turkey only); 150 kV; 132 kV; 110 kV and 90 kV.

\textsuperscript{24} Vol. I p. 64
2.2.2. Interconnections in the South and North-Western Mediterranean power block

This region is synchronised and complies with ENTSO-E/SCR standards.

2.2.2.1. The North African grid and Gibraltar connection

(A) Morocco-Spain interconnection

The first interconnection between Morocco and Spain was put on stream in August 1997. The maximum capacity that could be conveyed was 700 megawatts (MW). However, the operation of the Morocco-Spain interconnection faced security issues concerning the Moroccan and Spanish networks, as transit capacity in permanent mode was limited to 400 MW.

The installation of new underwater cables and reinforcement of the network made it possible to increase the transit capacity. With the implementation of a second interconnection in the summer of 2006, transit capacity was increased to 700 MW. When the techno-economic conditions so allow, it is envisaged to install a third line which will increase transit capacity up to 2,100 MW.

The possibility of exchanging electrical energy with Spain (mainly imports from Spain) has been an interesting opportunity for Morocco due to the inability of Moroccan supply to satisfy the growing national electricity demand. On average, imports from Spain have accounted for almost 14% of demand since 1999, accounting for 15.5% in 2007 and approximately 18% in 2009 (4,595 Gigawatt hours- GWh).

In 1999, the Moroccan Office National de l’Electricité (ONE) integrated the Spanish market as an external player. At first, ONE imported electricity through direct negotiations but since 2003, energy purchases and sales have been conducted on the Spanish exchange market, MIBEL (Mercado Iberico de Electricidad).

(B) Interconnection of the Maghreb networks through several stages

The interconnections between Algeria and Tunisia date back to the 1950s. There are currently five lines:

- 90 kV from Tajerouine in Tunisia to El Aouinet in Algeria, in service since 1952
- 90 kV from Fernana in Tunisia to El Kala in Algeria, in service since 1955
- 225 kV from Tajerouine in Tunisia to El Aouinet in Algeria, in service since 1980
- 150 kV from Metlaoui in Tunisia to Djebel Onk in Algeria, in service since 1984
- 400 kV from Mornaguia in Tunisia to Chefia in Algeria, in service since 2010.

The interconnections between Morocco and Algeria date back to 1988 and 1992 (implementation of two 220 kV lines from Oujda, Morocco: the first towards Ghazaouet, Algeria, the second towards Tlemcen, Algeria). In September 2009 then April 2010, two 400 kV lines between Bourdim in Morocco and Hassi Ameur in Algeria were put on stream. The exchanges are always in the form of “mutual aid”. In 2009, the net balance was 36 GWh in favour of Morocco (+ 252 GWh, - 216 GWh).

There are two 225 kV interconnections between Tunisia and Libya: one between Médénine in Tunisia and Abou Kammach in Libya (double circuit), the other between Tataouine in Tunisia and Rowis in Libya (individual circuit). Synchronisation tests with the Union for the Coordination of the Transmission of Electricity (UCTE) have failed to date, with the last test being conducted in April 2010. A 400 kV interconnection connecting Rowis in Libya to Mornaguia in Tunisia, is however envisaged for around 2015. If synchronisation with the Tunisian grid is successful, it will mean that interconnection is achieved between the West and East Southern Mediterranean through the Egyptian electrical system, which is already interconnected with Libya and the Mashreq.
The doubling of the Morocco–Spain interconnection and completion of the 400 kV shoreline line between Morocco and Tunisia in 2009–2010, has brought the Maghreb interconnected system one step forward.

(C) Electric interconnections in the Maghreb

These interconnections, which have changed little in 2010 compared to 2008, can be presented as follows.

Figure 2.2: Electric interconnections in the Maghreb (as at 2008)

Since 2008, the only change has been the completion in 2010 of the coastal line linking Algeria (Chefia) to Tunisia (Mornaguia).

2.2.2.2. Portugal–Spain interconnection with France

The border between France and Spain is among the most heavily congested in Europe. The interconnection capacity between France and Spain is currently insufficient with only four tie-lines (two of 220 kV and two of 400 kV) and very low transfer capacity levels (300-500 MW from Spain to France and 1100-1400 MW from France to Spain).

Yet these countries play a key role in connecting to Northern Africa, which could become increasingly important due to its huge potential for solar energy.

Moreover, Spain and Portugal are already involved in producing considerable amounts of renewable solar and wind energy, and France and Italy will host major developments in renewable electricity generation capacities over the coming decade.

With a view to avoiding future congestion, a new 400 kV line in the eastern Pyrenees is scheduled to be ready by 2014, increasing the current interconnection capacity from 1,400 MW to approximately 2,800 MW in the short term and 4000 MW in the long term, with a new interconnection line.

2.2.2.3. Interconnections with Italy

Enhanced net transfer capacity (NTC) at the France–Italy border will be achieved in the long term by developing a new high voltage direct current (HVDC) interconnection (1000 MW). Investigations are being conducted for future interconnections between Italy, Malta
(supported by the European Economic Recovery Programme), Croatia, Montenegro and Albania in the short–medium term.

Italy is already interconnected with Greece, increasing the Greek system’s reliability. The possibility of a second DC link enhancing the transfer capacity from 500 MW to 1000 MW is under consideration.

### 2.2.3. Interconnections in the South East Mediterranean countries

#### 2.2.3.1. From Libya to Syria

While Libya, Egypt, Jordan, Syria and Lebanon are interconnected, only Libya, Egypt, Jordan and Syria are operated synchronously. Energy exchanges are poor and “mutual aid” is the rule, as in the Maghreb countries.

**Libya–Egypt:**

This interconnection is composed of a 220 kV double circuit overhead line (OHL). Energy exchanges are based on commercial agreements. However, any expansion of commercial exchanges is hindered by the limited net transfer capacity (NTC) of the interconnections, in addition, in some cases, to a lack of surplus generation. In fact, the Libyan system is very long (2,500 km) but still not very powerful. In contrast, the Egyptian power system is by far the most important in the region. According to specialists, an asynchronous DC link located somewhere at the Libyan borders should be considered. The interconnection is to be reinforced by a new extra high voltage (EHV) line of 500 kV on the Egyptian side and of 400 kV on the Libyan side. Its commissioning is envisaged for the year 2015.

**Egypt–Jordan:**

In operation since October 1998, this interconnection consists of a 400 kV alternating current (AC) single circuit submarine cable (13 km) across the Red Sea between Taba (Egypt) and Aqaba (Jordan). It is expected to be reinforced in order to double the interconnection capacity up to 1100 MW.

**Jordan–Syria:**

Both countries are currently interconnected by a 400 kV AC single circuit 217 km OHL. It is envisaged to double this interconnection between Syria’s and Jordan’s grids (from 350 to 700 MW in commercial capacity) in the future.

**Syria–Lebanon:**

Both countries are currently linked through two AC lines from Tartous (Syria) to Deir Nebouh (Lebanon). These lines are used to supply electricity to Lebanon in “islanded” operation only. The rest of the Lebanese system is still separated from the other Mashreq countries.

#### 2.2.3.2. Israel and Palestine

As noted in Table 0.1 (page 26), electric power consumption per capita in Israel (7002 kilowatt-hours [kWh]) is the highest across the Southern Mediterranean, and is high even by European standards.

Israel’s electrical system runs in “islanded” mode. No information could be obtained on interconnection with the Gaza Strip and West Bank.

**Egypt–Gaza:**

Egypt is interconnected with the Gaza Strip through a 22 kV line supplying power to the southern part of the Gaza Strip.
There are plans to fully connect the Gaza Strip to the Egyptian network through a project financed by the Islamic Development Fund. Once decided, the line from El-Areesh (Egypt) would provide 150 MW to Gaza.

**Jordan-Palestinian Territories (West Bank):**

The interconnection between the Palestinian Territories and Jordan consists of a 30 km, 132 kV double circuit OHL. A new 400 kV between the two countries is envisaged in order to supply power to the West Bank. The line’s commissioning is scheduled for the beginning of 2013.

**2.2.3.3. Turkey: interconnection with Eastern Europe**

Located between Europe, the Middle East and the Black Sea (Caucasus), Turkey is strategically important. In the long run, Turkey’s power system could act as a bridge.

**Map 2.2: Interconnections between Turkey and neighbouring countries**

Turkey is already interconnected with European Member States. Turkey’s objective is to achieve interconnection with the ENTSO-E/SCR (European Network of Transmission System Operators for Electricity/Synchronous Continental Region) to benefit from synchronous parallel operation and the integration of the Turkish electricity market into the EU’s internal electricity market. Measures to improve the dynamic performance of the Turkish system are being undertaken to ensure full compliance with ENTSO-E/SCR standards.

Synchronisation with the ENTSO-E/SCR through three lines to Greece and Bulgaria (completed in 2007 and in the summer of 2008 for each of the 400 kV lines) provides the necessary technical conditions for importing/exporting significant amounts of electricity. The net transfer capacity (NTC) for import to Turkey is within the range of 800–1300 MW, while NTC for export from Turkey is within the range of 1000–1100 MW. The lines will be put into operation when the synchronous connection of Turkey to ENTSO-E/SCR is possible (2012).
As stated by the European Commission\textsuperscript{25}: “The extension of the synchronous zone from Greece (and later Bulgaria) to Turkey will create additional needs for reinforcement of the grids in these countries”.

Several cross-border lines are planned in south-east Europe to remedy the currently fragmented and non-optimised structure of the transmission grid in this region. All the reinforcements are based on 400 kV AC overhead lines. However, in the long-term (2018), a 400 kV Constanta (RO)-Pasakoy (TR) HVDC submarine cable across the Black Sea is planned to interconnect with Romania.

**Turkey–Syria**

Both countries are currently connected through a 124 km, 400 kV single circuit line from Birecik, Turkey to Aleppo, Syria, and local power generation in Turkey was commissioned in 2007. The line operates for local power exchanges from Turkey to Syria, but the two grids are not synchronised.

As explained by the MEDRING Report (April 2010): “One condition set by ENTSO-E for the synchronisation with Turkey is its permanent disconnection from neighbouring countries; thus, a possible synchronisation of Turkey with Syria, and consequently the whole Mashreq-Libya pool is unlikely in the midterm”\textsuperscript{26}.

### 2.2.4. Prospects up to 2020 and beyond

According to the EU Energy Infrastructure Priorities for 2020:

“By 2020, about 10 GW of new renewable generation could be built in the countries east and south of the Mediterranean, out of which almost 60\% solar and 40\% wind capacities. However, as of today, there is only one interconnection between the African and the European continent (Morocco-Spain) with about 1,400 MW capacity, which could be increased to 2,100 MW in the coming years. A direct current submarine 1,000 MW power line is being planned between Tunisia and Italy, to be operational by 2017. The use of these existing and new interconnections will create new challenges in the medium term (after 2020) with regard to their consistency with the evolutions of the European and North African network, both as regards their capacity and the corresponding regulatory framework. Any further interconnection must be accompanied by safeguards to prevent risks of carbon leakage through power imports to increase”\textsuperscript{27}.

In the same Report, several actions are therefore recommended concerning interconnections in the South West Mediterranean, which are the most feasible in the Basin, in order to ensure the integration of new capacities in South West Europe, mainly from renewable energy, and their transmission to other parts of Europe:

- “An interconnection capacity of at least 4,000 MW between the Iberian Peninsula and France will be needed by 2020.
- The development of Italy's connections with countries of the Energy Community, the realisation of the Tunisia-Italy interconnection, the expansion of the Spain-Morocco interconnector, the reinforcement, where necessary, of South-South interconnections in North African neighbour countries [...] and preparatory studies for additional North-South interconnections to be developed after 2020”\textsuperscript{28}.

\textsuperscript{25} COM(2010)677 final, Energy Infrastructures Priorities for 2020 and beyond, p. 30

\textsuperscript{26} MEDRING Update Report Volume II April 2010, page 37. As underlined and developed in the Report: “Problems to be overcome [...] are related to the different technical performances of the various blocs, especially as for their behavior in dynamic conditions. Main problems [...] are related to:
- frequency regulation [...];
- inter-area oscillations.”.

\textsuperscript{27} COM(2010)677 final, Energy Infrastructure Priorities for 2020 and beyond

\textsuperscript{28} Idem.
2.2.4.1. Interconnections between the North West Mediterranean region and the South West Mediterranean region

Algeria envisages developing two interconnections using DC submarine cables (400/500 kV, 230 to 350 km-long depending on route and water depth), towards Spain (Terga-Almeria) and Italy, either by a through line (El Hadjar-Latina, 100 MW) or via southern Sardinia (500 MW).

The interconnection project between Tunisia and Italy known as ELMED after the joint Italy-Tunisia venture set up in April 2009, envisages the construction of a 1,000 MW thermal power plant (gas- or coal-fired) at El Haouaria, and the construction of a 195 km, 1,000 MW power line (including a 800 MW HVDC export submarine cable to Sicily). The project would not come on stream before 2016. This interconnection would be complemented by a 400 kV interconnection line from Mornaguia in Tunisia connected to the Maghreb inter-connected network, to Spain and El Haouaria, the starting point of the line, to Italy.

The Tunisia ELMED project is designed in the following manner:

- It is a market-based project: production of 1,200 MW in Tunisia through mixed conventional/renewable sources, as decided by the market;
- It is a new market structure in North Africa: 80 % of the plant’s capacity is reserved for export investors;
- The remaining capacity is open, and could be used for trading “green energy” between the Maghreb and Italy;
- The interconnector will be developed in two stages (400/500 MW in the first stage and an additional 500 MW in the second stage). For the second stage to become operational, the Sicilian grid will need to be reinforced. The final configuration will be bipolar at ± 400 kV DC.

Note: It is likely that a feasibility study has been completed for HVDC south-north interconnection projects for a line between Libya and Sicily, but no details are currently available.

According to a special expert study conducted for the Maghreb electricity market integration (IMME) project, by 2020, exchange capacities in the Maghreb through the 400 kV coast line are expected to be:

- Morocco-Spain 1,400 MW
- Morocco-Algeria 1,400 MW (n lines)
- Algeria-Tunisia 800 MW (n lines)
- Algeria-Spain 1,200 MW (DC)
- Algeria-Italy 1200 MW
- Tunisia-Italy 800 MW (DC)

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29 Information provided by Eng. Michelangelo Celozzi, Representative of Terna for North Africa and Co-Director of ELMED. The ELMED project will consist of 1200 MW capacity power generation, 800 MW of which will be reserved for export to Italy through an interconnection with a capacity of approximately 1 000 MW.

30 Source: Study report No. 14, "Economic benefits of the reinforcement of cooperation in Maghreb" April 2010; IMME, Algiers
2.2.4.2. Closing the MEDRING or developing South-North Corridors

(A) Installing dedicated power export corridors across the Mediterranean Sea in order to increase power exchanges for commercial or energy security reasons is most feasible in the western part of the ring. However, the fragmentation of the electricity ring into four separate pools raises the question of the power systems’ integration, and of solidarity among south Mediterranean countries akin to that of north. The grids’ optimisation is also at stake.

Closure of the two interconnection lines between Tunisia and Libya (Abou Kamesh-Mednine 2x220 kV and Rowis-Tataouine 1x220 kV) would have created a synchronous AC system from Spain to Syria, between the TAM (Tunisia, Algeria, Morocco) and the LEJS (Libya, Egypt, Jordan and Syria) system. However, after a first unsuccessful trial in 2005, a second trial in spring 2010 also failed.

As stated above, Turkey’s interconnections are directed firstly to the north rather than the south.

Two more cut-sets therefore remain open: Tunisia-Libya and Syria-Turkey. Instead of connecting Tunisia to Libya then to the Mashreq grid using a full alternating current (AC) solution as previously attempted, the option of closing the Mediterranean Electricity Ring by using direct current (DC) technology should be examined, even if costly. As recommended by the MEDRING Update Report, the investment effort could be distributed among “the concerned parties”.

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31 On the complex issue of competition between AC and DC (known as the “War of Currents”), see the "High Voltage Direct Current" article for the general public on Wikipedia, the free encyclopedia http://en.wikipedia.org/wiki/High-voltage_direct_current
Moreover, as stated in the MEDRING Update Report, “Coordinated transmission grid planning needs to be ensured for a successful closure of the Ring. When selecting the optimal development plans of the transmission grids, particularly in the cross-border regions, the adoption of coordinated planning procedures is of the utmost importance”\textsuperscript{32}. Cross-border trading of electricity should follow common rules such as:

- Inter-TSO compensation mechanisms;
- Rules for capacity allocation and congestion management.

Concerning these issues, the completion of the IMME project in the Maghreb power pool in June 2010 may be considered as the greatest progress in the Southern Mediterranean, and its lessons could be disseminated.

In other respects, it would appear that the Mediterranean Electricity Ring is currently more of an idea than an ongoing reality, and the question of what should be done for its closure could remain unanswered for quite some time, far beyond 2020.

(B) To achieve the closure of the Ring, the most commonly presented projects are south-north interconnectors and HVDC corridor lines across the sea, including the reinforcement of the Gibraltar interconnection. The amount of power (in terms of GW) to be exchanged between the South East Mediterranean countries (SEMCs) and EU Member States as envisaged in the Mediterranean Solar Plan (MSP), requires a dramatic change in the development of new HVDC corridors across the Mediterranean Sea.

However, to optimise the investment costs, the number of corridors should be minimised, thus maximising the rating of each interconnector.

In the last update of the MEDRING Report concerning electricity (April 2010), the experts addressed the issue of closure of the south-north HVDC corridors. In North Africa as in the SEMCs, the systems are interconnected by AC lines. The failure of the Tunisia-Libya interconnection raised the question of setting up DC lines in some parts of the Ring. The experts of the Euro-Mediterranean Energy Market Integration Project (MED EMIP) made a first statement on this problem: “The possibility of closing the Mediterranean Energy Ring utilising also DC technology needs further investigation, a dedicated study should be undertaken to explore the feasibility of such an option. The study should aim at re-evaluating the assumptions adopted and results obtained in the former MEDRING study, launched ten years ago”\textsuperscript{33}.

The authors of this report also consider that the MED EMIP experts’ final recommendations concerning submarine routes for the south-north corridors and the selection and design of the HVDC links, could be enlightening and useful for the future. These recommendations include carrying out the following in-depth studies:

- “A technical analysis targeted at identifying the optimal sending and receiving ends of the new corridors, as well as their size and the required reinforcements in the transmission grids on land […]
- An environmental study providing an accurate analysis of the morphology of the Mediterranean Sea depth to assess the most viable submarine interconnection alternatives […]

\textsuperscript{32} MEDRING Update Report p. 86
\textsuperscript{33} MEDRING Report Vol. II p. 59
• A technological survey: since the new south-north corridors envisaged in the MSP are scheduled to be deployed in the coming decade (the target horizon is the year 2020), it is extremely important to anticipate the perspective developments in HVDC technology, particularly regarding high depth submarine power cables [...] 

• Economic analyses helping to highlight the profitability of the new corridors, thus fostering the attraction of the investments, which can - at a first glance - be estimated to be in the order of a billion euros per corridor [...] 

• Regulatory and legal issues: an adequate distribution of the investment burden needs to be guaranteed between all the beneficiary countries [...]34. 

As emphasised by the MED EMIP experts: “full support at the national and international political level is a "sine qua non" requirement to achieve progress towards the infrastructures foreseen in the framework of the MSP”35.

The closure of the Mediterranean Electricity Ring is therefore a genuine challenge for the years to come.

It will come into the EU strategy for restructuring, expanding and reinforcing the European grid. To this end, ENTSO-E recently published a “Pilot Ten-Year Network Development Plan” (TYNDP) which “will be the basis for seeking consistency with national and regional plans when the Third Package is enforced in early 2011”. The south-west and south-east European regional plans will have to take into account possible future imports of “green” electricity from the Southern Mediterranean, in line with the implementation of the Mediterranean Solar Plan.

In this perspective, it is worth quoting the ENTSO-E’s TYNDP: “The future European power grid will probably be connected to neighbouring systems at its Southern and Eastern borders, extending in particular from north of the polar circle to the Sahara with a close network both onshore as today, but also offshore. Such a change of scale, with a large amount of climate dependent RES will induce new operational limitations to mitigate disturbance over a wide perimeter and require reinforcements of existing high voltage networks onshore”36.

2.2.5. Final remark

As a general remark based on the above information on electricity infrastructures in and around the Mediterranean Basin, it can be considered that the absence or weakness of west-east (horizontal) cooperation in the Southern Mediterranean favours south-north (vertical) cooperation. This well known issue of poor development should be considered as a challenge for development cooperation between the Northern and Southern Mediterranean, rather than inevitability.

34 MEDRING Report Vol II pp. 83–84
35 Idem.
36 ENTSO-E’s TYNDP (Executive Summary, p. 11)
2.3. Gas routes and infrastructures

2.3.1. EU-MED gas demand in 2009

Primary gas demand

In 2009, the overall primary energy consumption of the European Union (EU-27) reached 1,665 million tons of oil equivalent (mmtoe)\(^\text{37}\). The six gas-using EU-MED countries\(^\text{38}\) consumed 617 mmtoe, i.e. 37\% of the energy demand of the EU, with 141 mmtoe of natural gas accounting for 23\% of this demand, a figure slightly below that observed in the EU-27 (25\%).

Energy demand dropped sharply in 2009 as a direct consequence of the economic downturn. In 2009, gas demand in the EU-27 decreased by 5.8\% compared to 2008, slightly above the overall energy slump of 5.5\%, which enabled gas to keep a relatively stable market share. While the consumption of the residential and service markets remained stable, in part due to harsher weather conditions, industrial demand and gas input for power generation suffered significantly.

Gas production

EU Mediterranean countries are far from being endowed with substantial gas reserves. Four of them (Portugal, Slovenia, Cyprus and Malta) have no reserves whatsoever. Spain’s small reserves in the Pyrenean piedmont and the Gulf of Viscaya are now depleted, and very limited production continues in south-west Andalucía. Greece’s production does not exceed 10 million cubic meters per annum. In France, production from the Lacq field has been maintained afloat for social and local reasons but is expected to be shut down by 2013. Only Italy still enjoys substantial domestic production, which accounts for 10\% of its current demand. However, production has been decreasing rapidly since it peaked at 18 billion cubic meters (bcm) in the mid-1990s, and was below 8 bcm in 2009.

As a result, the contribution of EU-MED countries to the European Union’s gas production is close to negligible, accounting for no more than 5\% of the 153 mmtoe produced by the EU in 2009.

Gas imports

All EU-MED gas countries therefore rely to a very large extent on imports to meet their gas demand. Indeed, with the exception of Italy, they all import the totality or near-totality of their requirements. Gas imports to the EU-MED countries amounted to 135 mmtoe in 2009, representing half of the total gas imports of the European Union (266 mmtoe).

The dependence rate is therefore very high (95\%), much higher than the average for the EU-27 (64\%).

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\(^{37}\) The figures in this section come from Eurostat, Statistics in Focus 43/2010, unless otherwise stated. They are expressed in tons of oil equivalent (toe). A commonly admitted conversion factor is 1 toe = 1,176 cubic meters of natural gas.

\(^{38}\) France, Greece, Italy, Portugal, Slovenia and Spain. There is no natural gas supply to Cyprus and Malta.
Table 2.1: Gas Supply and Demand in the EU-MED (2009)

<table>
<thead>
<tr>
<th>Country</th>
<th>Natural Gas</th>
<th>Total Primary Energy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Gross Consumption</td>
<td>Production</td>
</tr>
<tr>
<td></td>
<td>million toe</td>
<td>million toe</td>
</tr>
<tr>
<td>Portugal</td>
<td>4.2</td>
<td>--</td>
</tr>
<tr>
<td>Spain</td>
<td>31.2</td>
<td>--</td>
</tr>
<tr>
<td>France</td>
<td>38.2</td>
<td>0.7</td>
</tr>
<tr>
<td>Italy</td>
<td>64.0</td>
<td>6.6</td>
</tr>
<tr>
<td>Malta</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Slovenia</td>
<td>0.8</td>
<td>--</td>
</tr>
<tr>
<td>Greece</td>
<td>3.0</td>
<td>&lt;0.1</td>
</tr>
<tr>
<td>Cyprus</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>EU-MED</td>
<td>141.4</td>
<td>7.3</td>
</tr>
<tr>
<td>EU-27</td>
<td>414.3</td>
<td>152.9</td>
</tr>
<tr>
<td>Share of EU-MED</td>
<td>34.1%</td>
<td>4.8%</td>
</tr>
</tbody>
</table>

Source: Eurostat, Statistical aspects of the energy economy in 2009

Units are expressed in lower calorific values (LCV). 1 toe = 1,176 cubic meters natural gas.
Dependence ratios above 100% may indicate that some of the gas imported has been stored.

2.3.2. Gas demand projections to 2030

The economic crisis has dramatically altered energy demand patterns. In autumn 2008, the EU and the global economy entered the steepest downturn on record since the 1930s. Energy intensive industries experienced considerable drops in their production, while energy and electricity demand displayed negative growth rates in 2009. The medium term and sometimes long term economic outlooks published by official bodies such as the EC or the International Energy Agency (IEA) have been drastically revised to reflect lower economic growth.

In order to take this new context into account as much as possible, we have considered the projections established in 2010\(^{39}\) using the PRIMES model designed by the E3M-Lab of the NTUA\(^{40}\). While these projections are not meant to reflect official figures from the Commission, they are published by the DG Energy in the EU Energy Trends to 2030 – Update 2009 Report.

The projections follow two scenarios. The “Baseline” scenario determines the development of the EU energy system under current trends and policies. It includes current population and economic development trends, including the recent economic downturn. Economic decisions are driven by market forces and technological progress.

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\(^{39}\) The projections are based on provisional 2009 data, as complete 2009 energy data were not available at the time of computation

\(^{40}\) National Technical University of Athens
within the framework of concrete national and EU policies and measures implemented until April 2009. This includes the ETS\textsuperscript{41} and several energy efficiency measures but excludes renewable energy targets and non-ETS targets.

The “Reference” scenario is based on the same general assumptions as the Baseline. In addition, it includes policies adopted between April and December 2009 and assumes that national targets under the Renewables Directive and the GHG Effort Sharing Decision are achieved in 2020\textsuperscript{42}.

**Gas demand**

A comparative analysis of the results of the two scenarios shows that gas consumption does not vary significantly until 2015, as the trends are mainly determined by system inertia and investment decisions taken in the past. The full effect of the different policy assumptions can be observed in the course of the second half of the 2010 decade, where the consumption gap reaches 24 million toe in 2020, before narrowing to about 18 million toe in 2030.

**Figure 2.4: Gas Demand Projections in the EU-MED under the two PRIMES Scenarios**

![Gas Demand Projections](image)

**Source**: Based on figures from EU Energy Trends to 2030 – Update 2009

**Gas import requirements**

Given the limited dimensions of domestic production, gas import requirements in the EU-MED are close to the overall gas demand. Italy’s domestic production continues to steadily decrease, while the French and Greek fields are depleted no later than 2015. In 2030, import requirements reach 160 and 142 million toe (188 and 167 bcm) under the Baseline and Reference scenarios respectively.

\textsuperscript{41}ETS: Emission Trading Schemes

\textsuperscript{42}Directive 2009/28/EC; Decision 2009/406/EC
Table 2.2: Gas Demand Projections in the EU-MED, PRIMES Baseline Scenario 2015-2030 (million toe)

<table>
<thead>
<tr>
<th></th>
<th>2015</th>
<th>2020</th>
<th>2025</th>
<th>2030</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Portugal</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consumption</td>
<td>4.1</td>
<td>4.0</td>
<td>4.1</td>
<td>4.2</td>
</tr>
<tr>
<td>Imports</td>
<td>4.1</td>
<td>4.0</td>
<td>4.1</td>
<td>4.2</td>
</tr>
<tr>
<td>Production</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td><strong>Spain</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consumption</td>
<td>34.5</td>
<td>38.7</td>
<td>41.2</td>
<td>39.7</td>
</tr>
<tr>
<td>Imports</td>
<td>34.5</td>
<td>38.7</td>
<td>41.2</td>
<td>39.7</td>
</tr>
<tr>
<td>Production</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td><strong>France</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consumption</td>
<td>43.5</td>
<td>43.2</td>
<td>40.4</td>
<td>39.7</td>
</tr>
<tr>
<td>Imports</td>
<td>43.5</td>
<td>43.2</td>
<td>40.4</td>
<td>39.7</td>
</tr>
<tr>
<td>Production</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td><strong>Italy</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consumption</td>
<td>76.3</td>
<td>79.2</td>
<td>77.0</td>
<td>74.0</td>
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<tr>
<td>Imports</td>
<td>68.4</td>
<td>71.9</td>
<td>70.3</td>
<td>68.0</td>
</tr>
<tr>
<td>Production</td>
<td>7.9</td>
<td>7.3</td>
<td>6.7</td>
<td>6.0</td>
</tr>
<tr>
<td><strong>Slovenia</strong></td>
<td></td>
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**Source:** Based on figures from EU Energy Trends to 2030 – Update 2009
2.3.3. Gas supply in EU-MED countries

Portugal

This country’s gas history is fairly recent: Portugal received its first gas in 1996 through the Gazoduc-Maghreb-Europe (GME) that carries gas from the Algerian gas hub of Hassi R’Mel to the Iberian Peninsula through Morocco and the Straits of Gibraltar. Consumption has steadily increased since, driven by power generation, and was boosted in 2004 by the implementation of the Sines regasification terminal. Portugal received 4.4 bcm in 2009.

Portugal receives gas from six exporting countries, a fairly wide range of suppliers for a relatively modest demand. Piped gas comes mostly from Algeria (1.33 bcm) complemented by limited volumes from Spain. LNG is primarily supplied by Nigeria (2.1 bcm), which is now the largest supplier and meets nearly half of the country’s demand. Additional LNG volumes are shipped from such various locations as Trinidad & Tobago in the Caribbean (0.4 bcm), Equatorial Guinea, and the United Arab Emirates, Algeria and Oman in the Gulf (about 0.1 bcm each).

Since the development of the Sines terminal, LNG has become the main form of gas received by Portugal. The single facility is located in the south of the country and constitutes the main entry point in the domestic gas grid. The terminal received 2.8 bcm in 2009, which represents 63.9% of the total supply.

The pipeline network is connected with Spain in two places. The main entry point is the border station of Campo Maior, located about 200 km to the south-east of Lisbon. Gas is received from Algeria through two segments of the Spanish domestic grid in which the Portuguese importer holds equity, which constitute the extension of the GME across the Spanish territory. The second entry (or exit) point is located at Valença do Minho, in the north of the country, where it connects to the Spanish western grid in Galicia. This is a cross-border facility that is not attached to permanent transit flow. While 0.2 bcm were shipped to Spain in 2007 and 0.05 in 2008, no flow was recorded in 2009.

Spain

Spain has been the fastest growing gas market in Europe over the past two decades, recording two-digit annual growth rates in most of these years. The country received 36 bcm in 2009.

Gas liberalisation and huge needs for more power generation triggered impressive development of the gas infrastructures, in particular LNG terminals. New entrants looked for gas all over the gas world, leading Spain to be currently supplied by no less than 11 exporting countries. The incumbent exporter (both for LNG and piped gas) is Algeria, which remains the largest supplier with 12.1 bcm in 2009 (33.7%). Qatar and Nigeria export LNG and now rank 2nd (5 bcm each, 13.9%) after having outpaced the former number 2 (Egypt, 4.1 bcm), close to Trinidad & Tobago (4.2 bcm). Additional volumes are provided by Norway (3.3 bcm), the Gulf (Oman and Yemen, 1.3 and 0.1 bcm respectively), Libya (0.7 bcm) and cross border supplies from France and Belgium (0.2 bcm).

Spain is truly “the” LNG country of Europe. Indeed, the country remained a “gas island” for over three decades before it was permanently connected to the gas world in 1996 through the GME, known in Spain as the Gasoducto Pedro Duran Farell (GPDF).

Base figures of gas volumes and sources are provided by the BP Statistical Review of the World, June 2010 (see Table 2.3 below)
LNG accounted for three-quarters of all supplies in 2009, with the remainder being provided as piped gas. Since the GME/GPDF began operating in 1996, natural gas inflow to the Spanish mainland though the pipeline has been more or less constant, so that as demand has grown, the piped gas/LNG ratio has been slanting in favour of LNG. The gap was slightly curbed in 2004 after the Maghreb pipeline was expanded, and it will soften again in the near future when Medgaz, the second pipeline from Algeria, is on stream, but there is no doubt that LNG, robustly sitting on six regasification terminals, will remain the preferred means of supply in the future.

**Figure 2.5: Spain: LNG vs. Pipeline Supplies, 2002-2008**

![Trend in natural gas imports by supply type](image)

Source: Comision Nacional de Energia, Report on Natural Gas Supplies in 2010
Legend: GN: Natural Gas; GNL: Liquefied Natural Gas

**France**

France received 49.1 bcm in 2009. The LNG/pipeline gas split is exactly the opposite of Spain, with 73.4% as piped gas and 26.6% as LNG.

Due to its dual continental and coastal situation, France enjoys the possibility of being supplied by a large number of sources. Like in other countries, gas import liberalisation has led the country to considerably diversify its gas sources from the traditional ‘League of Four’ (Algeria, the Netherlands, Norway and Russia) to reach 13 countries in 2009. The incumbents, however, still constitute the bulk of the supplies and account for 80% of all supplies. Norway is the main supplier with 16.4 bcm (33.7%), followed by Russia (8.2 bcm, 16.7%), Algeria (7.7 bcm, 15.7%) and the Netherlands (6.4 bcm, 13.1%). Other European sources (Germany, Belgium, Spain and the UK) together provided 5.4 bcm of pipeline gas while 6.4 bcm of LNG were shipped from Nigeria, Egypt, Trinidad & Tobago, Qatar and Equatorial Guinea, as well as from the recently opened LNG scheme of Snohvit in Norway.

Pipeline gas is received at four border stations, three of which are located in the northern part of the country. Loon-Plage near Dunkerque (Dunkirk) receives gas from Norway through the Franpipe. It also receives Norwegian gas intended for the Italian market. The Taisnières station at the Belgian border conveys gas shipped from the Netherlands as well as cross-border gas from Belgium and from the UK through the Interconnector. Connection with the German pipeline network operates through the Obergailbach station.

444 With more to come
It mainly receives gas from Russia, complemented by cross-border gas shipped from Germany.

The French gas grid is linked with the Spanish network through two pipelines, both located in the western Pyrenean Range. While the coastal pipeline (Euzkadour) works in reverse flow and actually supplied 0.7 bcm from Spain, the larger Larrau pipeline only runs southwards and supplies Spain with gas from France and above all Norway.

LNG is received in three regasification terminals located in the South (Fos – now referred to as ‘Fos-Tonkin’ – and the recently opened Fos II-Cavaou site) and on the Atlantic coast near Nantes (Montoir terminal).

**Italy**

Italy is the largest gas consumer of the EU Mediterranean countries, and the only one to enjoy sizeable domestic sources, albeit declining. Domestic fields produced 7.4 bcm in 2009, down from 16 bcm ten years back.

In spite of its much developed coastline, most of the imported gas is channelled through pipeline (95.8 %), including volumes received from overseas sources such as Algeria and Libya.

Two main suppliers provide nearly two-thirds of the gas imports. The largest one is Algeria (22.6 bcm, 32.5 %) followed by Russia (20.8 bcm, 30 %). Libya (9.2 bcm, 13.2 %) became the third largest supplier when the offshore Green Stream pipeline was put on stream in 2004, ahead of two European countries, the Netherlands (7.5 bcm) and Norway (5.9 bcm).

Pipeline gas is received at four main entry points. Two are located in the north and two in Sicily. The alpine stations of Tarvisio and Gries Pass are connected to the Austrian TAG pipeline and to the Swiss system respectively. Tarvisio receives gas from Russia while Gries Pass channels gas from Norway, the Netherlands and, albeit to a modest extent, from Germany. A third northern point of entry exists at Gorizia (border with Slovenia); however, while gas from Algeria is carried through this point to feed Slovenia, Gorizia is currently not in use as a gas receiving point.

Piped gas from Algeria is transported through the TransMed pipeline system (also known as Gasdotto Enrico Mattei – GEM) that lands at the entry terminal of Mazara del Vallo in south-western Sicily. A second entry point was opened in Sicily at Gela to receive the Green Stream gas from Libya.

In spite of the length of its coastline (the largest of all EU-MED countries), Italy is poorly equipped in LNG terminals. Built between 1967 and 1970, the Panigaglia facility is located near the military port of La Spezia, on the Gulf of Genoa. Initially designed to regasify about 4.2 bcm, it has never really taken off and lost importance when the Libyan supply contract was interrupted and the TransMed was put on stream in the early 1980s. It processed close to 3 bcm in 2009.

While Italy was one of the first European countries to receive liquefied gas, no operator succeeded in developing new facilities until the recent past, despite an impressive portfolio of projects. Adriatic LNG is only the country’s second terminal, located 15 km offshore of Porto Levante, in the northern Adriatic Sea. A world premiere, it is the first offshore Gravity Based Structure (GBS). The operator includes Qatar Terminal Limited (45 %), ExxonMobil Italiana Gas (45 %), and Edison (10 %). Its capacity is 8 bcm, 80 % of which has been allocated to the Edison contract with RasGas of Qatar.
**Slovenia**

With 0.9 bcm received in 2009, Slovenia is the smallest EU-MED consumer. However, the country enjoys two operating entry points with Italy and Austria, while a third one with Croatia dates back to the former Yugoslavia system and is currently not in operation. Algerian gas (0.4 bcm) is channelled through Italy and delivered at the Sempeter border station. Russian gas (0.5 bcm) is delivered through the Austrian TAG pipeline and received at the Cersak station. There are no LNG terminals although a re-gasification facility project at Koper has been on the drawing board for decades.

**Greece**

About two-thirds of the gas consumed in Greece comes from Russia (2.1 bcm). It is received at the Sidirokastro entry point, located in the north-eastern Thrakia province, at the Greek-Bulgarian border. Since the operation of the Turkey-Greece pipeline started in early 2008, Greece has received gas from Azerbaijan (0.5 bcm in 2009) which is channeled across Georgia and the extensive Turkish network. The entry point is located at Kipi Evros, also in Thrakia, at the Greek-Turkish border.

The third entry point into Greece consists of the LNG terminal of Revithoussa, located on an island in the Gulf of Salamina near Athens. Following regasification, gas is transported by a short sealine to the entry point of Agia Triada on the mainland. The terminal handled 0.8 bcm in 2009, coming from Algeria, Egypt and Trinidad & Tobago.

**Cyprus**

The government of Cyprus has decided to build an Energy Centre at Vasilikos, on the southern coast. In addition to a new oil terminal, the Government of Cyprus wants to implement an LNG regasification terminal. Initially, natural gas will be mainly used by the nearby power station of the Electricity Authority of Cyprus (EAC) for power generation, but studies have been conducted to extend the use of gas towards the industrial and residential sectors. The Public Gas Corporation (DEFA) was founded in November 2007 to manage gas activity across the country.

**Croatia**

Although not a member of the EU-27, Croatia shares some common gas supply characteristics with other countries in the Balkans and former Yugoslavia. Natural gas accounts for about 24% of the total primary energy supply. The larger share of the gas consumed is produced by domestic fields (2.7 bcm) with the balance (1.1 bcm) being provided by Russia through a pipeline across Hungary. There is a long-standing LNG regasification terminal project that could be located in the Krk island off the coast of Rijeka. Another, more recent project consists of a branch line of the TAP project that would originate in Albania and supply the long Croatian coastline after crossing Montenegro.

### 2.3.4. Gas import sources

**Current situation**

In 2009, the six gas EU-MED countries\(^{45}\) imported 163 billion cubic meters (bcm) of gas\(^{46}\). The majority of this volume was supplied by pipeline (71.5 %) and the remainder as LNG (28.5 %).

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\(^{45}\) France, Greece, Italy, Portugal, Slovenia and Spain
In spite of their common Mediterranean situation and long coastline, the supply portfolios and route schemes of the EU-MED countries differ widely from one country to another. The two Iberian countries (Portugal and Spain) rely to a large extent on LNG whereas France, Italy and Greece receive mostly piped gas. Slovenia is the only EU-MED gas country without an LNG regasification facility, and therefore imports only piped gas.

Three exporting countries account for 63% of the total imports: Algeria (27.5%), Russia (19.4%) and Norway (15.7%). Algeria is the only exporter that supplies all six EU-MED gas countries.

The opening of the EU gas market has resulted in the development of ‘new entrants’, i.e. gas companies that have started to operate in the gas market in competition with the small bunch of ‘legacy’ operators that developed in a monopoly or quasi-monopoly context. Most of these new entrants purchase gas from importers, but some of them hold import licenses. The opening of the market has thus resulted in higher numbers of both shippers (gas marketers) and importers, leading in turn to supply diversification in terms of sources as well as routes. As a result, the number of gas sources and routes has increased dramatically over the past decade. In 2009, the gas imported by the EU-MED countries was provided by 19 exporting countries, which represents 22 routes as three supplying countries (Algeria, Libya and Norway) export gas in the form of both piped gas and LNG (see Figure 1.6 and Table 1.3).

**Figure 2.6: Gas Import Sources of the EU-MED, 2009 (bcm)**

![Gas Import Sources of the EU-MED, 2009 (bcm)](image)

**Source:** Based on figures from the BP Statistical Review of the World, June 2010

Half of the exporting countries are located in the ‘South’, in the broader sense of the term, including North Africa (Algeria, Libya), the Middle East (Egypt), the Caspian area (Azerbaijan), the Gulf (Qatar, Oman, UAE, Yemen), and Sub-Saharan Africa (Nigeria, Equatorial Guinea).

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46 Source: BP Statistical Review of World Energy, June 2010. BP figures are based on Cedigaz's provisional data. Some discrepancies may appear between BP and other sources, e.g. national operators and regulatory agencies.
Gas supply potential

There remains a limited number of gas producing countries that have not been tapped by EU importers. Of these countries, Iran has the largest gas reserves. It already exports gas to Turkey, although the volumes supplied do not yet meet the contractual quantities of 10 bcm per year. However, Iran’s export potential suffers from two constraints. Firstly, it is unlikely to become a gas supplier of the EU as long as pursues its nuclear policy. Indeed, none of the large-scale export projects based on the development of the giant Pars field – the Iranian part of Qatar’s North Dome field in the Gulf – have been implemented. Secondly, the capacity of the IGAT transmission system that connects the south of the country (where the production capacity is located) to the north (where most of the demand lies) is already largely insufficient, which has led Iran to import increasing gas volumes from Turkmenistan to meet the northern demand – as well as exports to Turkey.

Iraq is another option. The Kurdistan Region of Iraq (KRI) is endowed with substantial gas reserves that could supply (at least partly) projects such as Nabucco. Indeed, the KRI gas fields are much closer to the Turkish border than the Azeri fields.

The Caspian area, in particular Turkmenistan, is the third option. This country has the largest gas reserves in Central Asia and a small population, and hence strong potential. There have been longstanding plans for an export project to the West that would join the Azeri system across the Caspian Sea and beyond to Turkey. However, despite Turkmenistan’s verbal support of the Nabucco project, over the past two years it has signed several significant export contracts with Russia (initially 80 bcm, downscaled to 50 bcm), Iran (20 bcm) and recently China (40 bcm), giving a clear indication of the country’s priorities.

Israel has been producing gas in small quantities (2.8 bcm) from the offshore field Mari-B since 2004, which supplies domestic consumers. In addition, it imports gas from Egypt. A much larger offshore deposit, Tamar (with reserves estimated at 238 bcm), was discovered in 2009 and is planned to be put on stream in 2014. There again, the gas will be used domestically. An even larger field, Leviathan, has been discovered in the deep offshore. Its estimated reserves are 453 bcm, which could lead to export projects. However, due to the location of the field, any export projects will require agreements with Lebanon and Cyprus to demarcate each country’s economic exclusion zone.
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**Source:** Figures from the BP Statistical Review of the World, June 2010
2.3.5. **Existing supply infrastructures**

As described in the previous section, gas is transported to EU-MED countries by pipeline or as LNG.

*Pipelines*

Pipeline gas is channelled either by pipeline systems that cross EU Member States en route (e.g. Norwegian gas to Spain through the French grid or Russian gas to Italy through the Slovak Republic and Austria) or by international pipelines that originate in an exporting country and reach an EU member directly or through non-member country/ies. To avoid a lengthy description of all supply systems, which is beyond the scope of this report, we will focus on direct pipelines.

There are currently four international pipelines in operation. Three connect North Africa (Algeria and Libya) to Spain and Italy. The fourth enables Greece to receive gas from Turkey. Two more pipelines (Medgaz and Galsi) are either under construction or at an advanced stage of execution in the western Mediterranean area (see Table 1.4).

As can be observed on the eastern flank of the EU (north-east and south corridors) there is a clear, general trend, on the suppliers’ side, to promote projects that avoid crossing transit countries. In the western Mediterranean, such ventures have been made possible by the improvement of pipe-laying technologies that allow pipes to be laid at very deep distances below sea level (2000 metres and beyond).

*LNG*

There are 12 LNG regasification terminals in operation in the EU-MED. Half of them are in Spain, three in France and one in each of Portugal, Italy and Greece (see Table 1.5).

2.3.6. **New infrastructure projects**

For several years now, a number of international pipeline projects have been on the drawing board to bring gas from the East to Central and Eastern Europe and/or Italy and the Balkans. While different in sizes and routes, all but one plan to tap the significant gas reserves of the Middle East and the Caspian area. One of these projects is based on the transmission of Russian gas, and also aims to supply the same markets. All of these projects can be considered as meeting the EU-backed Southern Corridor concept.

In this section, we present the various projects as they currently stand. Their merits and drawbacks will be discussed in Section 3.3.5 below.

*Nabucco*

The Nabucco project plans to transport about 31 bcm from the Caspian area (Azerbaijan and possibly Turkmenistan) and/or the Middle East (Iraq) to Baumgarten in Austria. The 3,300 km large-size pipeline (56”) will cross four countries (Turkey, Bulgaria, Romania and Hungary) before it reaches Austria. The project’s sponsors are the leading gas companies of each country involved in the project (BOTAS, Bulgaria Energy Holding, Transgaz, MOL and ÖMV) and the German RWE. The project cost varies according to the sources, but it is generally admitted that it will be approximately 8 billion euros.
**South Stream**

South Stream is the pipeline project launched by Gazprom to compete with Nabucco. It is even more ambitious than the Nabucco on two counts: it has an overall larger transit capacity that should enable it to transport up to 60 bcm through two onshore pipes of 56"47, and is more technologically challenging as it plans to lay a deep sealine on the bed of the Black Sea from the Beregovoya exit point in Russia to the Bulgarian coast. From Bulgaria, two branches bring gas to Baumgarten through Serbia and Hungary (with an option to Slovenia) on the one hand, and to southern Italy through Greece on the other hand. The project is sponsored by Gazprom and the Italian ENI, following the scheme that was implemented for the existing Blue Stream pipeline to Turkey. The project was recently joined by France’s EDF. The cost is unknown.

47 The number and diameters of the offshore pipes have not yet been disclosed.
While both Nabucco and the South Stream are fully-fledged projects, the ITGI and the TAP are designed to carry smaller volumes of gas across the Straits of Otranto to southern Italy. They are not meant to develop a complete “wall-to-wall” pipeline but rather to tap into the existing gas system(s), in particular throughout Turkey and north-eastern Greece.

**Interconnector Turkey-Greece-Italy (ITGI)**

This project is sponsored by Edison of Italy and DEPA of Greece. ITGI plans to connect Thessaloniki to the vicinity of Lecce through an 800 km-long pipeline, with 600 km built across northern Greece to the Adriatic coast (Ionian Sea) and a 200 km sealine called Poseidon. The capacity is 8 bcm. The project is based on the gas available in Azerbaijan that would be transported through the Botas network, in particular the newly opened 36” Turkey-Greece pipeline where spare capacity is available.\(^4\)

**Map 2.6: ITGI pipeline**

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**Trans Adriatic Pipeline (TAP)**

This more recent project competes directly with the ITGI. It is of the same size, plans to tap the same reserves, targets the same markets and follows roughly the same direction, with the noticeable difference that it plans to cross, rather than to bypass, Albania. The route substantially reduces the overall pipeline length (520 km) as well as the length of the offshore section. The sponsors include EGL of Switzerland, the Norwegian Statoil, which holds a 25.5% stake in the Shah Deniz gas field in Azerbaijan, and the German giant E.ON.

\(^4\) The capacity of the 36” pipeline is about 7 bcm, 0.5 of which was delivered at the Greek border in 2009
Azerbaijan-Georgia-Romania Interconnector (AGRI)

In September 2010, the Presidents of Azerbaijan, Georgia and Romania launched the AGRI project – the latest avatar of the Southern Corridor family. AGRI is designed to transport Azerbaijani gas across Georgia to Kulevi on the Black Sea where it will be liquefied, loaded on LNG tankers then regasified in the Romanian Black Sea port of Constantsa and dispatched in the Romanian gas grid for further delivery to neighbouring markets. The capacity would range from 7 to 20 bcm.

Transcontinental Pipelines

The Strategic Mediterranean Gas Interconnections Study (often referred to as ‘Medring – Gas’) considers that a long-haul transmission pipeline between Egypt and Libya (further to Tunisia and Algeria) is not economically feasible and should not be pursued.

Two other ambitious transcontinental projects are on the drawing board. Although they are not located in the same area, they have two main aspects in common: they are not intended to directly connect gas sources to Europe, and they plan to give a pipeline outlet to gas reserves that are currently marketed through LNG schemes.

NIGAL\(^\text{49}\) (NIGeria-ALgeria)

Algeria’s Sonatrach and Nigeria’s NNPC signed an MoU in 2002 to build a 4,000 km-long pipeline from Warri in the Niger delta to the Hassi R’Mel hub, and beyond to the Algerian coastline (and Europe and other outlets) through Niger. The purpose is to allow Nigeria to diversify export routes and (supposedly) reduce transmission costs. The benefit for Algeria is less obvious as Nigerian gas would compete with its own domestic sources, which are sufficient to meet both domestic and export demand. Following a positive feasibility study, an intergovernmental agreement on the pipeline was signed by energy ministers of Nigeria, Niger and Algeria on 3 July 2009 in Abuja. Several operators have expressed interest in the project, including Gazprom, India’s GAIL, Total, ENI and Shell. The project would cost 10 billion USD, transport 20 to 30 bcm, and be on stream by 2015.

\(^{49}\) Also referred to as the Trans-Sahara Gas Pipeline or Trans-Africa Pipeline
**Qatar-Egypt pipeline**

On 30 November 2010, Egypt and Qatar announced that they would build a joint pipeline (presumably across Saudi Arabia) to export Qatari gas to Egypt, and beyond to Europe and other markets (as LNG). While the concept makes a lot of sense for both Qatar (seeking to develop exports) and Egypt (which is likely to lack gas in the future to supply both its domestic and export markets), it faces several economic obstacles. These include the very low prices in the domestic Egyptian market, which will yield a low (if not negative) netback value at production, and the fact that gas intended for Europe will need to be liquefied anyway, which reduces its economic interest when compared to the current seamless LNG chain all the way from Qatar.

**Map 2.8: Western Mediterranean Pipelines and NIGAL**

![Map showing Western Mediterranean Pipelines and NIGAL](source.png)

**Source:** Wikimedia

**Legend:** From West to East: Yellow: Gazoduc Maghreb-Europe (Gasoducto Pedro Duran Farell); Blue: Medgaz; Orange: GALSI; Purple: Transmed (Gasdotto Enrico Mattei); Green: Green Stream; Red: NIGAL
<table>
<thead>
<tr>
<th>Pipeline</th>
<th>Origin</th>
<th>Destination</th>
<th>Entry point (EU)</th>
<th>Date of oper.</th>
<th>Transit country</th>
<th>Length (km)</th>
<th>Diameter</th>
<th>Capacity</th>
<th>Operator(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Operating:</strong></td>
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<td></td>
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<td></td>
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</tr>
<tr>
<td>GME / GPDF</td>
<td>Algeria (Hassi R'mel)</td>
<td>Spain (Cordoba)</td>
<td>Tarifa (Andalucia)</td>
<td>1996</td>
<td>Morocco</td>
<td>515 (DZ) 520 (MA) 45 (offsh.) 270 (ES)</td>
<td>48” (onshore sealines: 3x22&quot;)</td>
<td>12 bcm</td>
<td>Sonatrach (DZ) EMPL (MA) Enagas (ES)</td>
</tr>
<tr>
<td>Transmed/GEM I</td>
<td>Algeria (Hassi R’mel)</td>
<td>Italy (Minerbio)</td>
<td>Mazara Del Vallo (Sicily)</td>
<td>1983</td>
<td>Tunisia</td>
<td>550 (DZ) 370 (TN) 155 (offsh) 340 (Sic.) 15 (offsh)</td>
<td>2 x 48” 20”-26” (sealines)</td>
<td>30 bcm (total)</td>
<td>Sonatrach (DZ) SOTUGAT (TN) TPMC (Sicily Channel) SNAM Rete Gas (IT)</td>
</tr>
<tr>
<td>Transmed/GEM II</td>
<td>Algeria (Hassi R’mel)</td>
<td>Italy</td>
<td>Mazara Del Vallo (Sicily)</td>
<td>1995</td>
<td>Tunisia</td>
<td>530 (LY) 540 (offsh)</td>
<td>32” (sealine)</td>
<td>8 bcm (Phase I)</td>
<td>ENI (IT) NOC (LY)</td>
</tr>
<tr>
<td>Green Stream</td>
<td>Libya (Wafa Field)</td>
<td>Italy</td>
<td>Gela (Sicily)</td>
<td>2004</td>
<td>--</td>
<td>210 (TR) 86 (GR)</td>
<td>36”</td>
<td>7 bcm</td>
<td>BOTAS (TR) DEPA (GR)</td>
</tr>
<tr>
<td>Turkey-Greece</td>
<td>Turkey (Karacabey)</td>
<td>Greece (Komotini)</td>
<td>Kipi Evros (Thracia)</td>
<td>2008</td>
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<tr>
<td><strong>Under construction or launched:</strong></td>
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<tr>
<td>Medgaz</td>
<td>Algeria (Hassi R’mel)</td>
<td>Almeria</td>
<td>Almeria (Andalucia)</td>
<td>2011</td>
<td>--</td>
<td>550 (DZ) 210 (offsh) 290 (ES)</td>
<td>24” (sealine)</td>
<td>8 bcm</td>
<td>Sonatrach (DZ) CEPSA, IBERDROLA ENDESA (ES) GDF-Suez (FR)</td>
</tr>
<tr>
<td>GALSI</td>
<td>Algeria (Hassi R’mel)</td>
<td>Italy</td>
<td>Sardinia (Porto Botte) Tuscany (Piombino)</td>
<td>2014</td>
<td>--</td>
<td>640 (DZ) 285 (offsh) 300 (Sard.) 280 (offsh)</td>
<td>48” 22” (sealine)</td>
<td>8 bcm</td>
<td>Sonatrach, Edison Gas, Wintershall, Enel Power, Eos Energia, Sfers spa, Progemisa</td>
</tr>
</tbody>
</table>
### Table 2.5: Existing LNG Regasification Terminals in the EU-MED

<table>
<thead>
<tr>
<th>Terminal</th>
<th>Date of oper.</th>
<th>Storage capacity (cm LNG)</th>
<th>Maximum cap. of LNG tankers (cm LNG)</th>
<th>Terminal throughput (bcm gas)</th>
<th>Operator(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Portugal</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sines</td>
<td>2004</td>
<td>230,000</td>
<td></td>
<td>4.8</td>
<td>REN</td>
</tr>
<tr>
<td><strong>Spain</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Barcelona</td>
<td>1969</td>
<td>540,000</td>
<td>140,000</td>
<td>13.2</td>
<td>Enagas</td>
</tr>
<tr>
<td>Huelva</td>
<td>1988</td>
<td>460,000</td>
<td>140,000</td>
<td>10.8</td>
<td>Enagas</td>
</tr>
<tr>
<td>Cartagena</td>
<td>1989</td>
<td>437,000</td>
<td>140,000</td>
<td>10.8</td>
<td>Enagas</td>
</tr>
<tr>
<td>Bilbao</td>
<td>2003</td>
<td>300,000</td>
<td>140,000</td>
<td>6.4</td>
<td>BBG</td>
</tr>
<tr>
<td>Sagunto</td>
<td>2006</td>
<td>300,000</td>
<td>140,000</td>
<td>8.0</td>
<td>Saggas</td>
</tr>
<tr>
<td>Mugardos</td>
<td>2007</td>
<td>300,000</td>
<td>140,000</td>
<td>3.3</td>
<td>Reganosa</td>
</tr>
<tr>
<td><strong>France</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fos (Tonkin)</td>
<td>1972</td>
<td>150,000</td>
<td>75,000</td>
<td>7.0</td>
<td>Elengy (GDF-Suez)</td>
</tr>
<tr>
<td>Montoir</td>
<td>1980</td>
<td>360,000</td>
<td>220,000</td>
<td>10.0</td>
<td></td>
</tr>
<tr>
<td>Fos II (Cavaou)</td>
<td>2010</td>
<td>330,000</td>
<td>270,000</td>
<td>8.3</td>
<td>STMFC (GDF-Suez, Total)</td>
</tr>
<tr>
<td><strong>Italy</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Panigaglia</td>
<td>1971</td>
<td>100,000</td>
<td>70,000</td>
<td>3.0</td>
<td>GNL Italia (ENI)</td>
</tr>
<tr>
<td>Adriatic LNG (Rovigo)</td>
<td>2010</td>
<td>250,000</td>
<td></td>
<td>8.0</td>
<td>Adriatic LNG (Qatar Petr., ExxonMobil, Edison)</td>
</tr>
<tr>
<td><strong>Greece</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Revithoussa</td>
<td>1999</td>
<td>130,000</td>
<td></td>
<td>4.6</td>
<td>DESFA</td>
</tr>
</tbody>
</table>

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50 Spain, Portugal: Based on maximum hourly send out x 8,000 hours/year
3. ASSESSMENT OF EXISTING POLICIES AND ISSUES

3.1. Introduction – EU policies

The energy sector in the European Union is governed by a fully fledged ensemble of directives, communications and regulations. Most of these documents deal with energy policy as a whole, although emphasis is often placed on electricity through renewable energy carriers. One of them concerns only gas and is dealt with in the gas section (see 2.3.1).

As these documents are obviously well known to the Members of the European Parliament, we focus hereunder on key components that are relevant to shaping EU policy in the Southern Mediterranean.

The first set of documents that we will discuss deals with strategy and general policy. The Second and Third Internal Energy Market Packages set out the rules for an open, integrated and competitive gas market in the EU, including the separation of transport and supply/production, transparency in operations, entry-exit systems for energy transmission grids, and the termination of separate transit regimes.

They promote market integration through framework guidelines and network codes, and create two key institutions: the Agency for the Cooperation of Energy Regulators (ACER), and the European Network for Transmission System Operators (ENTSO-E and G), one of the main tasks of which is to establish Union-wide Ten-Year Network Development Plans (TYNDP) as a starting point for joint and consistent investment planning.

The new Communication “Energy 2020 - A strategy for competitive, sustainable and secure energy is sturdily structured. It sets “Energy 2020” in a longer term perspective with energy objectives beyond 2020 and with priority areas. It is central to energy relations with the Southern Mediterranean, where energy security is a main concern both for the European Union and the Southern Mediterranean.

Ensuring energy security is clearly an overarching issue, with consumer countries seeking a guaranteed inflow of energy imports, and producer countries desiring guarantees on their export outlets. However, issues related to global awareness on climate change and to sustainable development are now also of major importance.

For the second time, the European Commission has updated the EU energy strategy, as it does every two years. The new strategy, which was published on 10 November 2010\textsuperscript{51}, was discussed by EU leaders during a summit on energy on 4 February 2011. The conclusions of the summit were published on 8 March. Given the topic of the present report, an extract of these conclusions is worth being quoted: “(11)....The Commission is invited to submit by June 2011 a communication on security of supply and international cooperation aimed at further improving the consistency and coherence of the EU's external action in the field of energy.

(12)...It [the EU] should encourage neighbouring countries to embrace its relevant internal energy market rules, notably by extending and deepening the Energy Community Treaty and promoting regional cooperation initiatives.... The Commission is accordingly invited to continue its efforts to facilitate the development of strategic corridors for the transport of large volumes of gas such as the Southern Corridor”.\textsuperscript{52}

\textsuperscript{51} COM(2010)639. Communication from the Commission to the European Parliament, the Council, the EEESC and the Committee of the Regions

\textsuperscript{52} Document (EUCO 2/1/11 REV1)
The new strategy will become the framework for all new EU energy policy initiatives – at least until the next update, in late 2012.

It proposes five priorities, and relevant actions within each priority, that are intended to tackle the issues faced by the European Union:

- **Priority 1:** Achieving an energy-efficient Europe;
- **Priority 2:** Building a truly pan-European integrated energy market;
- **Priority 3:** Empowering consumers and achieving the highest level of safety and security;
- **Priority 4:** Extending Europe’s leadership in energy technology and innovation;
- **Priority 5:** Strengthening the external dimension of the EU energy market.

While the Strategy is clearly oriented towards the reduction of carbon emissions, in particular through the promotion of renewable energy and energy efficiency measures (Priorities 1, 2 and 4), Priority 5 places strong emphasis on relationships with neighbouring countries: "Market integration and regulatory convergence should be pursued through comprehensive EU agreements based on the EU rules in the countries covered by the European Neighbourhood Policy and the Enlargement process."

The two documents discussed here below are somewhat more specific and concrete. The Communication on Energy Infrastructure Priorities for 2020 and Beyond was issued on 17 November 2010, to develop the second Action of Priority 2 of the above Strategy. The Commission considers that:

- Adequate, integrated and reliable energy networks are a crucial prerequisite not only for EU energy policy goals, but also for the EU's economic strategy;
- In light of the January 2009 gas crisis (Russia-Ukraine), the EU is paying the price for its outdated and poorly interconnected energy infrastructure;
- A new EU energy infrastructure policy is needed to coordinate and optimise network development on a continental scale;
- Under the current regulatory framework, all necessary investments will not take place or not as quickly as needed, notably due to the non-commercial positive externalities or the regional or European value-added of some projects.

Against such a sombre background, the Communication proposes medium and long term priorities to make energy infrastructures suitable for the coming decade. Priority corridors for electricity, gas and oil have been identified (see map 2.1). Of the seven corridors, four directly involve the Mediterranean area:

- Interconnections in SW Europe (electricity) aim at enabling North African renewable sources to flow towards EU-Med countries, in particular Spain, Portugal and France, and beyond towards Central Europe;
- The Southern Corridor (gas) is promoted to diversify both gas sources and routes from the Middle East to the EU;

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53 COM(2010)639. Communication from the Commission to the European Parliament, the Council, the EEESC and the Committee of the Regions
54 COM(2010)677 final. Communication from the Commission to the European Parliament, the Council, the EEESC and the Committee of the Regions
55 Including the Caspian area and Central Asia
The North-South Corridor in Western Europe (gas) is intended to break the quasi isolation of the Iberian Peninsula through a large-size gas bridge across the Pyrenean range;

The North-South Corridor in Eastern Europe (gas and oil) is intended to link the Baltic Sea to the southern seas (Adriatic, Aegean and Black Seas), so as to bring alternative sources of supply to central and eastern EU countries that currently rely heavily on a single source and route.

Map 3.1: Priority corridors for electricity, gas and oil

This Communication is also fairly specific and concrete with regards to modalities. It proposes to replace the TEN-E procedure with its long and rigid project lists, by a more flexible approach focusing on a limited number of European priorities and the identification of concrete facilities labelled “projects of European interest”. It also proposes a “toolbox” aiming at speeding up the programme’s implementation:

- Further development of regional cooperation via regional clusters, e.g. the BEMIP\textsuperscript{56};

\textsuperscript{56} Baltic Energy Market Interconnection Plan
Establishment of a contact authority ("one-stop shopping") for each project of European interest, serving as a single interface between project developers and the competent authorities involved at national, regional, and/or local level;

The introduction of a time limit for a final positive or negative decision to be taken by the competent authority will be explored.

The third key component deals with financing. Around one trillion euros must be invested in the EU energy system between today and 2020\textsuperscript{57}. Of this investment, approximately 200 billion euros are needed for energy transmission networks alone. The European Commission acknowledges that an investment gap estimated at about 60 billion euros is likely to remain by 2020, mainly due to the non-commercial positive externalities and the risks inherent to new technologies. As for funding, a number of measures are suggested:

- Leveraging private sources through improved cost allocation, including the introduction of guidelines or a legislative proposal to address cost allocation of major technologically complex or cross-border projects;
- Combining existing and innovative financial mechanisms that are different, flexible and tailored towards the specific financial risks and needs faced by projects at the various stages of their development.

**European Energy Programme for Recovery (EEPR).** The European Economic Recovery Plan (EERP) was put in place to counter the negative effects of the economic downturn. One component of the EERP, the European Energy Programme for Recovery (EEPR)\textsuperscript{58}, is specifically dedicated to the energy sector. A first batch of €1.6 billion was mobilised in December 2008 to help promote offshore wind projects and carbon capture and storage (CCS) facilities. A second tranche of €2.4 billion was allocated in March 2010 to gas (31) and electricity (12) transmission projects.

While climate change concerns South Mediterranean countries, awareness is not as widespread as in North Mediterranean industrialised countries, and no formal limitations on CO\textsubscript{2} emissions have been adopted by the different States\textsuperscript{59}. Nevertheless, the fight against global warming has been concretised through the impetus given to renewable energy generation. There is huge potential for solar energy in the Southern Mediterranean, and wind potential is also substantial.

South Mediterranean countries have been experiencing long-term strong demographic growth, and stabilisation will not occur before 2050. At the same time, most of these countries are committed to dynamic economic growth\textsuperscript{60}. The outcome is a growing energy demand, not only in terms of quantities, but also with minimum breakdowns and power cuts.

Accordingly, if renewable energy resources are to be exploited, their outlet can not only be for exports, but also to meet the growing national demands.

\textsuperscript{57} COM(2010)677 final. Para. 2.7.

\textsuperscript{58} Regulation (EC) No 663/2009 of the European Parliament and of the Council of 13 July 2009 establishing a programme to aid economic recovery by granting Community financial assistance to projects in the field of energy

\textsuperscript{59} On post Cancun issues, cf. the report by Pierre Radanne, Emeline Diaz and Ken Xie: “La politique internationale de lutte contre le changement climatique à l’issue de la Conférence de Cancún : note de décryptage” IEPF, January 2010

\textsuperscript{60} In the FEMIP South Mediterranean countries (all except Libya): “The potential workforce in the 15 to 65 age range is set to increase by more than 60 million by 2030”, Euro-Mediterranean Forum of Economic Institutes (FEMISE), Report on: “The crisis and ways out of it in the FEMIP Mediterranean partner countries” November 2010
The European Directive on Renewable Energy Sources was issued on 23 April 2009 (Directive 2009/28/EC amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC). It imposes renewable targets for 2020 across the EU, including a 20% target for the share of energy from renewable sources across the EU.

Article 9 of the Directive foresees the possibility of “joint projects between Member States and third countries”61. The Directive considers the possibility of developing a substantial amount of RE generation in North Africa and the subsequent transfer of power to Europe through new South-North Mediterranean electricity corridors. The promotion of renewable energy in the Southern Mediterranean can therefore be linked to internal EU objectives.

In accordance with this European regulatory framework, the “Mediterranean Solar Plan” was launched, followed by two major initiatives undertaken in the Northern Mediterranean, DESERTEC II and MEDGRID (which will succeed TRANSGREEN). In parallel, in the SEMCs’ energy policies, growing importance was attached to the promotion of wind and solar energy, supported by ongoing projects.

Furthermore, the EU Energy Strategy is guided by other priorities which will shape external relations with the Southern Mediterranean. In relation to the above objective of fighting climate change, the EU wants to make a technological shift “to de-carbonize the electricity and transport sectors”. To this end, the “Strategic Energy Technology Plan”, adopted in 2007, will be implemented as the core of the EU’s low carbon technology. It aims to accelerate the market introduction of low-carbon and efficient energy technologies. Since major initiatives are going to be taken in the Southern Mediterranean, with solar plants, wind farms and energy transportation grids, the question of developing facilities for “carbon capture and storage” is part of the SET plan, in line with the European Industrial Initiatives. Finding solutions is problematic due to limited storage capacities. Here again, relations with the Southern Mediterranean are concerned.

Consequently, the question of interconnections with the Southern Mediterranean is implied in one of the priority areas of the EU Energy Strategy: implementing modern integrated grids. The outcome shall not only be a “Supergrid” and/or a “Smart Grid”, but also a functioning internal market, implying that the same rules be applied across the board. Energy relations between the Northern and the Southern Mediterranean are governed by market economy rules62. In the energy sector, implementing market economy rules means structuring an open competition process with a monopoly unbundling process, under the supervision of a Regulation Authority, as can be observed in the European Union. As reported below, this is far from being the case in South Mediterranean countries, particularly in the electricity sector.

61 Cf. Official Journal of the European Union, 5.6.2009. Article 9 of the Directive stipulates in section 2, that: “Electricity from renewable energy sources produced in a third country shall be taken into account only for the purposes of measuring compliance with the requirements of this Directive concerning national overall targets if the following conditions are met: (a) the electricity is consumed in the Community, a requirement that is deemed to be met where: (i) an equivalent amount of electricity to the electricity accounted for has been firmly nominated to the allocated interconnection capacity by all responsible transmission system operators in the country of origin, the country of destination and, if relevant, each third country of transit; (ii) an equivalent amount of electricity to the electricity accounted for has been firmly registered in the schedule of balance by the responsible transmission system operator on the Community side of an interconnector; and (iii) the nominated capacity and the production of electricity from renewable energy sources by the installation referred to in paragraph 2(b) refer to the same period of time; (b) the electricity is produced by a newly constructed installation that became operational after 25 June 2009 or by the increased capacity of an installation that was refurbished after that date, under a joint project as referred to in paragraph 1; and (c) the amount of electricity produced and exported has not received support from a support scheme of a third country other than investment aid granted to the installation.”

62 It should be borne in mind that the 5th Euro-Mediterranean Ministerial conference, of 17 Dec. 2007, agreed a six-year Action Plan to create “a common Euro-Mediterranean energy market”
3.2. **Energy policies and issues in the electricity sector**

3.2.1. **Energy policies in South Mediterranean Power Pools**

In view of the current economic crisis and the consequences for South Mediterranean countries, the FEMIP (Facility for Euro-Mediterranean Investment and Partnership) asserted that the FMCs (FEMIP Member Countries) should develop new “catalysts for growth” in order to converge with the other countries in the region (which would require annual GDP growth of 7% on average).

Energy could be one such “catalyst for growth”, insofar as the sector’s liberalisation is pushed forward and opened up to foreign direct investment by making it more attractive.

The role of the Euro-Mediterranean partnership must be highlighted, since it has “made the countries in the region more attractive and will inevitably have a greater impact in the future in terms of spillover effects”\(^{63}\). Several MEDA projects of support to private sector development have been successfully performed in almost all SEMCs, and are currently continuing.

In the energy sector however, investment costs are high, as are trading risks. The setting up of Independent Power Producers (IPP) in energy production is at stake. The economic and commercial risks faced by IPPs could hamper the electric sector reform, which aims to implement new rules for electricity supply and distribution. Although not defined and applied everywhere, national regulation schemes are becoming pervasive, especially since in almost all SEMCs, economic pragmatism is now the rule; the State and the Market are no longer opposed. Interconnections are key to open regional markets up to electricity supply from abroad.

Continuing to subsidise electricity in SEMCs for social reasons is a crucial problem, since it can impede the development of interconnections by making cross border tariffs difficult to determine. Domestic electricity tariffs are low, and not high enough to ensure profitability for independent producers or renewed investment.

If this issue is not resolved, the multiplication of IPPs and thus the attractiveness of the energy sector for FDI (Foreign Direct Investment), will be limited. Ultimately, IPPs need guarantees regarding electricity payments. But will the States grant them?

When assessing energy policy in the electricity sector in the Southern Mediterranean, the most useful approach is to consider the main power pools sharing the South and East MEDRING. Three Power Pools are clearly the most able to spur electricity interconnections with the Northern Mediterranean, considering their own importance and links with neighbouring countries: (i) the North African pool, already interconnected and in a process of compromises between the different energy regimes; (ii) Egypt, whose weight is considerable in the interconnected Mashreq grid; (iii) Turkey, a single pool which is nonetheless in an advanced process of integrating the European grid.

These pools are presented hereafter, including energy policy and the situation in terms of renewable energy and interconnections.

\(^{63}\) FEMIP/FEMISE Report (Executive Summary)
3.2.1.1. The North African Power Pool

The electric sector of the three Maghreb countries – Morocco, Algeria, and Tunisia – is expected to record an annual growth rate of 5.3% (installed capacity) and 4.7% (electricity production), representing twice as much as the 2005 figures. Since the mid-1990s, the three countries have embarked on a reform process, with each country following its own scope and pace.

However, regulatory issues have not achieved the same state of development in each of the three countries:

- The only country with an official Regulation Agency is Algeria. The CREG (Commission de régulation de l’électricité et du gaz) was created in 2002. Its status and role are defined by law. Although invested with far-reaching prerogatives, the CREG acts under the direct responsibility of the Ministry of Energy, which is not in accordance with international and European standards.
- In Morocco, the setting up of a Regulation Agency is under study with the budgetary support of the EU (2009–2011). One of the conditions is precisely the “Definition of a national regulation scheme of the Moroccan electrical sector”.
- In Tunisia there is no regulation authority.

It is worth noting that the present chairman of the Algerian CREG, has for several months now been the Chairman of the Mediterranean Regulators, MEDREG. In October 2010, the MEDREG Action Plan for 2011-2013 was discussed in the perspective of reinforcing the role of the Association within the Euro-Mediterranean energy cooperation context. The declared aim was to improve and harmonise the regulatory framework to make it functional for new energy infrastructure investments and regional market integration.

Algeria

The 2002 legislation (“relating to electricity and gas distribution by mains”) has put an end to the monopoly of electricity and natural gas production and marketing in the national market, and has opened these activities to private investment and competition.

The law gives operators the right to freely produce, export or import electricity; it sets the conditions that pave the way for an electricity market between the Maghreb countries and south European countries (inter-connected networks through the Morocco–Spain underwater cable, and direct interconnection project between Algeria and Spain).

The reorganisation of the state-owned SONELGAZ has led to the creation of several subsidiaries within the group. However, more than eight years after the promulgation of the law, there are few private investors (i.e. at production level and with minority stakes); competition is not yet a reality (private investors request very strong guarantees and remain reluctant to take risks).

MEDREG is an association co-funded by the EU, gathering all Mediterranean countries from the North and South, with the exception of Lebanon, Libya and Syria.
**Renewable**

The national plan for the use of renewable energy has set the target of a 5% share of renewable energy in power generation by 2015. Several projects have been launched: (i) a hybrid power station (solar + gas) at Hassi R'Mel (150 MW including 30 MW CSP, to be put on stream in 2010), (ii) a 10 MW wind farm in Adrar; (iii) electricity supply by photovoltaic systems for approximately 20 villages, and (iv) hybridisation through photovoltaic panels (capacity of 200 MW) in existing diesel-run power stations that supply electricity in remote southern areas.

In addition, SONELGAZ is to invest 100 million US$ in the creation of a photovoltaic panel plant, with an annual production capacity of 50 MW (implementation in 2012).

The joint stock company New Energy Algeria (NEAL) is negotiating a contract with a pool of German companies to export electricity to be produced by thermal and solar power stations in the Sahara (6,000 MW). Electricity will be sent out through a 3,000 km-long cable at a cost estimated at €2 billion. The cost of the solar power stations themselves is estimated at between €12 and €18 billion.

**Morocco**

The legislative framework has allowed the participation of independent power producers (IPPs) since the mid-1990s. In 2007, approximately 65% of electrical production was already being generated by private operators, and this figure has currently reached 70%.

A new institutional and regulatory framework was adopted in March 2010 (Law 13-09) which allows competition for renewable-based power generation. Law 16-08 raised the ceiling for self-producers, from 10 to 50 MWh. Third party access (TPA) into the national grid and interconnections is dealt with in Law 13-09 and Law 16-08.

The design of the revised structure of the electricity sector is underway (with budgetary assistance from the EU).

Recent decisions include the creation of the MASEN (Moroccan Agency for Solar Energy) relating to large-scale solar-based power generation, and of ADEREE, the Agency in charge of the Development of Renewable Energy and Energy Efficiency.

**Renewable**

Of a total of 4,144 MW generated through solar-based projects recorded in the Mediterranean Solar Plan (MSP), Moroccan projects alone account for 2,000 MW (48%). The potential is estimated at 6,000 MW for wind and 2,100 MW for solar (both CSP and PV). The accomplishment of the solar and wind projects will drive the share of renewable energy to 42% of the overall installed capacity by 2020. The overall energy dependence of the country will be curbed from 95% as of now to 85% in 2020.

The "New National Energy Strategy" adopted in 2009 states that:

- Renewable energy should reach 10% of the overall energy demand and 20% of the electricity demand in 2012,
- Private sector participation should be mobilised for the development of renewable energy.

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65 SONATRACH 45 %, SONELGAZ 45 %, and SIM (*Semoulier Industrielle de la Mitidja*) 10 %
The construction of pumped storage power plants (PSPP) will mitigate the intermittency of electricity generated by solar and wind sources. 400 MW of PSPPs should be implemented every five to seven years.

In November 2009, King Mohammed VI announced the launching of the "Moroccan Project for Solar Energy", which plans to install 2,000 MW of solar-based power plants by 2020 in five sites that have been identified. The first international invitation to tender was launched by the MASEN in 2010; it plans to put the first power station on stream in 2015.

The PROMASOL programme aims to promote the development of solar-based appliances (water-heaters) so as to improve load curves and the environment.

**Tunisia**

From 1962, the state-owned STEG was the State monopoly for all power-related activities (production, transmission, distribution and sales). Since 1996 however, power production has been shared with the private sector. The Tunisian Authorities do not currently plan to introduce changes to the current structure.

The Law of 7 February 2009 related to energy efficiency gives self-producers access to distribution and transmission grids, particularly for renewable-based energy. Buy-back tariffs are set at Ministry level.

**Renewable**

The Tunisian Solar Plan (PST) covers the 2010-2016 period and encompasses approximately forty projects: (i) solar, (ii) wind, (iii) energy efficiency, (iv) other projects, and (v) studies and implementation of the PST.

The renewable energy and energy efficiency projects include and complement the four-year programme for energy management.

The main objectives of the PST can be summarised as follows:

- Strong penetration of renewable energy, in particular solar energy for power generation: 460 MW including 140 MW for CSP and 280 MW for wind,
- Reinforcement of demand-side management, with energy savings reaching 23% of primary supply in 2016,
- Interconnection with the European power grid allowing the exportation of electricity towards Europe. In 2016, export capacity should reach 600 MW, including 200 MW of wind-based and/or CSP-based power and 400 MW of coal- or gas-based power.

The PST plans to realise approximately ten centralised projects to be implemented by the private sector, of which half would be used to meet domestic requirements, with the remainder being directed towards exports.

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66 Ouarzazate (500 MWe), Aïn Beni Mathar (400 MWe), Laayoune (500 MWe), Boujdour (100 MWe) and Tarfaya (500 MWe)

At regional level

The three Maghreb countries are associated with the ENTSO-E and apply their main technical procedures dealing with frequency, reserves, commitment to mutual aid and compensation, with voluntary exchanges.

Currently in the Maghreb, except in Morocco where the share of the private sector in power production is already about 70%, the State remains the largest investor. Private capital is concentrated in production (except in Morocco, where electricity distribution in three large cities has been transferred to the private sector). Experience abroad shows that a concentration of more than 30% of production capacity in the hands of the legacy operator constitutes a significant barrier to open competition.

The conditions for the coordinated operation of the European and Maghreb power grids seem to be met. However, a framework remains to be devised whereby each country can work towards the implementation of a regional electricity market, while complying with common rules and preserving its freedom of choice for the development of its own system.

The regional electric system is indeed very dynamic, and the regional energy base is natural gas. For several years, the system has been driven by important structural and physical changes that should make it possible to increase the level of electricity transfers between countries, in particular:

- Reinforcement of the interconnections between the countries of the region thanks to the completion of the 400 kV lines known as the “shoreline connection”,
- Construction and implementation in the short term of significant production capacity, in particular in Algeria (with large combined cycles units),
- Increased growth of the regional electric demand (5 to 8% p.a.),
- Development and reinforcement of interconnections with Europe. In the three countries, a significant reinforcement of cross-border transmission infrastructure and interconnection capacity, among themselves and with the EU, has recently been achieved.

The power markets of the three countries continue to be regulated and operated by large operators. At the end of 2010, considerable discrepancies between the legislative frameworks of each country remained. The issue of converging towards “Strategic planning for the development of the electricity markets” is still high on the agenda.

Each country has undertaken projects which are neither coordinated nor structured at regional level, nor jointly financed (e.g. Algeria to Spain and to Italy, Tunisia to Italy). Interconnection capacity has historically been under-used. Nevertheless, the justifications for improved cooperation are numerous. For instance, promoting renewable energy has similar objectives for all three countries, whether for rural electrification or electricity exports towards the EU.  

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68 See the study carried out within the framework of the IMME project: “Harmonization of the legislative frameworks” (Miriam Oriolo, June 2009)

69 This question was the subject of a study (same title) carried out for Algeria within the framework of the IMME project (Celia Whitaker, November 2009), which raised great interest from the Algerian party (as well as the Moroccan party). One recommendation was that “the structure of the electricity market in Algeria be modified to create the prerequisites for competition. The minimum levels of modifications are the following ones:

- Restructuring of ownership: opening SONELGAZ SPE equity (and subsidiaries) with the aim of reducing the concentration of the park of production to a maximum of 30% at overall capacity
- Organisational restructuring of the sector: complete unbundling of the market and system operators in a structure entirely independent of the interests of production, supply, and especially SONELGAZ. The equity of the technical operator should not be open to market operators"
The “convergence of perceptions” regarding the concept of market opening and the electric sector’s reorganisation, as revealed through the implementation of the IMME (Intégration des Marchés Maghrébins de l’Electricité)70 project over the past three years, should also be underscored. As underlined during the Steering Committee (COPIL) of the project held in Algiers in January 2010: “One of the most important results of [the] IMME is its capacity to build dialogue opportunities between the representatives of the three beneficiary countries on such a key issue as [the] electricity market”.

In particular, it has become clear that the level of competition considered sufficient to kick-start the process for the progressive integration of the Euro-Maghreb market is the opening of the national markets at the wholesale market level. The conditions of the wholesale market should send clear signals in terms of coherence and efficient tariffs. This is a prerequisite to encourage production investments, and thus create a transparent mechanism to remunerate producers fairly.

This model can be gradually improved insofar as the prerequisites for the creation of competition in the national markets and the market integration conditions are implemented. It could be used as reference for similar projects to be undertaken in other regions, for instance by the MEDRING countries in the Southern Mediterranean.

3.2.1.2. The Egyptian Power Pool

Electricity consumption in Egypt is increasing rapidly. Egypt’s electricity use is expected to increase at an average annual rate of 5.8% in 2010/11, and is then projected to rise at 5.7% for the 2005–2030 period. Demand is projected to reach 54,200 MW by 2026/2771. Electrification is practically achieved.

In order to meet a rising electricity demand, Egypt’s installed electricity generation capacity has grown steadily over the last years, from 23,000 MW in 2007 to reach an expected capacity of 32,000 MW around 2012 (mainly from thermal plants).

Figure 3.1: A vision of the strategic position of Egypt


70 This project, funded by the European Commission, was implemented in Algiers from 2007 until 2010. It concerned the electrical interconnections between Algeria, Morocco and Tunisia and Spain.

The power generation monopoly of the Egyptian Electricity Authority (EEA) was removed in 1984 to allow local generation, by concluding energy purchase contracts with private operators. But Egypt's energy market is currently a single-buyer captive market. The government holds a near-monopoly over generation, transmission and distribution, and determines electricity prices for all sectors. The Egyptian Electricity Transmission Company (EETC) is in charge of managing the HV and EHV grid, and also acts as the single buyer. Substantial subsidies are provided to all sectors.

A series of restructuring steps have taken place since July 2001. The reform process started by unbundling generation, transmission and distribution activities and creating thirteen companies: five generation companies (GenCos), one TSO and seven distribution companies (DisCos). The generation, distribution and transmission companies created through unbundling are all state-owned. Their opening to private investment is expected next. However, IPPs have been set up and privately owned networks in remote areas are under approval.

A “new electricity law” is being discussed. This electricity law will have to introduce arrangements ensuring fair competition, clarifying subsidies and facilitating private investment. It should allow the coexistence of two markets:

- A free market with a spot market and the possibility of negotiating bilateral contracts between producers and eligible customers.
- A regulated market managed by a single buyer.

Furthermore, a political, regulatory and cooperation framework may be needed to encourage private groups, including foreign and particularly European ones, to invest in generation under the new market arrangements. Private investment will clearly be necessary to meet the rapid growth of electricity demand, and attractive solutions will have to be found.

Egypt is dependent on fossil fuels, but oil resources are depleting and estimates on natural gas reserves are controversial. Facing the current rising electricity demand is a real challenge. The Egyptian government has chosen to consider nuclear power and RE sources as new energy options. However, energy savings through improvements in energy efficiency could offer significant potential and must be taken seriously.

In 2007, the Government decided on a regular increase of electricity prices by 5% per year (supposedly net of inflation) in order to improve the financial situation of the electricity sector. Support schemes should be introduced to enable access to cheap electricity for targeted, low-income consumers. In order to adjust tariffs to the cost of supply, it is expected that they will be more balanced between bigger household consumers and industries, when subsidies to the productive sector have been reduced.

Concerning interconnections:

- The interconnector with Jordan is assessed as being adequate for present needs.
- The Tunisia–Italy interconnection is considered by several Egyptian experts to be vital before the Tunisia–Libya–Egypt interconnection is strengthened. Power resources in Libya should be used for exports westwards or eastwards.

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72 On these questions, see the "Egypt" Country Report from the Euro-Mediterranean Energy Forum and Integration of the Euro-Mediterranean Energy Market (09/2007)
• However: “The administered arrangements for use of interconnectors, based on physical compensation or bundled payments, are not a suitable basis for a competitive market. They will have to be gradually replaced by commercial agreements. In an intermediate stage they may be made between single buyers (or equivalent) in contiguous countries”73.

**Renewable:**

Egypt’s viable solar potential is estimated at 74 billion MWh/year. Market and feasibility studies are needed.

Egypt’s PV market is to date limited. The expected new electricity tariff structure could change the demand.

The best wind resources are in the western part of the Gulf of Suez with a potential of approximately 20,000 MW. Short- and medium term plans for Egypt’s wind energy development are targeting the Gulf of Suez. Egypt’s New and Renewable Energy Authority (NREA) has monopolised the development of wind farms through donor-funded projects. The current total installed wind energy capacity is approximately 500 MW; the government’s target is 7,200 MW by 2020. This has spurred investments in large wind turbines.

The “new electricity law” promotes the RE sector and its integration into the national energy system. TSOs and licensed distributors are mandated to connect RE power plants to their networks. Feed-in tariffs will be guaranteed for the electricity sold into the grid. It is assumed that competitive bidding, for a determined share of the Egyptian grid from RE, will create a guaranteed market. This law will have to provide an appropriate framework, including:

• The possibility of concessions and authorisations for private investors.
• Network access for power plants.
• Guaranteed remuneration and favourable feed-in tariffs (or renewable energy certificates) for small- / medium-size projects, as well as for cogeneration investments in industry.
• A technical and contractual framework.

There are no immediate prospects for exporting electricity from renewable to the EU.

Nevertheless, the signing of an MoU between Egypt and the EU on a Strategic Partnership on Energy raised two main points: cooperation on the establishment of an Energy Efficiency Agency; and the establishment of a work programme for the gradual convergence of Egypt’s energy market regulations with those of the EU.

**3.2.1.3. The Turkish Power Pool**

It is likely that Turkey will see the fastest medium- to long term growth in energy demand among the IEA member countries74. Electrification is practically achieved. Priority is given to ENTSO-E interconnections. It is expected that they will reinforce the security of supply and enhance competition on the wholesale market as well as the emergence of a regional market in the Balkans region. Since 2005 therefore, a regulation policy has been progressively implemented in order to support the unbundling process.

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74 Report “Turkey Review 2009” OECD/IEA 2010
It is expected that the restructuring of companies will enhance the performance of the electric sector, reducing cost and debt as well as attracting new investments.

Closely intertwined with economic growth, energy use in Turkey is expected to roughly double over the next decade, and electricity demand is likely to increase even faster. In 2007, the official forecasts were 242 TWh in 2010, and 481 TWh in 2020. Growth at this pace requires not only large investments but also measures to ensure energy security, especially in the electricity sector.

In its "Electricity Market and Security of Supply Strategy", approved on 18 May 2009, the Turkish government outlines an overall target for renewable sources to provide at least 30% of electricity generation by 2023.

Outline of the reform of the Turkish electricity sector:

- The unbundling process of the sector will be accompanied by a full incorporation of companies with financial responsibility and autonomy. Among them, TEAS and TSO will remain state-owned.
- The Energy Market Regulatory Authority (EMRA) regulates wholesale and final electricity tariffs as well as transmission and distribution tariffs. The large share of gas in power generation has increasingly linked gas prices with electricity costs. The liberalisation of gas imports expected by 2012 will reinforce this. The EMRA will strengthen its efforts to adjust household and industry prices as further preparation to market opening.
- TETAS (transmission) acts as a wholesale company buying from EUAS (the public generation company) and IPPs, and selling to TEDAS (distribution).
- The unbundling of the sector will be consolidated by a new Electricity Law and eventually revised to take into account implementation experience.
- In order to maintain self generation, the Government may re-introduce a feed-in tariff for CHP and RE, and possibly other schemes, such as green certificates.
- The competition legislation, in line with the EU IEM (Internal Energy Market), will fully apply by 2012. A new version of the Electricity Law will be enacted prior to further market opening, establishing the role and power of EMRA on the electricity market.
- A qualitative objective is to diversify fuel sources, supply routes and origins, with a quantitative objective being to limit the share of natural gas in the power mix to below 40%. Thus, the share of domestic lignite and to a lower extent renewable energy is expected to increase. Nuclear energy has been envisaged by the government with targeted commissioning of a first nuclear plant from 2012, provided that issues such as economics, safety and waste management are addressed.
- The regulator has extensive relations with EU regulators and CEER (twinning programmes).
- EU assistance is provided for the development of new legislation and regulations on market opening, and EE/RE.

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Renewable/energy efficiency:

Turkey has large potential for increasing power generation from renewable sources. The government has estimated the technically viable potential for hydropower generation at 216 TWh. There is high remaining potential for hydro- and wind power and moreover, the Turkish government has extensive plans for solar and geothermal energy.

According to the EMRA, Turkey has around 14,000 MW of hydropower capacity and 2,500 MW of wind power under construction.

Atlases to map the potential for wind, solar and geothermal energy are being prepared. The wind atlas indicates a technical power generating capacity of 48 GW and the geothermal atlas indicates 600 MW. Photovoltaic applications have a total capacity of around 2 MW and are mainly used where the transmission of electricity is not economically feasible.

There is high potential for energy efficiency improvements in all sectors, particularly in transport and buildings. Furthermore, peak demand for electricity is gradually increasing due to the growing use of appliances for heating and cooling. This demand could be reduced through more efficient appliances and by reducing the need for heating and cooling through better insulation.

3.2.2. Renewable energy and energy efficiency in the Southern Mediterranean

The Mediterranean Energy Ring, linking Europe with the Southern Mediterranean through electricity and gas interconnections, needs to be completed. In particular, it should integrate the development of the huge potential of solar and wind energy.

Renewable energy such as wind and solar energy, which has particularly high potential in the Southern Mediterranean (contrary to hydropower), can play a major role in tackling the twin challenge of energy security (the resources will not deplete) and global warming (their exploitation produces little CO\(^2\)).

Another issue, which is most often neglected in the SEMCs’ energy policies, is the improvement of energy efficiency. Improving energy efficiency could stimulate economic growth, energy security and environmental protection. The EU is fully aware of the importance of this issue, having proposed the initiative for an International Partnership for Energy Efficiency Cooperation (IPEEC), whose establishment was decided in June 2008 at G8 meetings, as a Forum composed of industrialised countries with some emerging countries. However no SEMCs are members. The trend of energy consumption per unit of GDP produced in the south indicates a decrease (-13\%) over a long period (2007–2030), but this is lower than in the north (-34\%). There is evidence that more efforts should be made and initiatives taken in the south\(^{76}\).

Cooperation in the field of energy efficiency should be enhanced, in the construction sector for instance, because this is a fast expanding sector due to demographic growth.

- The setting up of the “Regional Centre for Renewable Energy and Energy Efficiency” (RCREEE) in Cairo\(^{77}\) is a positive initiative for the future. The European Commission (EC) supports RCREEE through two regional programmes: "MED-EMIP" (concerned by the MEDRING) and Phase II of "MED-ENEC" (concerned by construction).

\(^{76}\) The OME (Observatoire Méditerranéen de l’Energie) has produced several efficiency indicators, in kTOE/capita and in kTOE/GDP, in sectors such as industry, transport, residential, and “others”. Cf. “Mediterranean Energy Prospects” p. 18, OME – Paris 2010

\(^{77}\) Established in June 2008 by the following members: Algeria, Egypt, Jordan, Lebanon, Libya, Morocco, Palestine, Syria, Tunisia and Yemen
This European support could be intensified following the model of ELENA (European Local Energy Assistance), a technical assistance mechanism (financed through “Intelligent Energy Europe”) which aims for the setting up of investment programmes through feasibility and marketing studies, energy audits, and calls for tenders for sustainable energy projects to be financed by the EIB.

The creation 15 years ago of MEDENER (Mediterranean Association of the National Agencies for Energy Conservation) under the impetus of ADEME (France) was also positive, but MEDENER only acts as a forum for 11 agencies in the Mediterranean.  

The proper implementation of energy efficiency requires an energy efficiency law that justifies the purpose of the activity, establishes a clear government focus, assigns the responsibilities of actors, and makes provision for an agency and specific instruments. This is the case in Tunisia, which from this point of view appears to be the most advanced country in the Southern Mediterranean. It recently became the case in Morocco (see above). It is also the case in Jordan, where a Renewable Energy and Energy Efficiency Law has been passed and in Israel, where, on 18 September 2008, the government decided to promote energy efficiency measures in order to reduce electricity consumption. As part of this decision, the Israeli government set a guiding objective - to reduce electricity consumption by 20% by 2020.

However, the lack of funding and shortage of Energy Service Companies (ESCO), whose services are compensated by a share of the energy savings achieved over a defined period, mean that energy efficiency policy continues to be a pioneer area in the Southern Mediterranean.

3.2.2.1. The Mediterranean Solar Plan

The purpose of the MSP is to set up 20 GW of additional new and renewable electricity production by 2020, using a mix of technology: PV, CSP, and wind power. It aims to contribute to the convergence of national energy policies and to the emergence of a regulatory environment, enabling the massive scaling up of renewable energy in the region.

The MSP could therefore frame the reform of energy sectors.

The possibility of exporting part of this electricity to the Northern Mediterranean is a guarantee of profitability for investors, hence the importance of article 9 of the Directive 2009/28/EC.

The MSP includes numerous projects in SEMCs. It is expected to:

- Develop renewable energy (RE) generation in the region, in order to meet the increasing energy demand in the Southern Mediterranean;
- Contribute to developing an integrated "Euro-Mediterranean electricity market", which could export part of the electricity produced to the EU.

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79 Presentation made at Brussels seminar (Feb. 2010) expert group meeting on interconnections, by Ing. Ziad Jebri Sabra, Dr Alternative Energy and Energy Efficiency: RE will account for 7% in the primary energy mix in 2015, 10% in 2020 (600–1000 MW in wind energy; 300–600 MW in solar). EE programmes to reach 20% savings by 2020 in all sectors; establishment of an EE Fund for encouraging private sector investment in RE


81 The "Mediterranean Solar Plan" is one of the six official projects that were launched at the Paris Summit, in June 2008, gathering the 43 Head of States of the "Union for the Mediterranean" (UFM). After a "stand-by" due to international political crisis, the MSP was re-launched on 25 June 2009 at a ministerial meeting in Paris.
It is understood that the MSP shall:

- Bring support for country dialogue: establish cooperation agreements and regulatory frameworks considered as vital for long term objectives;
- Work out the conditions for suitable market aggregation;
- Analyse the risks of technical processes (such as CSP or PV);
- Promote the development of electricity interconnections.

Three steps have been identified for the accomplishment of the MSP:

1) Preparation (2008/2009): Establishing governance principles for the implementation of the MSP, setting goals for obtaining countries’ approval, in order to set up the conditions for the projects’ profitability.

According to a recent MSP statement in February 2010 in Brussels, effective changes in the legal frameworks are expected in Morocco, Tunisia, Jordan and Syria. They will concern national solar plans, laws on renewable energy and the introduction of specific tariffs. Similar changes are in progress in Egypt and Turkey.

Sixty seven projects were listed in the agenda for 2010 and after; 74% of these projects were private, and 26% public.

The distribution of projects according to energy sources is the following: wind (26%), PV (45%), CSP (26%), biomass (2%), hydro (1%).

South Mediterranean countries can be differentiated according to the number of projects:

- 1 to 5 projects: Algeria and Jordan;
- 5 to 10 projects: Egypt, Israel, Syria, Lebanon and Turkey;
- Over 10 projects: Morocco and Tunisia.

According to the status of the projects, the following differentiation can be made among the countries:

- 25 projects are officially supported by national programmes for an amount of 4 144 MW: 2000 MW in Morocco, 1070 MW in Syria, 700 MW in Tunisia, 270 MW in Egypt, and 107 MW in the Palestinian territories (which already have more than 1 000 MW in PV).
- 14 projects are under private initiatives for an amount of 650 MW: 245 MW in Morocco, 315 MW in Turkey, 50 MW in Cyprus, and 46 MW in Syria. There are ongoing discussions in the other countries.

### 3.2.2.2. Main current initiatives in renewable

A) The EUROPEAID project, “Paving the way for the Mediterranean Solar Plan in Northern Africa and the Middle East”, is concretising the MSP.

All ENPI-South countries, which belong to the SEMC group (but without Libya and Turkey), are concerned, namely: Algeria, Egypt, Israel, Jordan, Lebanon, Morocco, occupied Palestinian Territory, Syria and Tunisia.

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82 Presentation by P. Lorec, Deputy Director General, "Direction générale de l'énergie et du climat" -MEEDDAT, Brussels, Expert Group on Electricity Interconnections, 8-9/02/2010
83 Launched in October 2010, in a meeting in Brussels
The objectives of “Paving the way” project are the following:

- Strengthen existing renewable energy (RE) and energy efficiency (EE) networks in order to assist MPCs to implement a sustainable energy policy;
- Boost progress in the establishment of a harmonised legislative and regulatory framework, and strengthen institutional capacity;
- Improve knowledge, transfer and capacity building in renewable energy technologies;
- Work with concerned Ministries on pricing policies and subsidies;
- Agree on a cost sharing formula for investment in renewable and EE;
- Define and contribute to implementing a roadmap for an MSP involving all the MPCs in the Southern Mediterranean.

The project is based in Cairo (Egypt), with a branch in Rabat (Morocco).

B) Furthermore, two complementary European initiatives are forecasting the development of renewable energy production. Countries with a large desert area are targeted, particularly in North Africa, but also in the Middle East and Arabic peninsula.

**DESERTEC II** (industrial initiative), launched on 30 October 2009, is a non-profit Foundation aimed at exploiting the solar potential of desert areas across the world.

**Map 3.2: DESERTEC scheme**

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84 12 shareholders from Germany, Spain and Algeria. There is also a DESERTEC – Australia.
DESERTEC is an energy production concept, mainly, but not exclusively, supported by German interest. Due to the area covered, the project will involve geopolitical agreements and can take a place in the MSP. If technically realist (CSP, PV, wind farms), the cost of this project, which plans to supply 15% of electricity needs in the EU by 2050, is estimated at 400 billion euros. The goal of DESERTEC is to achieve 40 GW of renewable energy by 2050. The project is designed to stimulate and federate industrial initiatives and investors. The solar and wind power plants would be connected to the European power markets. The projects should be feasible and attractive for companies.

Besides DESERTEC II, it should be noted that in Abu Dhabi in the Gulf, in one of the biggest oil producing countries, the way to solar energy is already duly engaged. The building of a 500 MW solar plant was launched in 2007 to provide solar power to 10,000 homes, and in order to lessen dependency on hydrocarbon power. Plans for the biggest solar power plant in the world were announced in December 2010.

MEDGRID, succeeding TRANSGREEN, has been designed to complete the DESERTEC production project by another large project aimed at power transmission. A first task is to work out a programme for the development of electricity transportation across the Mediterranean by 2020. The first scheme should arrive in 2013.

The pricing level of renewable energy remains a major issue for both initiatives, which are aimed at attracting investors. The pricing levels are much higher than for thermal or hydro electricity. Indeed, the level currently stands at about €600 /MWh, whereas, as commonly agreed by experts, it should be at most €100 /MWh, even with the advantage of “feed-in” tariffs, in order to be competitive with the current oil price level (about $90/barrel in January 2011).

It should be borne in mind that the primary energy demand in South Mediterranean Partner Countries is predicted to increase by 70% in the next 20 years. Despite the RE potential, meeting this demand increase would rely up to 87% on fossil fuels in a "business as usual" scenario.

The implementation of the MSP faces many challenges before developing RE, the most crucial being that the forecast projects are not currently profitable. Two main tasks should be undertaken:

- Promoting energy price reforms and energy efficiency: renewable technology costs are still quite far from grid parity.
- Addressing the financing of projects and infrastructure: innovative tools to bridge the financial gap are required.

The funding of projects is crucial and problematic insofar as outlets are not guaranteed. The Clean Technology Fund of the World Bank intends to be a co-financer in the range of US$ 750 million. This may help leverage total concessionary funding in the order of US$ 6-8 billion.

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85 The German company DII GmbH initiating DESERTEC was officially created in November 2009. DESERTEC was launched by a Consortium mainly composed of German stakeholders, such as Deutsche Bank, RWE, Siemens, etc., and namely with the partnership of CEVITAL (Algeria). It was then joined by many partners from various interested countries. These include: Saint Gobain Solar (France), Enel Green Power, Terna Energy (Italy), Nareva Holding (Morocco), RED Electrica (Spain), IBM Deutschland, Concentrix Solar (a subsidiary of the French company SOITEC), etc.

86 The statutes were signed and registered in December 2010. The association, launched by EDF in France, gathers about 20 partners (among them ONE - Morocco, TAQA Arabia – Egypt, Walid Elias Establishment – Syria, PANMED – Jordan, etc.).

87 Observatoire Méditerranéen de l’Energie.
Projects registered within the Clean Technical Fund are related to CSP and transmission lines: 13 projects in five countries (3 x 3 in Morocco, Algeria and Tunisia, and 2 x 2 in Egypt and Syria), totalling 885 MW and two transmission lines (Tunisia–Italy and Jordan–Syria).

The European Commission created an innovative financial instrument (26/01/2009) called the Neighbourhood Investment Facility, whose primary objective is to finance key infrastructure projects. Key financing partners could be the EIB, KfW, AFD, AfDB, World Bank, IFC, MIGA and others.

Concerning the EIB, the FEMIP has identified 90 projects in SEMCs, in wind-, solar-, and hydro-energy, representing 10.3 GW and €1.3 billion in subsidies. Leading projects include, for instance, the wind park near Tanger and the solar plant in Ouarzazate in Morocco. In some cases, such as the building of a coal thermal plant dedicated to the Tunisia-Italy interconnection, the financing is blocked due to environmental considerations. It seems that a significant number of these projects are not mature, as they have not reached the stage of presenting a feasibility study. A better project structure can obviously stimulate private investment. Most of the mature projects are now in wind energy, and the question of why so many countries are presenting solar projects could be raised. However, according to FEMIP88, for these projects to become a reality, €21 billion are needed before 2020, €1.2 billion of which would be subsidised.

According to the objective assigned to the “Paving the way” project, “Activities should enhance synergies with ongoing EU- and other donor-funded cooperation, as well as reinforce existing energy agencies and their networks […]”89.

3.2.3. Developing regional interconnections

SEMCs could face critical situations due to a low generation margin, and in such case would have to activate load shedding measures. Hence the necessity of links with neighbours through interconnections which can reduce frequency deviations and interchange power errors. Strong interconnections also yield better technical performances and enhance the security of supply. Consequently, opening the power systems to international electricity trade is a driving force. However, in many cases in the Southern Mediterranean, physical exchanges remain low due to limited NTC (Net Transfer Capacity).

According to an OME (Observatoire Méditerranéen de l’Energie) statement:

“Three technical issues have to be addressed when considering the possibility of exporting power in the order of several GW from North-Africa/Eastern Mediterranean to Europe:

- Transmission grids in SEMC: the existing grids in the region are weak or already saturated. Moreover, they have been designed with reference to conventional generation distributed along the coastal line (fossil fuels generation) or the Nile river (hydropower generation). If a large new RES power production is developed, one needs to reinforce the grid or, better, to “redesign” these grids - establishing dedicated corridors, possibly in DC or with “power flow controller” devices.

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89 ENPI Info Centre Euro Med Regional Project News, Presentation by the service procurement notice: Paving the way for the Mediterranean Solar Plan (16/03/2010). www.enpiinfo.eu/mainmed.php?id_type=1&id=21053
• **Crossing the Mediterranean Basin:** the morphology of the Mediterranean Sea is quite complex and technical barriers exist related to sea depth and slopes. Furthermore, there are some additional environmental constraints, such as protected submarine areas, and the maximum capacities of cables can set a limit on the transmission of high amount[s] of power.

• **Impact on the EU transmission grid:** the current structure of the EU transmission grid does not allow the injection of several GW from the South.\(^{90}\)

Regulatory and legal issues must then be raised because the countries where the infrastructures are to be built should share the required investments. Moreover, the infrastructures which could be foreseen within the MSP framework will require international support, which will also have political dimensions.

The future south-north HVDC links across the Mediterranean basin could offer several “market benefits”:

- Possibly by mitigating the increase of electricity prices in Europe by exchanging energy produced in the SEMCs;
- Promoting the creation of electricity markets, starting in the Maghreb then spreading and possibly including the Mashreq countries;
- Enhancing cooperation with the EU and the progressive integration of SEMCs into the European internal energy market.

Consequently, energy supply security in southern Europe could be improved. This would benefit Italy in particular, which is a great importer of electricity through the heavily congested Alps corridors.

The MSP indeed aims to export part of the electricity produced by solar and wind plants, across the Mediterranean. Besides the technical problem of crossing the sea, a major constraint which has to be overcome is the setting up of a recognised certification body in order to attest that the exported electrons are “green”.

### 3.2.3.1. Crossing the sea: towards an EUMENA Supergrid

According to DESERTEC II\(^ {91}\), it has been estimated that the costs of producing and transporting solar-thermal power between 2020-2030 will be lower than that of the conventional power production technologies in Europe, due to constantly rising fuel prices and environmental costs. This makes the forecast of a trend towards major renewable energy inflow from the MENA area into the European grid realistic.

There are plans for a EUMENA Supergrid to be set up, since interconnections with the Arabic peninsula and Gulf countries are developing.

This forecast was reinforced at the Brussels Seminar by the MEDELEC declaration: “If we want the MSP to be a success, direct connections will have to be built across the sea”\(^ {92}\).

However, as underlined in the DESERTEC presentation, “a holistic approach for integration of European and MENA grids and markets is needed”.

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\(^{90}\) “Mediterranean energy prospects” Report, Paris 2010

\(^{91}\) Brussels Expert Group meeting on interconnections (Feb. 2010), presentation of Paul Van Son, CEO D II

\(^{92}\) Presentation made by MEDELEC representative in Brussels, Expert Group on Electricity Interconnections, 8-9/02/2010
It is certain that HVDC will play a pivotal role in connection with existing / expanding AC grids. There are two main reasons for having the power transmission line over large distances:

- Minimising losses: with EC lines losses increase at a rate of 3 % every 1000 km of transmission;
- Optimising connections with surrounding AC systems: the direction of power flow can be changed very quickly.

The DESERTEC forecast provides the following map, summarising all existing proposals for the Mediterranean Ring (including, for instance, the very hypothetical Libya–Italy interconnection):

Map 3.3: Proposed Mediterranean ring

![Map showing proposed Mediterranean ring connections](image)

The significance of interconnection projects with Italy stands out, with three from North Africa (Maghreb and Libya).

Italy has the highest interconnection rate in Europe. It is at the crossroads of interconnections through the Mediterranean and the Adriatic sea. There are 18 interconnection transmission lines with Italy. Many sections of the grid are congested. The projected interconnections are:

- By ground line: Italy–Slovenia;
- Across the Adriatic (undersea lines): Italy–Croatia (2 x 500 MW, feasibility studies completed), Italy–Montenegro (2 x 500 MW, feasibility studies completed), and Italy–Albania (500 MW, feasibility study in progress). They will be connected through the grid to the existing Italy–Greece interconnection (500 MW).
- Across the Mediterranean: Italy–France, Italy–Tunisia (see section 2.2.4.1. above), Italy–Algeria (2 x 500 MW, feasibility study completed), and Italy–Libya (no study available).
To develop this Mediterranean grid, some major questions should still be raised:

- Forecasts must be made as to the integration of intermittent renewable electricity in the European Grid.
- The EU electricity markets’ opening was expected to result in a convergence of electricity prices in Europe. The congestions in electrical grids imply that finally, the structure of the electricity production park will also converge. The imminent importance of renewable production in Europe makes this convergence more urgent since intermittence can best be mitigated in a large grid. The European "Supergrid" is the planned outcome of this approach, and the “smart grids” forecast in the European “Energy 2020” strategy will allow the optimisation of supply through decentralised energy sources such as renewable.

The most possible routes in the short–medium term are through the Gibraltar interconnection, in order to supply Spain, France, Italy, and then South East Mediterranean Europe.

- The question is do they need this energy in the short-medium term, since increasing efforts have been made to comply with the Directive 2009/28/EC?

All forecasts show that these countries, apart from Italy, will not need this supplementary electric supply before 2020, assuming that the CO² reduction target is maintained at 20 %. However, after 2020, and if this CO² reduction target is increased to 30 %, it is plausible that this electricity from the Southern Mediterranean will be needed to complete the European energy balance.

Conversely, how will interconnections be developed in the Southern Mediterranean? The most advanced case is that of the three Maghreb countries, and lessons can be drawn from it.

### 3.2.3.2. Building the grid in the Western Mediterranean

An interconnected regional grid is essential to overcome constraints within and between countries. It will enhance the security (better management of the spinning reserve\(^{93}\) thanks to the time gap of peak demand between the interconnected countries) and the reliability of the electric system (better management of the system peak load, thanks to the surplus offer, and downgrading of old plants which can be removed more easily). It can use various production means and different products can be sold, such as renewable, at different times depending on the best consuming hours.

It will also enable better investment planning because the optimisation will be at global rather than country by country, allowing optimisation of the load factor.

Exchange opportunities exist at the exploitation level, such as time gaps between countries (for instance official time in Morocco is one hour in advance of Algeria), use of the spinning (or synchronous) reserve, and differences in holidays and working days from one country to another. This will mitigate inefficiency due to starting excessively large units to meet a specific demand, by calling on the power capacity of an interconnected neighbour country.

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\(^{93}\) Spinning reserve (also called "synchronous reserve"): amount of capacity (MW) available in excess of customer demand from generation units delivering energy (MW-hrs) to the system
The electricity transit agreement between Algeria and Spain is worth recalling in this context, as is the bilateral agreement on the economic conditions of electricity purchase and sale between ONE (Morocco) and SONELGAZ (Algeria). The latter was signed in July 2008 during the Energy Ministerial Conference in Algiers (3 July 2008), where the following declaration was issued by the three Ministers (translated from the original text in French): “The purpose of an interconnected Maghreb is to overcome the current situation of instantaneous mutual aid in order to build a true Maghreb market and develop commercial agreements with Europe in the long run”94.

There are indeed two dimensions to Maghreb electricity interconnections: between themselves in the South West Mediterranean, and towards Europe in the North West Mediterranean. The challenge is the building of a West Mediterranean grid.

As a preliminary remark, it should be pointed out that inter-Maghreb commodity exchanges represent only 3.4% of the region’s trade (21% in ASEAN, 19% in MERCOSUR) and that the exports of these three countries towards Europe are approximately 50 times higher than between Maghreb countries. However, changes are ongoing and a preferential agreement signed between Tunisia and Algeria in December 2008 foresaw the dismantling of customs taxes for 2000 products.

Concerning electricity, exchanges between Algeria and Morocco are currently limited at 250 MW, and at 150 MW between Algeria and Tunisia, representing about 1% of the global consumption in the region. Between Spain and Morocco on the other hand, exchanges represented approximately 20% of Morocco’s net consumption. The objective is therefore to exceed the “mutual aid” between countries.

The forecasts to 2020 are the following95:

- 1400 MW between Morocco and Spain (nominal capacity: 2100 MW)
- 1400 MW between Morocco and Algeria (several lines)
- 750 MW between Algeria and Tunisia (n lines)
- 1200 MW between Algeria and Spain (Terga–Almeria, DC)
- 1200 MW between Algeria and Italy via Sardinia (DC)
- 800 MW between Tunisia and Italy via Sicily (ELMED DC).

According to a simulation made by experts (on HILLMIX Software) comparing two development paths for Tunisia, Algeria and Morocco until 2020: T+A+M or TAM, juxtaposition or conjunction, the results are the following, in favour of the TAM:

- The production savings (mainly thermal) would be 1.978 MW: about 7% of total investment.
- The earnings would be: €6.9 billion (13% of the total) for a joint development, of which €2.5 billion for investment expenses.
- Cost improvement of the specific electric consumption is also expected: 2.2 cents €/kWh against 2.4 cents €/kWh in islanded development.

94 Original text in French: L’objectif d’un Maghreb interconnecté est de dépasser le stade actuel des secours mutuels instantanés pour créer un véritable marché maghrébin et développer des accords commerciaux à plus long terme vers l’Europe.

95 The following information comes from the expert study conducted for the IMME project: “Bénéfices économiques d’un renforcement de la cooperation des échanges au Maghreb” Frederic Reveiz, Gerard Malenge, Pierre Holveck, Med Nourredine Dbouib, Hamid Haddouche, Mohammed Hmammouchi, Algiers May 2010
Several cross border opportunities stand out:

- The necessary exchanges would be approximately 1000 to 2000 MW for the three countries, in consistency with the planned interconnection capacities (see above).
- Main goals for short term exchanges:
  - To import electricity at costs lower than own costs during peak time or in case of temporary deficit;
  - To export out of peak time, in order to improve the plants’ utilisation factor;
  - Concerning Algeria and Tunisia, exchanging electricity with Europe via Spain.

Of course, some difficulties would have to be overcome:

1) Defining the transit tariffs: to reach an agreement on the principles, the EU Directives on cross border electricity exchanges could be referred to. The three countries should decide what would be the most appropriate method.

2) How should transnational coordination for production investment be organised, given that, in order to cope with heightened demand in south Morocco, for instance, it would be necessary to invest in Algeria? Who would be in charge of planning?

3) Maintaining subsidised tariffs is an obstacle to the system’s optimisation (no incentive to invest in production). How should they be suppressed?

4) Is it possible to develop electrical interconnections without developing the gas interconnection? Algeria is a main power in gas, and electricity production and selling in Algeria is subsidised, resulting in very low electricity tariffs.

This last point is a cornerstone of the interconnections between Maghreb countries. It was underlined by the CEO of SONELGAZ upon the signature of the “Algiers Declaration” (see below), speaking in a national broadcast (21 June 2010): “we must go toward a tariffs increase... It is important to go toward the real price”. But what is the “real price” in a gas country such as Algeria?

Other problems will arise when integrating the Maghreb electricity market, such as, for instance, the question of market coupling in order to optimise the available capacity.

Both options, between Maghreb countries and/or towards the EU, are still open. Avoiding that they enter into conflict is desirable for the sake of sustainable development in the Maghreb region.

This objective motivated the signature of the “Algiers Declaration” on 20 June 2010 by the three Energy Ministers of Morocco, Algeria and Tunisia, in the presence of the Energy Commissioner of the EU. The Algiers meeting aimed for the implementation of the agreement signed in Rome in December 2003 by the three Energy Ministers and the European Commission during a Euro-Mediterranean Ministerial Council.

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97 Cf. the specific study within the framework of the IMME project: Action 06 “Méthodes de calcul des tarifs de transit international et de gestion des congestions” May 2010, by Frank Braun, Mohammed Hmamouchi, Mustapha Elhaddad, Hamid Haddouche
Algiers Declaration (extracts translated from the original text in French):

“The Ministers:

1  Reaffirm their desire to pursue the reforms of the national energy sectors.  
   [...]  
3  Undertake to pursue the actions designed to harmonise the legislative and  
   regulatory frameworks and the technical and economic conditions required to  
   create a viable electricity market in and between the three Maghreb countries  
   and their integration into the European Union market,  
   [...]  
6  Agree that access to the networks must be non-discriminatory and transparent,  
   and subject to appropriate pricing,  
   [...]  
8  Invite the network managers to draft a set of common rules to facilitate cross-  
   border trade in electricity, [...]  
15  Emphasize the importance of developing new and renewable energies, of  
    promoting energy efficiency and of safeguarding the environment within the  
    framework of electricity market integration, pursuing a sustainable development  
    approach,  
    [...]  
17  Approve the Action Plan appended to this current declaration and mandate the  
    Permanent High Level Group to set up a monitoring committee responsible for its  
    implementation, [...]”.

The second action of the action plan is set out as follows: “To set up in each country  
appropriate regulation authorities”.

3.3. Energy policies and issues in the gas sector

3.3.1. EU policies and strategies for the security of gas supply

The “general” legislative framework\(^98\) presented in Section 2.1 above includes sections on  
natural gas. In addition, dedicated legislation has been developed to specifically cater to  
gas issues, such as the regulation on the security of gas supply. This section briefly  
describes the gas-oriented policies.

The Communication on Energy Infrastructure Priorities for 2020 and Beyond highlights  
several issues that specifically deal with natural gas:

- Gas is set to continue to play a key role in the EU’s energy mix and will gain  
  importance as the back-up fuel for variable electricity generation;
- Conventional natural gas resources require additional, diversified imports. Gas  
  networks face additional flexibility requirements in the system, and the need for bi-  
  directional pipelines, enhanced storage capacities and flexible supply, including  
  liquefied (LNG) and compressed natural gas (CNG);
- A diversified portfolio of physical gas sources and routes and a fully interconnected  
  and bidirectional gas network are needed.

\(^{98}\) Including directives, regulations and communications
Three of the proposed corridors deal directly with gas and the Mediterranean:

- The Southern Corridor to bring gas from the Caspian Basin, Central Asia and the Middle East to the EU;
- The North-South Corridor in Central Eastern and South-East Europe, aiming at connecting the Black, Adriatic and Aegean Seas to the Baltic Sea and the BEMIP;
- The North-South Corridor in Western Europe.

The Communication also makes reference to the regulation on the security of gas supply. **Regulation Concerning Measures to Safeguard Security of Gas Supply**. This Regulation clearly tackles the consequences of the Russia-Ukraine dispute that considerably impacted the supply of the European Union, in particular the Central and Eastern countries in early 2009. As Energy Commissioner Piebalgs stated: "We have known for some time that the existing arrangements to deal with gas emergencies are insufficient. The Russia-Ukraine gas dispute in January 2009 confirmed our fears." The Regulation refers to previous documents, including the Second Strategic Energy Review (November 2008) and the Report on Implementation of the European Security Strategy (December 2008).

The Regulation calls Member States to be fully prepared in case of supply disruption, through clear and effective preventive action plans and emergency plans involving all stakeholders and incorporating fully the EU dimension of any significant disruption. The plans should be based on appropriate risk assessments based on a common indicator known as N-1, defined as the shutdown of the main supply infrastructure (import pipeline, LNG terminal or production facility) in each Member State. The gas grid should be able to supply all “protected customers” for at least 30 days in severe conditions.

The Member States will designate a “competent authority” with specific responsibility for the security of gas supply, including performing the risk assessment, setting up a preventive action plan, preparing emergency plans, and making it compulsory for TSOs to implement the required measures, such as investment in new interconnections or reverse flow pipelines. This authority will be responsible for the constant monitoring of gas supplies at national level to identify weaknesses early on.

The authority, which can be a regulatory or government authority, will be responsible for implementing the Regulation and coordinating with other Member States and with the Commission. The Commission will remain heavily involved in the design and the monitoring of the action plans through coordination between the authorities and such institutions as a strengthened Gas Coordination Group (GCG), ACER and ENTSO-G.

The cost of required new security infrastructures will be supported by the TSOs, which will be allowed to integrate them into gas bills. However, where the cost of meeting EU security of gas supply requirements necessitates investments which the market or individual Member States may not be able to pay, EU financial support may be available, for example through the European Economic Recovery Plan.

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Regional cooperation is strongly encouraged, in particular for the performance of the risk assessment and the definition of the Preventive Action Plan and Emergency Plan, and the execution of the latter, for instance, through the operation of cross border pipelines in reverse flow. Annex IV of the Regulation proposes examples of cooperation between Member States, including, in respect of South European countries:

- The Iberian Peninsula (Spain and Portugal) and France,
- Bulgaria, Greece and Romania,
- Slovenia, Italy, Austria, Hungary and Romania,
- France, Germany, Belgium, the Netherlands and Luxembourg.

The European Energy Programme for Recovery (EEPR) proposes 31 gas infrastructure projects, including 15 cross border pipelines, 14 reverse flow connections, one LNG terminal and one underground storage facility (UGS). Of these projects, eight cross border pipelines and one reverse flow connection involve Mediterranean Member States or deal with supplying the European Union from the Caspian/Middle East area. These nine projects have been allocated a total of 937 million euros, i.e. 39% of the 2.4 billion earmarked for the second tranche.

Table 3.1: EERP: Eligible gas projects in EU-MED countries

<table>
<thead>
<tr>
<th>Import Pipelines</th>
<th>Project</th>
<th>Sponsor(s)</th>
<th>Country(ies)</th>
<th>EU contribution (million €)</th>
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<tbody>
<tr>
<td></td>
<td>Nabucco</td>
<td>Nabucco Gas Pipeline International (NIG)</td>
<td>AT, BG, DE, HU, RO</td>
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<td>ITGI - Poseidon</td>
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<td>GALSI Spa</td>
<td>IT</td>
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<tr>
<th>Cross-border pipelines</th>
<th>Project</th>
<th>Sponsor(s)</th>
<th>Country(ies)</th>
<th>EU contribution (million €)</th>
</tr>
</thead>
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<tr>
<td></td>
<td>Interconnection Greece-</td>
<td>DEPA, Edison, Bulgaria Energy</td>
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<td></td>
<td>Bulgaria</td>
<td>Holding</td>
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<td></td>
<td>Gas interconnection Larrau</td>
<td>Enagas</td>
<td>ES</td>
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<tr>
<td></td>
<td>France-Belgium interconnection</td>
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<thead>
<tr>
<th>Reinforcement of national grids</th>
<th>Project</th>
<th>Sponsor(s)</th>
<th>Country(ies)</th>
<th>EU contribution (million €)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Gas grid between Austrian</td>
<td>Geoplin</td>
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<td></td>
<td>border and Ljubljana</td>
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<td>Reinforcement of French</td>
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<td>grid on the Africa-Spain-</td>
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<td>France axis</td>
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<th>Reverse flow</th>
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<td>REN</td>
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</table>

Source: Annex to EEPR Regulation, Part A

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101 Including gas import pipelines from the Caspian/Middle East area
### 3.3.2. Policies and issues in South and East Mediterranean countries

There are three gas exporters to Europe in the South and East Mediterranean area: Algeria, Egypt and Libya. The first two countries present some strong similarities:

- First, they are major gas producers and have appropriately elected to rely on gas to supply their domestic market so as to release as much oil as possible for exports.
- Second, they are heavily populated\(^\text{102}\) and must cope with a growing domestic energy demand, which tends to create conflicting policies as to how to allocate gas production.
- Third, they have developed a socially oriented pricing policy that tends to maintain domestic gas prices well below their value, which in turn misallocates the resource and artificially develops gas demand.

Conversely, they have been following quite different policies in respect of, for example, the openness of the gas (and oil) sector to foreign investment, and participation in the development and exploitation of hydrocarbon resources.

**Algeria**

*Export policy*

Algeria has been present in the gas export market for 45 years. It has been a pioneer in both LNG (first loads to the UK and France in 1964) and offshore pipelines (Transmed to Italy in 1983). As the sixth world producer and fifth world exporter of gas, it holds the largest reserves of the Mediterranean region with 150 Tcf\(^\text{103}\), mostly as non-associated gas. The country relies heavily on hydrocarbon exports for its trade balance (97% of total exports) and contribution to the State budget. In 2005, the then Minister of Energy and Mines announced a very ambitious export development programme, aiming at raising gas exports from 60 to 85 bcm by 2010 – a 12% p.a. growth rate.

Unfortunately for Algeria, this challenge is far from being met. The gas crunch in Europe in 2009 certainly did not help. The gas demand in Algeria’s main markets plummeted by 10% in Spain and 8% in Italy, leading Algeria to export a mere 58 bcm following 63 bcm in 2008. But other factors, as discussed below, have largely contributed to making the target out of reach. The replacement in June 2010, after ten years in office, of the Minister of Energy Chakib Khelil by Youcef Yousfi, a former energy minister and head of Sonatrach, is likely to re-direct the country’s export strategy towards more accessible objectives. The amount of 85 bcm is currently set for 2012, although analysts consider that 2014 is a more realistic deadline.

*Upstream reform*

When he took to office in 2000, Chakib Khelil appeared likely to be a radically reforming minister, drawing on his twenty years spent with the World Bank, where he was instrumental in reforming the hydrocarbons sector in Latin America.

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\(^{102}\) The populations of Algeria and Egypt are 36 and 78 million respectively, highly concentrated in a limited portion of the overall territory, generating strong demographic density. The population of Libya is only 6.5 million (see Introduction, Table 1).

\(^{103}\) Tcf: Trillion cubic feet, 150 Tcf is about 4,200 billion cubic meters
He proposed a series of reforms aimed at liberalising the domestic energy market and changing the status of Sonatrach, turning it from an arm of the state into a fully commercial company. He went as far at one stage as to suggest that Sonatrach might one day be privatised, but that was going too far for both Sonatrach executives and unions, as well as for the general public, and the minister had to back-track on the privatisation issue.

The centrepiece of his reform package was a new Hydrocarbons Law aiming to replace that dating from 1986. The reform faced fierce opposition from the same stakeholders and had its provisions watered down before it was finally passed into law in 2006. In its final form, the law contains provisions that ensure that Sonatrach remains in the driving seat in the Algerian industry, including allowing it to maintain control over Algerian gas developments.

**Foreign investment**

The production and the transport of gas are still centred on the giant Hassi R'Mel gas field, which plays the role of the country’s gas hub, where all production converges and all pipelines leave from to feed both domestic and export markets up north. However, despite its size – and large remaining reserves – a substantial part of the production must be recycled back into the reservoir to maintain pressure and allow the production of valuable amounts of condensate. To complement this, Sonatrach has started to develop other fields around In Salah through concessions granted following licensing rounds – a main component of the 2006 reform. However, while initial rounds attracted keen interest from the operators in the mid-2000s, the last round, launched in July 2010, failed to attract as much interest and only three out of ten perimeters were awarded. In spite of the reform and the creation of an upstream (licensing) Authority, the relationships with foreign investors have always proved difficult, as illustrated by several agreements that have recently been broken or not confirmed.

**Egypt**

**Main features**

Egypt’s natural gas history began in 1995 when foreign and domestic oil and gas companies were given permission to actively drill for gas in order to satisfy domestic demand. In 1999, the Egyptian government encouraged the further search for export markets. An Integrated Gas Strategy was devised in 1999. It included a Master Plan that set out the bases of the Government’s policy and was meant to remain valid through 2017. The Master Plan involves price optimisation to attract investors, increased gas exports, and infrastructure development, qualified by six considerations:

- An export ceiling — 25 % of total production (the figure has been revised along the ‘three thirds’ theory: one-third of the reserves for exports, one-third for the domestic market, and one-third to remain undeveloped to cater for the future generations);
- No foreign or domestic gas operator may export gas from Egypt prior to investing in Egypt’s domestic gas market;
- Special incentives were established to encourage foreign and Egyptian Exploration & Production (E&P) companies to establish marketing franchises, in order to promote gas-based business within Egypt;
• Incentives were also established to encourage diversification within the gas industry;
• Exploration & Production (E&P) incentives were aimed to maintain a higher level of attractiveness, when compared with neighbouring countries;
• All businesses within Egypt - whether state-controlled, private, or mixed - were encouraged to convert to natural gas for energy needs.

Industry structure
The gas (and oil) sector is still heavily in the hands of the State. The Egyptian General Petroleum Corporation (EGPC) is a state entity in charge of managing upstream activities including infrastructure, licensing and production. The promotion of the sector along with the development strategy is managed by the Egyptian Natural Gas Holding Company (EGAS). Both EGPC and EGAS work with companies in joint venture partnerships. To promote exploration in the more expensive deepwater offshore, the Egyptian government revised pricing policies by agreeing to pay more for natural gas produced in these areas, assuring continued international interest in developing these potential resources.

Foreign investment
Unlike Algeria, Egypt has adopted attractive legislation allowing a strong increase of foreign investments, especially concerning offshore gas. This spilled over into a rapid growth of gas production from 14 to 62 bcm between 1998 and 2009. International oil companies (IOC) are heavily involved in exploration and production (E&P), as well as gas liquefaction. They are usually the main European oil and gas operators, including BP, BG, Total, Shell, as well as major gas consumers, including power utilities such as GDF-Suez, ENDESA and ENEL.

Export policy
Like Algeria, Egypt has been able to widely develop domestic networks and consumption, because such objective could go along with an aggressive, and successful, export-oriented policy. In 2010, gas exports were expected to reach 21 bcm, about half the level of domestic demand (44 bcm). However, domestic demand is still growing at a very fast rate (7% p.a. in the past decade), fuelled by power generation that absorbs about two-thirds of the domestic demand, which has made meeting the country's domestic gas demand a serious political challenge for the government. In June 2008, the Petroleum Minister imposed a two-year moratorium on any new export contracts, which is supposed to be lifted (or renewed) by the end of 2010. To date, no decision has reportedly been taken, but analysts consider that the recent blackouts during the Ramadan period as well as strong popular opposition to further developing exports are likely to lead the Government to extend the moratorium – whether openly or tacitly. A negative consequence is that IOCs have shown some reluctance to getting more involved in field development, given the uncertainties on gas allocation and pricing. As an example, only four out of seven offshore blocks offered in 2009 have received bids and been awarded (and there was only one bid for two of them). However, a more recent deal struck with BP and RWE, whereby the IOCs are allowed to hold 100% of the production operation – a departure from the previous requirement that EGPC and Egas should have equity interests upstream, together with better prices for the gas sold for domestic consumption - was regarded as a positive move of the Government towards more attractive terms.
Libya

Given its long-lasting international isolation, Libya is still in an initial phase of exploiting its natural gas resources. In fact, it possesses only one consistent channel for export purposes, namely the Green Stream gas pipeline with an overall capacity of 11 bcm a year connecting it with Italy. Libya intends to significantly increase its gas production, replacing oil both in the electricity and industrial sectors, in order to have surplus oil for export and increase gas exports. However, the results of recent explorations are rather disappointing. Consequently, production increases could be slower than anticipated. Furthermore, while still attracted by the potential of the country, foreign investors’ involvement is constrained by the strong uncertainties surrounding the institutional and commercial frameworks.

3.3.3. Pricing and contract types

Since the beginning of gas history, continental Europe (thus including EU-MED countries) has been relying on long term (LT) contracts associated with oil-indexed prices and take-or-pay clauses. The system was largely accepted by both suppliers and purchasers as it was the best means to warrant predictable and secure revenues for investors tied in long term ventures, and to make sure that gas would remain competitive (provided $P_0$ was correctly set) vis-à-vis its main competitor – oil. Although spot markets have developed since the 1990s, in particular – but not only – thanks to LNG trade, LT contracts still constitute the bulk of the supply to Europe.

However, several factors have recently compounded to seriously rock the supremacy of LT contracts. First, the increasing share of LNG makes gas trade much more liquid than rigid contracts, with mid-size cargoes – sold at spot price – able to reach an LNG terminal or to be re-directed to the best market under short notice. Second, the economic downturn has significantly reduced gas demand in Europe (in particular for power generation) in countries well equipped in terminals, such as Spain. Third, an impressive array of liquefaction trains has been put on stream in the last two years, in particular in the Gulf (Qatar and Yemen), creating over-supply in spite of the development of the Asian markets. Last but not least, the spectacular development of unconventional gas in the US has driven gas prices downwards, made LNG imports less necessary (the US ceased to import Algerian LNG in 2008), and led US-oriented LNG producers and shippers to rapidly find new markets with better value.

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104 In a gas purchase agreement (GPA), $P_0$ is the base price of gas initially agreed upon at contract signature. The price of gas may then be modified, according to the escalation formula set in the GPA, as the reference price of oil – or oil product mix – evolves.

105 Yemen is usually considered as a “Gulf” producer, along with Qatar, Abu Dhabi and Oman
Figure 3.2: Spot Prices at Henry Hub (US) and NBP (UK) in 2009

![Graph showing spot prices at Henry Hub (US) and NBP (UK) in 2009.]

**Source:** Gas Strategies, *Europe’s gas industry needs transformation to adapt to energy revolution*, December 2009, quoted in GMF Policy Brief, February 26, 2010

With the European markets likely to continue to be in gas for some time, price-based competition is bound to increase, threatening the structure of LT contracts with prices linked to oil. For most of 2009, traded gas prices in North West Europe's spot markets have been running $2-3/mmbtu below the LT contract prices.

Incumbent gas producers, including Algeria's Sonatrach and Russia's Gazprom, have always strongly advocated in favour of LT contracts, and were vehement critics of the European Commission's approach to the gas markets at the time the first Gas Directive was enacted in 1996. As an example, Sonatrach has never accepted to sell gas in spot cargoes.

In a market dominated by long-term and oil-indexed supply contracts, the impact of the tendencies briefly described above will be slow. However, the perspectives of an extended period of large availability of LNG at good prices will ease European concerns regarding security of supply. Mediterranean exporting countries, and above all Algeria, will be subject to pressures in favour of a greater flexibility of existing long-term contracts and to pressures to grant more favourable conditions to foreign investors for the exploration and development of gas reserves. This latter issue is of particular relevance because, in a buyer's market, less attractive commercial incentives to foreign operators are driving them away from much needed investments (in producing countries), as observed in the recent past in Algeria and Egypt.
### 3.3.4. Pipeline or LNG?

Pipeline gas and LNG basically present the same physical and usage characteristics. However, LNG is generally ‘purer’ than pipeline gas because the liquefaction operation requires high quality gas whereas pipelines can transport almost any type of gas, provided basic treatment has been applied such as dehydration and filtering. At the reception point, pipeline gas and LNG may be mixed to supply consumers. They do not require separate pipelines or markets\(^{106}\).

The choice between pipeline gas and LNG is therefore driven by economic or operating issues. From an economic standpoint, it is generally admitted that LNG is cheaper than overland pipeline over distances beyond 3,500-4,000 km, which is for instance the case of Nigeria-Europe or Gulf-Europe routes. It is cheaper than an offshore pipeline as soon as the distance exceeds 1,200-1,500 km. However, the real economics depend to a substantial extent on the physical and geographical characteristics of the route. Technical – hence economic – conditions of offshore pipe-laying are quite different depending on whether the pipeline is laid across the North Sea or the Baltic Sea (in very shallow waters), or across the Black Sea (over 2,000 meters deep) or some parts of the Mediterranean. Similarly, the cost of a liquefaction plant or regasification terminal depends, as it is the case for any large size civil works, on its location and on the magnitude of the harbour facilities required to handle the LNG tankers – irrespective of the gas facilities themselves. Maritime installations may constitute up to 40% of the total cost of a liquefaction plant.

**Figure 3.3: Comparative costs of pipeline and LNG**

\[
x \times 80 \text{ euros} / 1 \text{ 000 m}^3
\]

![Graph comparing costs of pipeline and LNG](Source: Institute of Gas Technology)

**Source:** Centre d’Analyse Stratégique, La sécurité gazière en Europe, N°26-2010

**Legend:** Gazoduc sous-marin: Offshore pipeline; Gazoduc terrestre: Overland pipeline; GNL: LNG

From an operating standpoint, LNG generally offers added supply flexibility. The characteristic of discrete shipments, i.e. non permanent flow, makes LNG more appropriate for spot cargoes or seasonal supplies. This is particularly interesting where

\(^{106}\) Conversely to low calorific (L-gas) and high calorific (H-gas) gases
an LNG exporter holds contracts with buyers located in both tropical countries (where the peak load occurs in summer due to air conditioning) and temperate countries (with peak load in winter). An interesting example is given by Spain, where pipeline gas is responsible for part of the base load and it brings a more stable performance over the course of the year, as the modulation resulting from the seasonal nature of demand is covered through LNG. In general, international gas pipeline connections operate with quite regular flows that adjust to the flexibility of gas purchase contracts and to the need to comply with the “take or pay” guaranteed purchase clause.

### 3.3.5. Supply diversification

The Regulation on the Security of Gas Supply stresses that the diversification of gas routes and sources is a key component to ensure the security of gas supply for Member States: “The diversification of gas routes and of sources of supply for the Union is essential for improving the security of supply of the Union as a whole and its Member States individually. Security of supply will depend in the future on the evolution of the fuel mix, the development of production in the Union and in third countries supplying the Union, investments in storage facilities and in the diversification of gas routes and of sources of supply within and outside the Union including Liquefied Natural Gas (LNG) facilities”

Supply diversification has improved over the past decade, due to the development of new gas sources and the construction of several LNG terminals in some countries in the Mediterranean area (particularly Spain, and also France, Portugal and Italy) and northern EU (the UK). However, several issues still remain:

- Gas is still largely supplied by the three legacy providers, including Algeria (28 %), Russia (19 %) and Norway (16 %), even in the EU-MED countries where LNG accounts for the largest share of gas supply in the EU;
- LNG contracts and supplies are and will remain marginal, compared to the size of pipeline supplies. While LNG makes it possible to tap a wider number of gas producers, it is not able to actually counter massive additional pipeline supplies of a single producer of the size of Gazprom. Indeed the largest new LNG supplier, Qatar, which has become the largest world LNG producer, accounted for no more than 4 % of EU-MED imports in 2009;
- The new Regulation will certainly improve the security of supply in Europe, in particular in Central and Eastern Member States, as it sets out concrete obligations, e.g. reversible pipelines and cross-border interconnections. However, it suffers, in our opinion, from two key shortcomings:
  - All the measures focus on mitigating the technical risks that may occur in a Member State’s network, as evidenced by the N-1 standard concept. It does not address the political and strategic risks that may threaten the supply of the European Union. As such, it gives a valuable answer to one of the two policy components: the diversification of routes; but it does not concretely address the issue of the diversification of sources;
  - It leaves to the market (TSOs and shippers) the core responsibility of evaluating the risks and remedying them, under the supervision of the European Commission. The European Commission retains a secondary responsibility; it does not take the lead for the promotion of the diversification of sources.

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107 Regulation (EU) NO 994/2010, whereas # (7)
A striking illustration is given by the competition for the South Corridor. As briefly described in Section 2.3.6 above, two main projects are competing to supply Europe with additional volumes in the medium term: the EU-backed Nabucco and the Gazprom/ENI-sponsored South Stream. One of the key problems is that, while both projects will definitely diversify the supply routes, only one will, in addition, diversify the sources. We believe that only the Nabucco, in association with one of the two smaller-size Greece-Italy projects, is able to fulfil the double objective of route and source diversification. With 112 bcm in 2009\textsuperscript{108}, Russia already accounts for 29\% of EU imports. The implementation of the Nord Stream will bring an additional 55 bcm when fully operational (2013). The South Stream is designed to carry 60 bcm. While part of these additional volumes will presumably substitute for supplies that are currently channelled through Ukraine (and possibly Belarus), the share of Russia is likely to reach over 50\% of EU imports.

3.3.6. Environmental Challenges

The role that larger natural gas supplies will play in a push by many countries toward more renewable fuel sources may have a significant outcome for efforts to reduce CO\textsubscript{2} emissions worldwide and combat climate change, and yet natural gas remains, in some instances, controversial. Some see natural gas as a big improvement over more carbon-producing energy sources like coal, while others are concerned about the environmental impact of sourcing methods like "fracking". Will natural gas serve as an aid in the transition to more responsible energy consumption, or will its newfound availability depress energy prices and slow the move to renewable sources like wind and solar energy? What are the opportunities - or challenges - that natural gas may present for a sustainable energy economy?

As a fossil fuel, natural gas firstly competes with other fuels – oil and coal. Natural gas is the cleanest of all the fossil fuels, as evidenced in the chart below. Composed primarily of methane, the main products of the combustion of natural gas are carbon dioxide and water vapor. Coal and oil are composed of much more complex molecules, with a higher carbon ratio and higher nitrogen and sulfur contents. This means that when combusted, coal and oil release higher levels of harmful emissions, including a higher ratio of carbon emissions, nitrogen oxides (NOx), and sulfur dioxide (SO\textsubscript{2}). Coal and fuel oil also release ash particles into the environment, substances that do not burn but instead are carried into the atmosphere and contribute to pollution. The combustion of natural gas, on the other hand, releases very small amounts of sulfur dioxide and nitrogen oxides, virtually no ash or particulate matter, and lower levels of carbon dioxide, carbon monoxide, and other reactive hydrocarbons.

\textsuperscript{108} BP Statistical Review of World Energy, June 2010. Other sources quote higher figures.
Natural gas, as the cleanest of the fossil fuels, can be used in many ways to help reduce the emissions of pollutants into the atmosphere. Burning natural gas in the place of other fossil fuels emits fewer harmful pollutants, and an increased reliance on natural gas can potentially reduce the emission of many of these most harmful pollutants.

Conversely to most renewable energy sources, natural gas is a fuel; as such, gas can be used in many more applications than just generating electricity. It is a much more versatile energy source than RES, which gives it a much higher value.

We believe that natural gas and RES should not be regarded as fierce competitors but rather as complementary energy sources. As said John Watson, Chairman and CEO of Chevron Corp. “If you believe that renewables have strong promise for the future, I’m with you. In the long sweep of time, they are going to meet a bigger and bigger share of global demand. But it’s false to assume that renewables can replace conventional energy in the near term, as we are sometimes asked to believe. (...) The solutions to our energy problems are rarely a case of either/or. It’s not a choice between more drilling or more efficiency, coal or wind, nuclear or solar. We need greater efficiency and more renewables. We need nuclear and clean coal. We need wind and oil and natural gas. To achieve energy security, we need it all.”

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109 Speech to the U.S. Chamber of Commerce in Washington, D.C., October 2009

### Fossil Fuel Emission Levels
- **Pounds per Billion Btu of Energy Input**

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Natural Gas</th>
<th>Oil</th>
<th>Coal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon Dioxide</td>
<td>117,000</td>
<td>164,000</td>
<td>208,000</td>
</tr>
<tr>
<td>Carbon Monoxide</td>
<td>40</td>
<td>33</td>
<td>208</td>
</tr>
<tr>
<td>Nitrogen Oxides</td>
<td>92</td>
<td>448</td>
<td>457</td>
</tr>
<tr>
<td>Sulfur Dioxide</td>
<td>1</td>
<td>1,122</td>
<td>2,591</td>
</tr>
<tr>
<td>Particulates</td>
<td>7</td>
<td>84</td>
<td>2,744</td>
</tr>
<tr>
<td>Mercury</td>
<td>0.000</td>
<td>0.007</td>
<td>0.016</td>
</tr>
</tbody>
</table>

**Source:** EIA - Natural Gas Issues and Trends
4. CONCLUSION: RECOMMENDATIONS FOR AN ENERGY STRATEGY IN THE SOUTHERN MEDITERRANEAN

An important fact regarding the background of this study is that there are profound differences in energy use and power consumption between the Northern and Southern Mediterranean. Moreover, the economic and social situation of South Mediterranean countries is experiencing strong demographic growth which, combined with a GDP growth rate of between 6% and 7%, is resulting in unprecedented domestic “energy pressure”, which will continue over the next decade and possibly beyond. This must be considered carefully, as the links between the north and south cannot be reduced to energy alone, but encompass complex human dimensions. These South Mediterranean countries are the European Union’s nearest neighbours, and while the sea may be a physical obstacle to energy flows, this is not so for human flows; social disturbances in the south will have inescapable consequences on social welfare in the north.

This is all the more so as these countries, like elsewhere, are facing the economic crisis, heightening tensions regarding employment and living conditions.

Due to the amounts involved in the necessary investments, the energy sector is greatly affected by the financial crisis. However, as underlined by the Facility for Euro-Mediterranean Investment and Partnership (FEMIP), new “catalysts for growth” are possible in this context, and energy is one of these. It is widely accepted that energy is the foundation of economic and social integration, as it was at the beginning of the European Community. The integration of power and energy markets in different parts of the Mediterranean is the prelude to further integration, and the way to achieve greater unity is to give hope to people in a context rendered sombre by the crisis. For instance, until now the Arab Maghreb Union (AMU) could be likened to an empty shell, yet its mere continuation shows that the question of regional integration is a goal for the people of the region.

Such regional integration should also be a goal for the EU due to its wealth, proximity and influence. Energy security is a global concept. It should be borne in mind that energy importers’ energy security can be deeply threatened by the energy insecurity of its partners. Energy security is therefore a challenging issue in North-South Mediterranean relations.

It was also pointed out at the end of section 2.2 that the weakness of South–South (horizontal) relations paradoxically favours South–North (vertical) relations. However, horizontal relations are clearly necessary for effective regional development. Indeed, considering the growing prosperity of ASEAN and MERCOSUR, where intra-regional exchanges are far more developed than in the Southern Mediterranean, it appears that horizontal relations would benefit this latter region. As stated by Jacques Delors in April 1989, the “non Europe” came with a cost. In the case of the Maghreb for instance, the cost of non-cooperation was estimated by the magazine “Jeune Afrique” specialising in North Africa, at $100 billion in 2015.

When dealing with North African countries, should the EU therefore separate its relations with Algeria since it is, and will be, a main gas exporter to Europe?
As stated before, energy relations between the Northern and Southern Mediterranean should be developed within the framework of cooperation development including issues other than energy. The objective should be to build a co-prosperity zone in the Mediterranean basin, in the spirit of the Barcelona process.

EU support to the Southern Mediterranean is soon to be reviewed in many economic and social fields. In the energy field specifically, the implied consequences should be carefully considered: integration based on opening up markets would be impossible without a general liberalisation of the economy, since attracting foreign investors is impossible in the context of a strict state economy.

Considering the two energy sources, power and gas, and the relations that are or would be implemented across the Mediterranean in order to supply the north or to develop interconnections, there is a clear differentiation between the West and the East Mediterranean basins on either side of the Italian peninsula:

- Most of the starting points for gas connectors are on the south-east side, with transit countries from the Middle East;
- On the south-east side, Turkey is playing a major role as a transit country for gas but also due to its imminent synchronisation with the south-east Europe ENTSO-E grid, which can be completed by a synchronous grid with Syria and the Middle East;
- The only projected power interconnectors are between Maghreb countries, on the west side;
- Algeria is playing a major role through two power interconnectors with Spain and Italy, and through its export capacities in gas (2nd supplier of the EU) by pipe or by boat;
- Egypt plays an important role as gas supplier, and also by acting as the link between the Maghreb and Mashreq for power interconnections;
- In the north, the strategic countries in terms of being supplied in power from the south and as transit countries with the European ENTSO-E grid, are Spain, France and Italy.

The three energy pools sharing the South Mediterranean area - the Maghreb with Algeria, Egypt and the surrounding area, and Turkey - are the main actors in the Southern Mediterranean from the energy point of view, in terms of power and gas.

4.1. Recommendations on electricity and energy efficiency issues

1. Supporting associations and centres for renewable energy and energy efficiency

The authors of this report are aware of the recent resolution adopted by the European Parliament on 15 December 2010: energy efficiency should be a leading priority of the European Energy Strategy. This should also be the case for the Southern Mediterranean, since it has in fact been neglected in most of these countries until now.

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The presentation of the recommendations is not meant to reflect any notion of ranking or priority. The authors consider that all of the proposed measures should be undertaken. The matrix at the end of the Report provides some guidelines as to implementation phasing.
Several associations gathering representatives from the Northern and Southern Mediterranean, active in discussion forums on energy cooperation and concerned by the introduction of new energy policies either in the field of energy efficiency, such as the Mediterranean Association of National Agencies for Energy Conservation (MEDENER), or in energy regulation (power and gas), such as the Association of Mediterranean Regulators (MEDREG), must be encouraged and supported. In particular, participation of the Southern Mediterranean in the International Partnership for Energy Efficiency Cooperation (IPEEC), which appears until now to have been reserved to the most developed countries, should somehow be made possible.

To this end, support to the Mediterranean Renewable Energy Centre (MEDREC) in Tunis, the Mediterranean Renewable Energy Programme (MEDREP, a UNEP initiative) and the Regional Centre for Renewable Energy and Energy Efficiency (RCREEE) in Cairo, must be pursued and possibly enhanced. To achieve this, the European Commission should provide diversified support focussed on developing local expertise through special funding and the transfer of know-how.

The International Renewable Energy Agency (IRENA) was created in January 2009 in Abu Dhabi, and is seriously engaged in developing solar energy resources in order to become an equivalent in renewable (solar and wind) to the International Energy Agency (IEA) for oil and gas. It should be supported by the EU, namely through relations with the new Centre for Technology and Innovation which is going to be set up in Bonn.

2. Signing Strategic Energy Partnerships with the main power pools in the Southern Mediterranean

A strategic Energy Partnership has been signed with Egypt, and Turkey is already engaged in strategic relations with the EU. The next step should be to sign such a Partnership with the Maghreb Power Pool, using the MoU between Egypt and the EU as a draft model. However, the context in the Maghreb is quite different since the electricity grid interconnections are already set up. Negotiations with Algeria alone as the most powerful energy entity in the region could be a mistake, since Algeria, Morocco and Tunisia are already engaged together, mainly in line with the terms stipulated in said “model”. Furthermore, in order to translate the “Algiers Declaration” of July 2010 into reality, and to implement the related “Plan of Action”, it was decided that a “High Level Group” would meet regularly. A first meeting was held in Brussels in October 2010, with the participation of the Electricity Directors from each of the three countries. At the same time, Morocco is actively preparing to take over the Presidency of the energy coalition of the three countries from Algeria. A possible innovation could therefore be common negotiation of the EU with the three Maghreb partners:

- **The Strategic Energy Partnership should insist on energy efficiency** (namely in transport, industry and housing, requiring specific studies), which currently tends to be considered as a last priority. The creation or enforcement of EE agencies should be encouraged along the lines of the Agence Nationale de Maîtrise de l’Energie (ANME) in Tunisia for instance, which is renowned and highly efficient.

- **The strategic partnership should also comply with the regulations in force in the EU in order to ensure the opening of markets and free competition.** Many efforts remain to be made in terms of methodology, i.e. to determine a common method for transit tariffs and to manage congestion. To this end, the assistance of the MEDREG might be officially requested and encouraged.
3. Fostering regional integration in order to promote renewable energy

Regional integration requires interconnection of the grids and the technical possibility of making the whole network able to receive and distribute the intermittent power of renewable energy, which could place “islanded” grids in difficulty.

Insisting on the promotion of renewable energy therefore means insisting on building interconnected grids. Since the whole MEDRING is split into four parts, a duly regional approach is coherent with the MSP. In the East Mediterranean, negotiations with Egypt should involve all the partners of a future integrated grid. In this region, the same process as on the western side with the IMME project could be launched.

The new electricity production from renewable energy should firstly benefit local people, and a regional network is the most appropriate.

Renewable energy production raises the question of power storage in order to regulate the feeding of the grid through this source, a main characteristic of which is intermittence. A solution that has already been tested (in northern countries where mountain rivers and dams are abundant, but also in southern countries such as Morocco) is the setting up of PSPPs (Pumped Storage Power Plant). Morocco for instance, where one PSPP is already operational at Afourer (464 MW), plans to build 400 MW capacity PSPPs every 5-7 years. However Morocco is an exception; it is a mountainous country with significant rainfall where such solutions are possible.

The need for storing electricity can be reduced by the interconnection of grids, allowing the optimal dispatch of power among consumers in different locations of a large region.

4. Extending the ELENA (European Local Energy Assistance) mechanism to a specific MED ELENA mechanism

The purpose of a MED ELENA mechanism, similar to ELENA, would be to enhance local (urban and regional) initiatives in favour of renewable energy and energy efficiency in order to cope with energy and climate challenges.

Many initiatives remain at a conceptual level and are difficult to implement due to insufficient technical competences. Following the ELENA mechanism (linked to Intelligent Energy Europe), the MED ELENA would provide specific support in areas such as eco-buildings, eco-transport in towns, etc.

Like ELENA, this support could be managed by the EIB.

An achievement of this special support would be better access to external financing from International Financial Institutions (IFIs).

5. Ensuring effective Mediterranean Solar Plan (MSP) governance

To achieve the MSP expectations for MSP governance, three categories of actors can be identified:

- The European Commission and the EIB, which should be strongly involved;
- The Barcelona Secretariat, since the MSP is an initiative of the Union for the Mediterranean (UfM);
- The World Bank, which can intervene through the Clean Technology Fund.
The most efficient scenario for MSP governance would be to combine their know-how and to appoint a team of specialists and civil servants in governance, who would bring support both to the States and to the project sponsors and leaders, and liaise with the financial institutions. They should be able to maintain leadership of the UfM co-chairmanship.

To this end, it would be necessary to identify the profiles of the required officers, then to make a selection with the Commission’s advice.

Furthermore, a charter would need to be drafted before convening a network of the three categories of actors.

6. Launching technical, environmental, technological and economic analyses on electricity highways as soon as possible, in order to complete the Mediterranean Solar Plan (MSP)

These surveys are recommended in the “MEDRING Update 2010” Report (cf. section 2.2.4.2 of this report). Given the scale of the power transit corridors which could be built, a consensus must be obtained for the construction of these future electricity highways (HVDC corridors) which are bound to the achievement of the MSP. Regulatory issues concerning the coordinated operation of the future interconnectors should then be addressed. International consensus is required.

Several studies should be launched following the recommendations of the MED-EMIP experts:

- **“An environmental study providing an accurate analysis of the morphology of the Mediterranean Sea depth to assess the most viable submarine interconnection alternatives [...]**
- **A technical analysis targeted at identifying the optimal sending and receiving ends of the new corridors, as well as their size and the required reinforcements in the transmission grids on land [...]**
- **A technological survey: since the new south-north corridors envisaged in the MSP are scheduled to be deployed in the coming decade (the target horizon is the year 2020), it is extremely important to anticipate the perspective developments in HVDC technology, particularly regarding high depth submarine power cables [...]**
- **Economic analyses helping to highlight the profitability of the new corridors, thus fostering the attraction of the investments, which can - at a first glance - be estimated to be in the order of a billion euros per corridor [...]”**

7. Considering that market prices are not the only indicators for energy decisions, and that nuclear can be an option

Many considerations are not based on economics. Nuclear energy could remain an option for many South Mediterranean countries such as Turkey, Egypt, Libya, Algeria and Morocco. Certain growing energy needs, such as water desalination, will require considerable amounts of energy, and nuclear energy may appear to be an alternative to renewable. The implementation of a nuclear plant, however, is subject to the capacity of the grid to which it is going to be connected. It is generally admitted that the capacity of the nuclear plant should not exceed 10% of the grid’s capacity, in order not to imbalance the grid when it is connected – or disconnected, e.g. for maintenance.

111 MEDRING Update Report
Safety remains a major and costly concern, and the best way to address this issue is to seriously train the necessary personnel. This is a 20-year effort, and it should be considered as of now with adequate assistance from the north. Furthermore, nuclear waste disposal is a real and major problem, for which a sustainable solution is still problematic despite recent progress in the reprocessing of waste.

The whole nuclear process requires highly sensitive decisions by the political authorities. Neutral and uncontroversial advice from the EU, within the framework of the Non-Proliferation Treaty, would help local responsible decision-makers. The decisions to be taken should be balanced between economic, technical and environmental considerations (namely taking into account the reduction of CO² emissions).

4.2. Recommendations on gas issues

Some of the recommendations expressed above are also valid for gas issues. In particular, the recommendations that focus on cooperation with electricity operators and stakeholders in the South Mediterranean countries fully apply to the gas sector.

8. Strongly supporting the diversification of gas sources

The January 2009 crisis, following that of 2006, and Russia’s withdrawal from the Energy Charter Treaty in August 2009 have severely altered the confidence of many stakeholders in Russia’s ability to maintain reliable gas supplies in the event of another major crisis. Strong support should be provided to those projects that genuinely improve the European Union’s security of supply through the diversification of sources, with a first application to the Nabucco pipeline.

9. Devising new tools to facilitate the construction of European infrastructures

A major obstacle to the development of infrastructures is the lengthy process of obtaining all the authorisations and permits required to build them. Ever constraining regulations and highly decentralised powers of decision have often prevented operators from developing much needed facilities. This is one of the main reasons why Italy has not been able to develop LNG terminals, in spite of the numerous projects that have been on the drawing board for decades. ENTSO-G considers that reducing the permitting process from 10 years on average to 5 years for the main projects, would indeed provide an invaluable impetus to the achievement of key infrastructures. A specific fast-track procedure, based for instance on the French “Déclaration d’Utilité Publique” could be designed and applied to those projects labelled “Project of European Interest”, and included in the new Regulation on the Security of Supply.

10. Developing medium and long term Gas Master Plans at regional and EU levels

The former gas industry in most European countries was structured on national monopolies whose task was, inter alia, to prepare long term gas planning and to have such plans validated by the regulatory body, usually the minister in charge. This responsibility has vanished with the liberalisation of the gas market. Following a long period during which the very notion of planning had disappeared, the issue of security of supply led the Commission to favourably re-consider the concept of planning. A recent application is the Ten Year Network Development Plan (TYNDP) that both ENTSOs have to prepare on a two-year rolling basis. While limited in design (TYNDPs apply primarily to networks), it may constitute a first blueprint for more ambitious and in-depth planning.
11. Strategic gas storage

Conversely to oil, no EU regulation, including the recent Regulation on the security of gas supply, makes it compulsory to develop and maintain strategic gas storage. This does not mean that there is no gas storage across Europe. Indeed, several gas operators, e.g. in France, Italy and Germany, have developed underground gas storage facilities (UGS) for operational purposes, where the geological characteristics of the terrain or the presence of depleted gas or oil fields would so allow. However, these facilities are generally designed to meet the seasonal swing (additional winter demand for heating) and are meant to remain purely operating facilities within a regulated activity, like transmission and distribution networks. They are definitely not intended for storing gas for a long period of time as a strategic facility. While said Regulation focuses primarily on transmission networks and cross-border pipelines to ensure security of supply within and between Member States, some thinking should be given to the appropriateness of strategic storage – a task that the ENTSO-G could be entrusted with.

4.3. Recommendations on both electricity and gas issues

12. Encouraging South Mediterranean countries to move towards energy pricing based on the real economic costs

In many energy-producing developing and emerging countries, energy prices are de facto heavily subsidised, i.e. energy products, including secondary energy such as electricity, are sold below their real economic delivery cost in the worst case scenario, or below their market value, e.g. in the international market. This is the case, for instance, in Algeria and Egypt, where the low prices of oil products, gas and electricity generate ‘sky rocketing’ demand artificially driven by low prices and prevent energy operators from adequately meeting the demand.

While energy policy in South Mediterranean countries obviously belongs to their sovereign decision, existing or future Euro-Med partnerships should include a component aiming to assist governments in devising and implementing measures leading to end-user and transfer prices (e.g. between different energy operators or activities) that reflect the real cost of the energy delivered.

The same price transparency should apply to transfer/selling prices to neighbouring countries.

13. Promoting a genuine and efficient energy strategy

When it comes to the medium and long term security of supply, developing and improving the rules and their application within the internal market through coordination mechanisms and domestic infrastructures is no longer sufficient. The Lisbon Treaty has included the idea that unbiased and open competition cannot be considered a unique and final objective per se, but rather a means to reach the construction of Europe. A dedicated energy security package with a strong gas component should be devised, to reinforce the existing packages on the internal market and energy-climate issues.

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\(^{112}\) Regulation (EU) N° 994/2010

\(^{113}\) Including production, transformation, transmission, storage and distribution
# A. Electricity and Energy Efficiency

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<tr>
<td>1. Supporting associations and centres for renewable and energy efficiency</td>
<td>Several associations gathering representatives from the Northern and Southern Mediterranean, active in discussion forums on energy cooperation and concerned by the setting up of new energy policies, both in the field of energy efficiency and in the field of energy regulation, must be encouraged and supported.</td>
<td>Precisely identify the associations to be supported. Provide diversified support focussed on the development of local expertise through special funding and the transfer of know-how.</td>
<td>Support the International Renewable Energy Agency (IRENA) in Abu Dhabi, acting with the new Centre for Technology and Innovation which is going to be set up in Bonn.</td>
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<td>2. Signing Strategic Energy Partnerships with the main power pools in the Southern Mediterranean</td>
<td>Such a Partnership has been signed with Egypt. Turkey is already engaged in strategic relations with the EU. The next step should be to sign a Partnership with the Maghreb Power Pool. The Partnership should insist on energy efficiency (namely in transport, industry and housing, which require specific studies). It should also comply with the regulations in force in the EU in order to ensure the opening of markets and free competition.</td>
<td>Set up a working group in the coming months in order to define the necessary studies to be carried out, namely by updating those conducted for the Maghreb countries under the IMME project. Assess the current power pool structure and its efficiency in order to identify how to reinforce it institutionally.</td>
<td>Promote a regional grid code and streamline the integration procedures.</td>
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<td><strong>3. Fostering regional integration in order to promote renewable energy</strong></td>
<td>Regional integration requires the interconnection of the grids and the technical possibility of making the whole network able to receive and distribute the intermittent power of renewable energy, which could place “islanded” grids in difficulty. Insisting on the promotion of renewable energy therefore means insisting on building interconnected grids. A regional network raises the question of power storage in order to regulate the feeding of the grid by renewable energy, a main characteristic of which is intermittence. The storage of electricity is facilitated by the interconnection of grids allowing the optimal dispatch of power among consumers in different locations of a large region.</td>
<td>Carry out a study in all possible regional power pools in order to assess the various peak loads (daily, weekly and yearly) and to calculate the optimal dispatch of the spinning reserve.</td>
<td>Promote strict management of the intermittence of renewable and favour regional power integration.</td>
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<td><strong>4. Extending the ELENA (European Local Energy Assistance) mechanism to a specific MED ELENA mechanism</strong></td>
<td>Many initiatives remain at a conceptual level and are difficult to implement due to insufficient technical competences. In line with the ELENA mechanism (linked to Intelligent Energy Europe), the MED ELENA would provide specific support in areas such as eco-buildings, eco-transport in towns, etc.</td>
<td>Develop the MED ELENA mechanism with the EIB and promote it in the Southern Mediterranean through specific programmes.</td>
<td>By encouraging local initiatives, support specific eco-energy saving programmes in housing, transport and industry, which comply with a low carbon energy strategy in southern Mediterranean countries.</td>
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<td>5. Ensuring effective governance of the Mediterranean Solar Plan (MSP)</td>
<td>Combining the know-how of the three categories of actors able to lead the governance of the MSP (the European Commission and the EIB, the Barcelona Secretariat, and the World Bank with the Clean Technology Fund).</td>
<td>Convene a network of the three categories of actors.</td>
<td>Renew and enlarge the governance taking into account the possible enlargement of the MSP.</td>
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<td>Identify the profiles of the required officers and make a selection.</td>
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<td>Draft a charter of MSP governance.</td>
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<td>6. Launching studies on electricity highways in order to complete the Mediterranean Solar Plan</td>
<td>Given the scale of the power transit corridors which could be built, a consensus must be obtained for the construction of the future electricity highways (HVDC corridors), which are bound to the achievement of the MSP. Regulatory issues concerning the coordinated operation of the future interconnectors should then be addressed. International consensus is required.</td>
<td>An environmental study to assess the most viable submarine interconnection alternatives.</td>
<td>A technical analysis targeted at identifying the optimal sending and receiving ends of the new corridors, as well as their size and the required reinforcements in the transmission grids on land. Economic analyses helping to highlight the profitability of the new corridors.</td>
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<td>A technological survey in order to anticipate developments in HVDC technology.</td>
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<td>A technical analysis targeted at identifying the optimal sending and receiving ends of the new corridors, as well as their size and the required reinforcements in the transmission grids on land. Economic analyses helping to highlight the profitability of the new corridors.</td>
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<td>7. Assessing nuclear options</td>
<td>Certain growing energy needs, such as water desalination, will require considerable amounts of energy, and nuclear energy may appear to be an alternative option to renewable. However, safety remains a major and costly concern. Furthermore, nuclear waste disposal is a real and major problem for which a sustainable solution is still problematic, despite recent progress in the reprocessing of waste.</td>
<td>Provide neutral and uncontroversial advice within the framework of the Non-Proliferation Treaty, in order to help local officials balance their decisions between economic, technical and environmental considerations.</td>
<td>Provide assistance and training support to the necessary technical and scientific staff.</td>
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### B. Natural Gas

**8. Strongly supporting the diversification of gas sources**

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<th>Strong support should be provided to those projects that genuinely improve the European Union’s security of supply through the diversification of sources.</th>
<th>Initiate/review (if already carried out) a thorough, unbiased study of the share of each supplying country in the overall gas supplies of each Member State (MS), both current and projected.</th>
<th>Consider setting common rules that tend to limit the share of a given supplying country within a EU gas region.</th>
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<td>Extend the concept of 'N-1 in each Member State', used in the TYNDP, to 'N-1 outside MS', so as to assess the risk of a major supply disruption affecting several MS.</td>
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**9. Devising new tools to facilitate the construction of European infrastructures**

| A major obstacle to the development of infrastructures is the lengthy process of obtaining all the authorisations and permits required to build them. | Develop a new legal/regulatory tool aiming to streamline the implementation procedures of Projects of European Interest. Review the existence, pros and cons of such tools that may exist at national level in MS. | |

**10. Developing medium and long term Gas Master Plans at regional and EU levels**

| This concept of gas planning has vanished with the liberalisation of the gas market. | Devise Regional Gas Master Plans, including demand, supply, required infrastructures and emergency tools. | |

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\[114\] Our understanding of the Regulation is that supply disruptions occurring outside the EU (e.g. pipeline in Ukraine or liquefaction plant in a non-member State) are not considered in the TYNDP.
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<td>11. Strategic gas storage</td>
<td>No EU regulation makes it compulsory to develop and maintain strategic gas storage.</td>
<td>Initiate a study on the storage capacity in each MS and EU region, including 'soft' storage measures in the form of interruptible contracts, back-up agreements. Set up a working group to define minimum strategic storage requirements at MS and regional level, including 'hard' and 'soft' tools, and a regulatory framework to handle and maintain European inventories. Devise regulations to monitor and control minimum requirements.</td>
<td>Include a strategic storage component in a future Energy Security Package.</td>
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<td>C. Both Energies</td>
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<td>12. Encouraging south Mediterranean</td>
<td>Energy prices are heavily subsidised, which generates artificial demand and prevents energy operators from adequately meeting the demand.</td>
<td>Initiate a study of domestic electricity and gas prices and of real economic costs in key countries (Algeria, Egypt), including an assessment of the drain on the national budget and the lack of revenue. Assist governments in devising new pricing policies and options to progressively increase prices towards economic costs while maintaining safety nets for the poor.</td>
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<td>countries to move towards energy</td>
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<td>pricing based on the real economic costs</td>
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<td>13. Promoting a genuine and efficient</td>
<td>A dedicated energy security package with a strong gas component should be devised, which will reinforce the existing packages on the internal market and energy-climate issues.</td>
<td>Short term and medium term actions are highly dependent on the procedures and lead times that govern the functioning of the European Institutions. The authors of this report are not in a position to make any phased proposals in such a complex area.</td>
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